THE EFFECTS OF DIFFERENTIATED PHYSICAL ACTIVITY PROGRAMMES ON THE MOTOR PROFICIENCY OF CHILDREN WITH LEARNING DISABILITIES

by

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DEDICATION

This thesis is dedicated to my family and especially to my son TERRAN WALTER SCHEEPERS

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LIST OF FIGURES

SYNOPSIS

TITLE	The effects of differentiated physical activity programmes on the motor proficiency of children with Learning Disabilities
CANDIDATE	G K Scheepers
PROMOTOR	Prof M F Coetsee
CO-PROMOTOR	Dr E S Bressan
DEGREE	PhD (HMS)

With this study, the researcher investigated the effect of specially designed physical education programmes on the motor proficiency of learners with learning disabilities.

The subjects (N=60) were all learners from the Zululand Remedial School in Empangeni, Kwa Zulu/Natal. Two experimental groups participated in a twelve week Perceptual Motor (N=20) or a Sensory Motor (N=20) intervention programme, while a Control group (N=20) was tested on all test variables, but did not participate in a intervention programme.

Using a *repeated measures with matched pairs design*, the Bruininks Oseretsky Test of Motor proficiency (long format) was used during the pre, post and post post testing periods. An ANOVA calculation revealed that the Perceptual Motor group achieved a significant improvement in their motor proficiency ($p < 0.01$). The Sensory group improved significantly on their motor proficiency score. The Control group showed no significant changes on their scores.

The results displayed enough evidence to prove that a specially designed physical education programme (to suit the special needs of learners with learning disabilities) is of the utmost importance.

Additional data was gathered to establish whether there was any relationship between motor proficiency and body composition profiles, self- concept and classroom behaviour. A very low correlation was found on each of these variables. This raises questions about the nature of the relationship between motor proficiency and these variables and indicates that further substantial studies are required.

SINOPSIS

TITEL	Die effek van verskillende liggaamlike opvoedingprogramme op die motoriese vaardigheid van kinders met leerprobleme
KANDIDAAT	G K Scheepers
STUDIELEIER	Prof M F Coetsee
MEDE STUDIELEIER	Dr E S Bressan
GRAAD	PhD (MBK)

Met hierdie studie, het die navorser gepoog om die effek van spesiaal ontwerpe liggaamlike opvoedingprogramme op die motoriese vaardigheid van leerders met leergestremdhede te ondersoek.

Die proefpersone (N=60) was almal leerders van die Zululand Remedierende Skool in Empangeni, Kwa Zulu/Natal. Deur gebruik te maak van 'n "*repeated measures with matched pairs*" ontwerp het twee eksperimentele groepe aan 'n 12 week lange Perseptueel Motoriese program (N=20) of aan 'n Sensoriese Motoriese program (N=20) deelgeneem. 'n Kontrole groep (N=20) het ook die onderskeie toetse afgele, maar het nie 'n intervensie program gevolg nie.

Die "Bruininks Oseretsky Test of Motor Proficiency" (lang formaat) is tydens die pre, post en post-post toetsgeleenthede gebruik. 'n ANOVA toets het bewys dat the Perseptueel Motoriese program die beduidenste (p <0.01) positiewe verandering in motoriese vaardigheid mee gebring het. Die Sensoriese Motoriese program het 'n positiewe verandering getoon (p < 0.05). Die Kontrole groep het geen verandering getoon nie.

Die resultate verskaf genoegsame bewys dat 'n spesiaal ontwerpte liggaamlike opvoedkundige program, (na aanleiding van spesiale behoeftes van leerders met leergestremdhede) van uiterste belang is.

Bykomende inligting is ingewin om die verwantskap tussen motoriese vaardigheid, liggaam samestellings profiel, self-konsep en klas gedrag te toets. 'n Swak korrelasie is gevind tussen al die veranderlikes. Dit laat vrae onstaan omtrent die aard van die verwantskap tussen motoriese vaardighede en hierdie veranderlikes wat verdere meer indringende ondersoek vereis.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER ONE

INTRODUCTION

1.1 PROLOGUE

Children do not automatically develop the skills, knowledge, attitudes, and behaviour that lead to regular and enjoyable participation in physical activity. They must be taught. The responsibility for this instruction is vested primarily in physical education programmes in the schools. Children learn by doing. Children can be immensely active and energetic. Movement activities are natural avenues for this energy. Physical movements provide one of the most important avenues through which a child forms impressions about itself and its environment. Movement activities contribute to the total physical, mental, social, emotional growth and development of the child. Through movement activities a child acquires skills, knowledge, and attitudes that help it discover and understand its body and how it works, its physical abilities and its limitations. The role that motor ability plays in the total development of the child is considered so important by authors such as Kephart (1967, & 1971), Cratty (1966), Ayres (1972) and Sherrill (1993), that each of them has designed programmes to improve the motor ability of the child. Through these they attempt to enhance the child's learning and consequently its development. Hong (2001) states that learning is probably the single most important function that we can achieve in terms of adaptation to and control of the environment. Proponents of the ecological approach to teaching and learning see neither the person nor the environment as the most important component in the learning event, but that both play important roles.

Authors such as Mercer (1979) stress that in the learning event there is significant interaction between the learner's potential and the total environment within which they find themself. The child's total learning environment (which includes adults such as parents and teachers with whom they come into contact, as well as didactic aids that is used) makes a unique contribution to its total development process. Should a child of normal intelligence fail to demonstrate the same academic and physical competencies as do the majority of its peers or fail to achieve its perceived innate learning potential, the child is classified as having one of a number of learning disabilities.

The impact of learning disabilities (LD) on the academic, social and psychomotor performance of children has been a source of concern for parents and educators for several decades. Learning disabled children are those who for one reason or another are unable to keep up with normal school work. Remedial or Special education is required when a child has a significantly greater difficulty in learning than most children his or her age or a disability which either prevents or hinders him or her from making use of the educational facilities of a kind generally provided in school. Teaching children with LD is obviously more complex and difficult than working with children who learn spontaneously and easily and have all body systems intact and functioning in predictable ways. In South Africa children who have been identified and professionally diagnosed with LD can be placed in Remedial Schools such as the Zululand Remedial School situated in Kwa Zulu/Natal, South Africa (The South African Association for Learning Disabilities 2000).

To be able to read, write and perform with adequate success at school, all children need certain innate abilities. The motor ability of a child is perhaps the most visible of these innate abilities (see figure 1.1).

To be able to read, write and perform with adequate success at school, all children need certain innate abilities. The motor ability of a child is perhaps the most visible of these innate abilities (see figure 1.1).

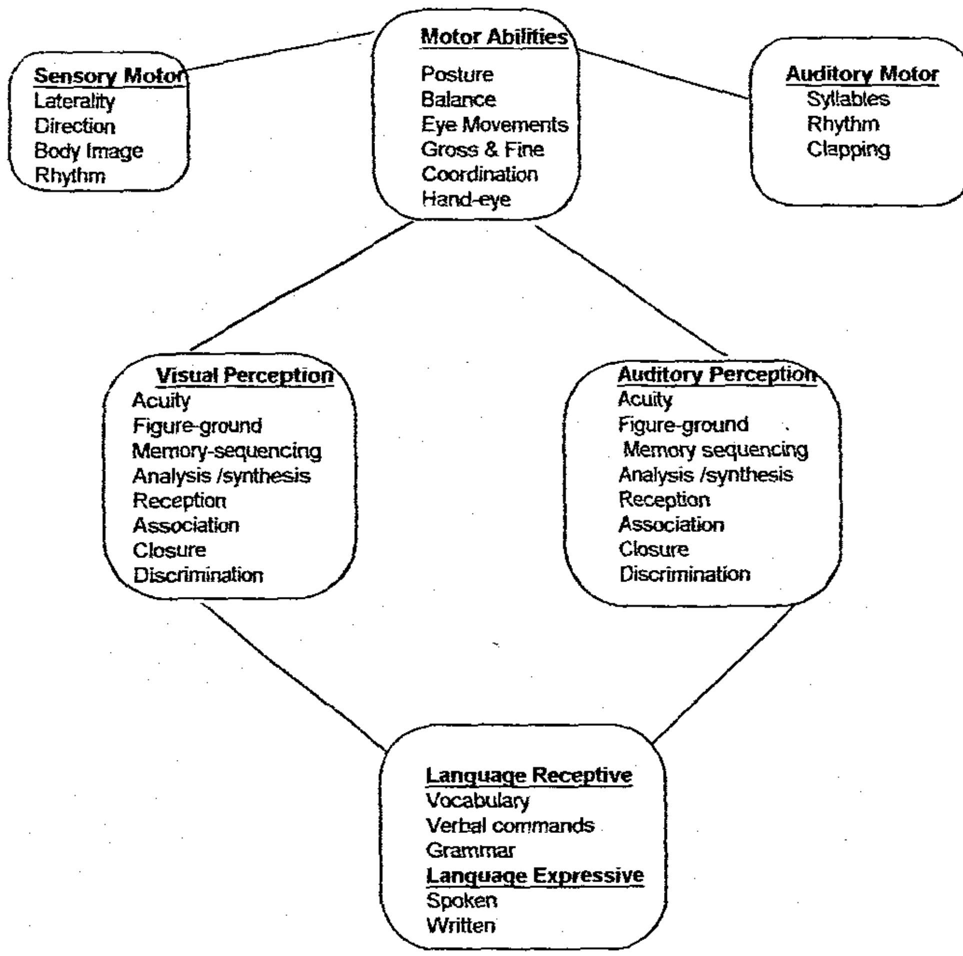


Figure 1.1: The Innate abilities children require to read and write (Engelbrecht, 2000)

Should a child of normal intelligence fail to demonstrate the same academic competencies as do the majority of their peers , it is believed that there is a dysfunction in one or more of the above areas (see figure 1.1)

Thus a learning disability is defined as a disorder in one or more of the basic psychological processes involved in understanding or using language, spoken or written, which may manifest itself in the imperfect ability to listen, think, speak, write, spell or perform mathematical calculations (Auxter, et al., 1993).

Children with LD who have a dysfunction in their motor abilities, are at risk for a significant decline in self-esteem, According to Levine (2000) children crave motor gratification as they grow up. Consequently, children are apt to be highly conscious of how they are judged by others. They need to feel that their bodies are somewhat effective in space. Such feelings contribute substantially to the development of a positive body image and self-concept. It is disheartening to have physical/motor inabilities that perpetually bring embarrassment and incite ridicule or criticism. Many studies state that the best way to ensure children can achieve a positive self-concept and increase their learning ability is to have them train their motor skills starting in infancy and continuing throughout life (Auxter, et al., 1993: Burton, 1987; Sherrill & Montelione, 1990; Sherrill ,1993).

A lack of physical activity could influence motor development, as participation in frequent physical activities is also important for the development of motor skills (Saakslanti, et al., 1999; Thomas 1984). Development of motor skills play an important role in the overall development of school readiness (Pienaar, 1994; Gallahue & Ozmun, 1998).

Although all children with LD do not display motor problems, many do (Bruininks & Bruininks, 1977; Miyahara, et al., 1995; Schaffer, et.al., 1989; Sherrill; & Pyfer, 1985). Haubenstricker (1982) contended that many children with LD display visual and spatial motor difficulties and thus can be considered "clumsy" or "awkward."

Physical education has a major role to play in the development of children with learning disabilities. Physical education should be an integral part of the total education of any child as it is closely allied to other creative and learning experience and skill acquisitions. One of the fundamental goals of the physical education programme should be to prepare students for the challenges of the 21st century by providing opportunities to attain the skills and knowledge to be physically active as part of a healthy lifestyle. Children should become competent in movement forms, motor skills, social skills and learn to enjoy physical activity while not compromising safety. Children with LD could derive enjoyment and personal meaning from movement as they gain competence in their movement ability. Children who master various motor skills will reap the benefits of a physically active lifestyle, better health, higher educational achievement, better preparation for work, improved attendance, and improvement in their self-concept. Establishment of lifelong patterns of participation in physical activity expands beyond the physical education class to the opportunities and support provided by the school and community.

1.2 PURPOSE OF THE STUDY

In recent years a growing body of research, theory, and practical experience has sharpened our understanding about the beneficial aspects of physical education programmes for children. The purpose of this study was two-fold:

- firstly, to determine which of the two intervention programmes (a top, down Perceptual Motor or bottom, up Sensory motor programme, (Auxter, et al., 1993), would bring about a greater improvement in motor proficiency, classroom behaviour, and self- concept in children with LD.

- secondly to develop physical education activities to suit the special needs of South African children with learning disorders.

Hopefully the results of this research could be used to determine what type of activities could be incorporated into the school curriculum, for learners with special educational needs.

1.3 STATEMENT OF THE PROBLEM

In today's urbanized world, it is unlikely that the majority of children will develop movement competency to any high degree through free play alone. There is some evidence that children have always needed adult intervention in their play in order for play to develop any creative and meaningful aspects (Miller, 1971 ; Bailey, 1976). Even though children have time to play before and after school, adult intervention through physical education classes can facilitate the development of movement competence. Developing movement competency is only one aspect of child development. Movement is a meaningful way of learning and communicating for children. When teachers ignore this, they deny many children the opportunity for positive learning experiences (Marshall & Bouffard, 1997).

Physical education is an important part of the school curriculum. It is not merely "play", "letting off steam" or an activity that is divorced from the other learning experiences in schools. However, to achieve its rightful position as one of the bases, physical education must be seen in its relationship to the total curriculum. Classroom teachers and physical educators must/should work together, as both have much to contribute that cannot be accomplished alone. This working relationship can develop physical education activities that correlate with other learning experiences. The rewards for this effort can be found in the satisfaction of helping children develop their movement and learning abilities to their fullest extent (Hoffman, et al., 1981).

Sherrill (1993), indicates that children with LD need a different kind of physical education content than that which exists in most traditional physical education settings. It is further stated by Engelbrecht , (2000) that all children need certain motor abilities to read and write (see figure 1.1). These motor areas can be addressed by adapted physical education programmes designed to meet the needs of children with learning disorders.

As very few Adapted Physical Education programmes exist for children with special needs in South Africa, it is the aim and intention of the researcher to design and develop physical education activities for children with learning disabilities (Longhurst, 1995; Hugo, 2000).

1.4 RESEARCH QUESTIONS

Five research questions were formulated to guide this study:

1. Will children with LD who participate in structured physical education programmes show improvements in their motor proficiency?

2. Will children with LD who participate in structured physical education programmes show improvements in their self-concept?

3. Will children with LD who participate in structured physical education programmes show improvements in their classroom behaviour?

4. Which of the two intervention programmes (Perceptual Motor vs Sensory Motor) will bring about a greater improvement in motor proficiency, self-concept and classroom behaviour?

5. What effect does stature, mass and percentage body fat have on the children's motor performance?

1.5 RESEARCH HYPOTHESES

In accordance with the stated purpose of this study and in an attempt to answer the research questions, the following hypotheses were formulated:

Hypothesis 1: A twelve week intervention programme would have a beneficial effect on the motor proficiency of children with learning disabilities.

Hypothesis 2: A twelve week intervention programme would have a beneficial effect on the self-concept of children with learning disabilities.

Hypothesis 3: A twelve week intervention programme would have a beneficial effect on the classroom behaviour of children with learning disabilities.

Hypothesis 4: Stature, mass and percentage body fat, will have no significant effect on the motor performance of the children.

1.6 LIMITATIONS

This study involved children with learning disorders severe enough to require education in a special school. All children in this study came from the same school, which is situated in KwaZulu-Natal. The characteristics of such a "special group" put the following limitations on this study:

- variability between the children in terms of their learning disorder,
- use of medication,
- use of different Occupational Therapists, and

- use of different home language amongst the children made it difficult to pair children.

1.7 DELIMITATIONS

Participants were selected from learning disabled children (8- 12 years of age), currently attending the Zululand Remedial School situated in Empangeni, KwaZulu/Natal, South Africa.

- To allow for the smooth administration of the study, subjects came from the same school. All subjects were thus available at the same time to take part in the intervention programme. This also caused the least amount of disruption to the normal, daily running of each class.

- The intervention programme was administered twice a week for one hour sessions. Twice a week was decided upon as the children were also attending therapy sessions. Should more than two sessions a week have been used, too much class work would have been missed.

- The time allocation for the intervention programme was between 12h00 and 13h30, a time when it was believed and indicated by school staff for administered medication to have diminished in effect.

1.8 CONCLUSION

As the South African Education Curriculum and Syllabus is in the process of being revised and renewed, it is the duty of professionals to ensure that the content of the curriculum and syllabus adequately reflects the needs of children with special needs.

Even if the researcher succeeds in answering the research questions, her efforts will be futile if the Curriculum Developers and Policy Makers do not take children with special needs into consideration.

CHAPTER TWO

REVIEW OF LITERATURE

2.1. NEUROLOGICAL GROWTH AND MOVEMENT DEVELOPMENT

To fully understand a child with a learning disability, it is necessary to consider the factors which influenced the child's early development. By examining the stages of development and the function of the nervous system, one may pinpoint the stages at which a particular child experienced some developmental difficulties that are limiting their academic and or motor abilities and behaviour (Cheatum & Hammond, 2000; Wade, 1992).

2.1.1 Organisation of the Nervous System

Basic to the understanding of how motor development and learning takes place is a knowledge of the organisation and function of the nervous system. The nervous system is the master controlling and communicating system of the body. Every thought, action, instinct, and emotion reflects its activity. The nervous system is divided into two principal parts:

a). the ***central nervous system (CNS)***, which includes the brain and spinal cord and the,

b). ***peripheral nervous system (PNS)***, which includes the cranial nerves, spinal nerves, and the autonomic nervous system (see figure 2.1) (Marieb & Mallatt, 1997).

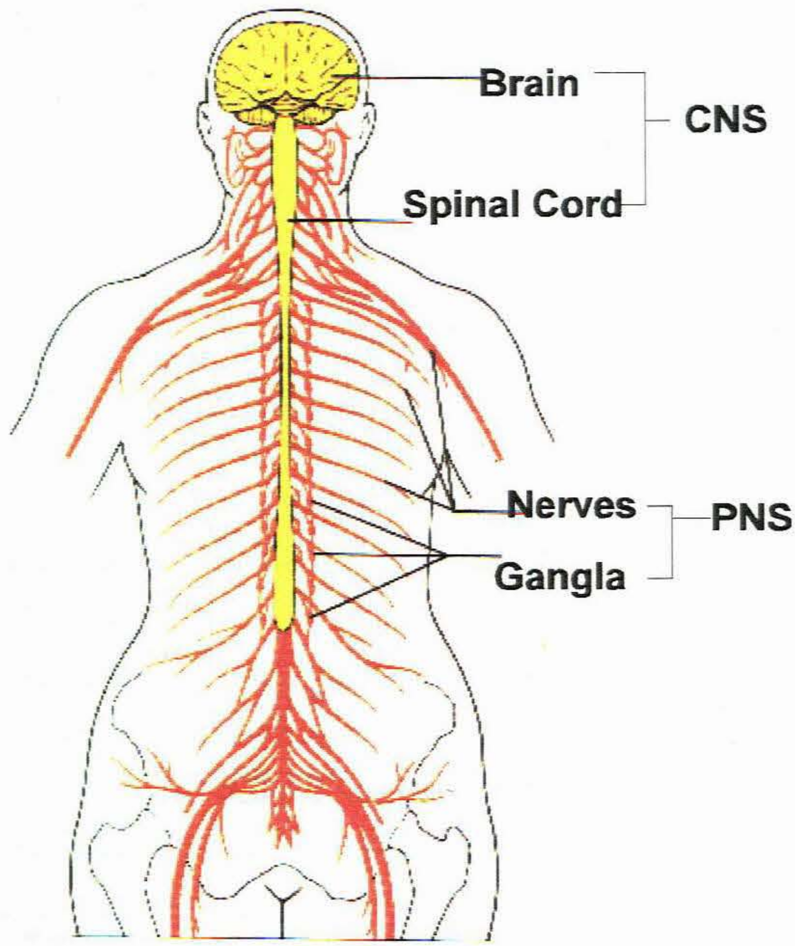


Figure 2.1: Basic divisions of the Nervous System: The CNS and PNS (Marieb & Mallatt, 1997)

The nervous system has three overlapping functions:

a). It uses its millions of sensory receptors to monitor changes occurring both inside and outside the body. Each of these changes is called a *stimulus,* and the gathered information is called sensory input.

b). It processes the sensory input and makes decisions about what should be done at each moment - a process called *integration*.

c). It dictates a response by activating the *effector organs*, our muscles or glands; this response is called motor output.

The reception of information involves a *sensory receptor, sensory nerves*, and a *sensory pathway* that conveys information to the brain. The brain is the processing station that analyses the sensory information and either stores it for future use or immediately responds to the sensory input. The response travels down a *motor pathway* in *motor nerves,* to reach a specific *effector organ* (skeletal, cardiac, and smooth muscle , or glandular tissue). The cell of the nervous system that is responsible for receiving, transmitting and storing information is the neuron. The nerves represent bundles of axons from many neurons. Nerves are described functionally in terms of the information they transmit. *Somatic nerves* convey information to involuntary structures (e.g. smooth and cardiac muscle and glands). The direction of information is defined by the terms *sensory* or *afferent,* meaning from a sensory receptor to the central nervous system, and *motor* or *efferent,* meaning from the central nervous system, to an effector organ (Bell, 1970; Miller, et al.,1977; Wade, 1992).

As can be seen from figure 2.2, the organisation of the nervous system is complex but highly ordered.

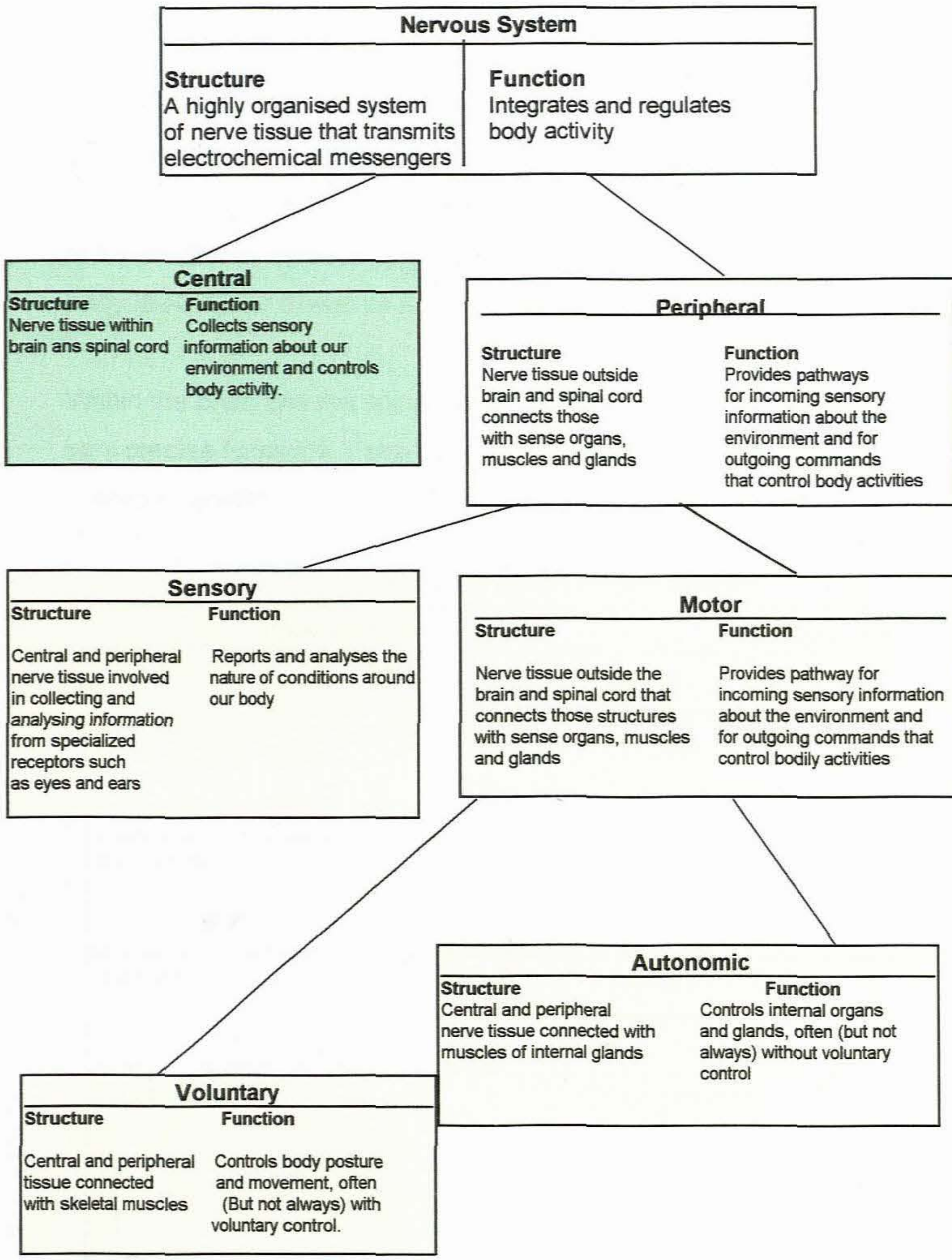


Figure 2.2: Divisions of the Nervous System (Adapted from Miller, et al., 1977)

The central nervous system, as the name implies, is located in the central axis of the body; the brain, in the cranial cavity and the spinal cord, in the vertebral cavity. Projecting from the brain and the spinal cord are the nerves of the peripheral nervous system, which are distributed to all the areas of the body (Bell, 1970; Cheatum & Hammond, 2000).

Within the brain and the spinal cord are specific centres or areas that have very precise functions, (see table 2.1), in integrating the activity of the nervous system.

Table 2.1: **Brain structures and their functions**

Brain Structure	Function
Cerebral Cortex	Thought Voluntary movement Language Reasoning Perception
Cerebellum	Movement Balance Posture
Brain stem	Breathing Heart Rate Blood Pressure
Hypothalamus	Body temperature Emotions Hunger Thirst Circadian Rhythms
Thalamus	Sensory Integration Motor Integration
Limbic System	Emotional Behaviour
Hippocampus	Learning Memory

Brain Structure	Function
Basal Ganglia	Movement
Midbrain	Vision Audition Eye Movement Body Movement

(Adapted from Miller, et al.,1977)

2.1.2 The Nervous System and Motor Control

At birth, man possess a number of built-in motor nerve circuits which produce synchronous movements. A few basic movement responses exist at birth, whilst others develop as extensions of the basic patterns as the nervous system matures. In other words, complex movement patterns are learned. The learned movement patterns are controlled by the organs of the CNS (Wade, 1992). These organs are the brain (cerebrum; the basal ganglia; the cerebellum); the brain stem; and the spinal cord. All these organs are interconnected by an elaborate network of nerve pathways (Cheatum & Hammond, 2000; Sage, 1984).

2.1.2.1 The Cerebellum

The cerebellum sits to the rear of the brainstem, lying just behind the pons. The cortex of the cerebellum is composed of grey matter and the interior of both white and grey matter. It is attached to the brain stem by the cerebellar peduncles which carry nerve fibers. Impulses from all receptors travel to the cerebellum. Impulses from eyes, ears, proprioceptors, etc, are integrated. The results of integration of these impulses enable one to have co-ordinated movements and to judge time and distance (Bell,1970). Through its connections to the medulla, pons, midbrain and spinal cord, the cerebellum is able to monitor equilibrium, posture and joint movements. Activity in the cerebellum is unconscious and the results of this activity plays a part in the many feedback systems of the central nervous system (Miller,et al. ,1977). The cerebellum also assists in the coordination of more complex perceptual motor skills. When the higher brain centre sends out a command for muscle contraction, a copy is sent to the cerebellum. Through its inter-neurons, the cerebellum can monitor the actual performance of the actions associated with the command. If any minor adjustments need to be made in the command, the cerebellum will do so itself. If major adjustments must be made, it will inform the higher brain centre's that a new command must be issued (Sage, 1974; Wade, 1992).

2.1.2.2 The Cerebrum

The cerebrum forms the largest portion of the brain. It is composed of two *hemispheres* covered by a *cortex*, a bridge of white matter that connects the hemispheres (the *corpus callosum*), the *limbic system* and the *basal ganglia*. The cerebrum is the "executive suite" of the nervous system, the home of our "conscious mind". It enables us to be aware of ourselves and our sensations, to initiate and control voluntary movements, and to communicate, remember and understand. Since it is composed of gray matter, the cerebral cortex contains neuron cell bodies, dendrites, and very short un-myelinated axons, but does not contain fibre tracts. The cortical areas that control motor functions lie in the posterior part of the frontal lobe. They are the primary motor cortex, the pre-motor cortex, the frontal eye field and Broca's area (see figure 2.3). Each area has specific functions:

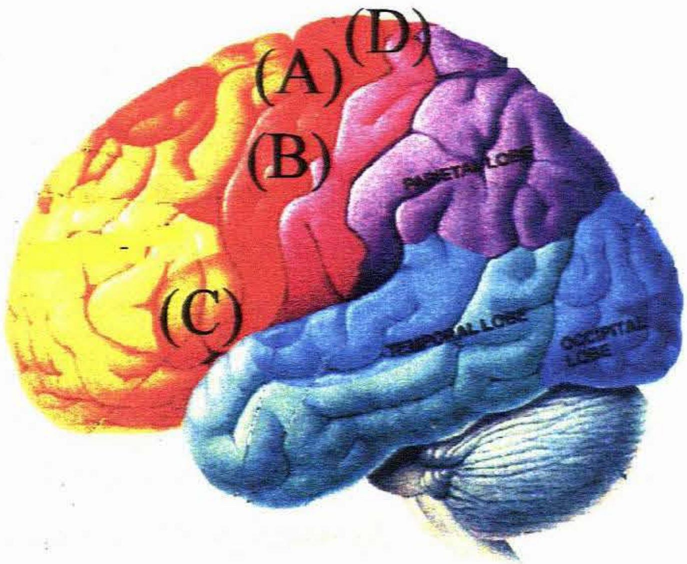


Figure 2.3:Structural and functional areas of the cerebral cortex.

(Marieb & Mallet, 1997)

- **(A) Pre-motor cortex:** Controls learned motor skills of a repetitious or patterned nature.
- **(B) Frontal eye field:** Controls voluntary movements of the eyes.
- **(C) Broca's:** It is thought that the true function of the Broca's area may be to "pre-plan" all our voluntary movements, sending instructions to the primary motor and pre-motor cortex for execution.
- **(D) Motor cortex:** The human body is spaciously represented in the primary motor cortex of each hemisphere. (Griffiths, 1981; Marieb & Mallet, 1997).

All human movement is dependent upon the contraction of muscles, and large parts of the cortex are specifically concerned with controlling the muscles of the body. Complex organization of voluntary motor behaviour requires the combined functioning of many parts of the cortex. It requires a complex system of cortical regions functioning together in very close coordination, with every region responsible for one particular part of the organization of the motor behaviour. The region of the cortex from which most neurons arise is called the motor cortex area. Networks within the motor cortex receive the action plan for movement from the pre-motor cortex. The motor cortex generates a specific series of commands for muscle contraction. These commands are sent down the spinal cord, and finally to the muscles involved (Wade, 1992). It is believed that the motor area is primarily responsible for controlling discrete movements of the various skeletal muscles of the body (Bell,1970). Destruction of this part of the cortex results in a dysfunction of fine motor voluntary movements. It is believed that the pre-motor area is specifically concerned with the control of coordinated movement of several muscles at a time and therefore the acquisition of specialized motor skills. It would seem that the motor areas of the cortex are responsible for the initiation of motor impulses and for transmitting the impulses to the muscles. The whole cortical mechanism is connected to various areas of the cortex, and each area plays its own unique role in the functional organisation and integration of the motor movement. Some areas ensure that motor impulses are sent to the correct destination, others provide spatial orientation and synthesis, while others are concerned with serial organization and the linking of distinct motor movements into smooth movements. Lastly certain areas of the cortex play a role in programming complex motor acts and regulating the whole system for a comparison between the actual movements and the intended movement pattern (Sage,1984).

2.1.2.3 The Basal Ganglia

Deep within each hemisphere are large groups of neurons referred to as the basal ganglia. The basal ganglia work together with the motor cortex to coordinate motor behaviour. The basal ganglia inhibit cortical influences so as to bring about smoothly coordinated movements. Learned gross motor movements are initiated at the level of the basal ganglia. Damage to parts of the basal ganglia can result in disorders like athetosis and Parkinson's disease(Sage, 1984; Wade, 1992)).

2.1.2.4 The Brain Stem

The two main structures of the brain stem are the pons and the medulla oblongata, which contain numerous nuclei that are concerned with the control of motor activity. Input to the brain stem arrives from many sources. Fibers from all of the sense organs pass through the brain stem and they give off many collaterals which synapse with the brain stem centre. The cerebellum, the cerebral cortex, and the basal ganglia project motor fibers into the brain stem. This area of the brain is, then, an integrative area for combining and coordinating all sensory information with motor information. This information is then used to control many of our involuntary motor movements. The brain stem plays an essential part in the more automatic types of motor activity. Much of our postural, locomotor, and other automatic types of motor activity is mediated by the brain stem. Many brain stem functions concerned with posture and equilibrium are performed reflexively (Griffiths, 1981; Marieb & Mallatt ,1997).

2.1.2.5 The Spinal Cord

The spinal cord is made up of grey and white matter. The grey matter contains motor nerve cells in the anterior horn and sensory nerve cells in the posterior horn. The white matter of the spinal cord is composed of myelinated and un-myelinated axons. These axons allow communication between different parts of the spinal cord and brain. They run in three different directions: (a) ascending - sensory information, (b) descending-motor instructions from brain and spinal cord, (c) interneuron- fibres cross from one side of the cord to the other. They are arranged in funiculi which are named in accordance with their location and include the anterior funiculus, the lateral funiculus and the posterior funiculus. The nerve fibers from the spinal nerves which enter via the dorsal root, are sensory fibers. Motor fibers to muscles leave the cord over the ventral root. The spinal cord carries the sensory and motor fibers to and from the peripheral nerves. Higher level activity is integrated with spinal reflexes in the cord. Spinal reflexes include the monosynaptic or stretch reflex and the tonic lumbar reflex (Marieb & Mallatt, 1997; Wade, 1992).

2.1.2.6 Motor pathways

All motor pathways in the CNS, no matter where their origin, are directed toward motor neurons in the sub-cortical structures in the brain and spinal cord. Pathways concerned with movements of the lower motor pathways that control movements of the lower limbs originate on the medial surface of the cerebral cortex near the midline. Pathways that carry impulses which cause movement of the neck and head originate near the lateral fissure in the cortex. Motor control is primarily contra-lateral but muscles located near the medial plane, such as respiration muscles, can be controlled by either hemisphere (Bell, 1970).

The sources of sensory information about the external world and our bodies are many and varied, but the means of control of voluntary and involuntary movement in response to sensory information are few. There are at least twelve different kinds of sensory receptors, with their various pathways to the brain, but there are only two major motor pathways. These two motor pathways are the pyramidal tract and the extra pyramidal tract. The pyramidal tract is made of those fibers which originate in the cerebral cortex and pass to the spinal cord through the medullary pyramids. The pyramidal tracts are mostly concerned with the voluntary initiation of controlled movements and modification of reflex behaviour by facilitating or inhibiting synaptic transmission in the brain stem and spinal cord . The pyramidal tract regulates fine motor actions(Sherrill, 1993). The extra pyramidal tracts regulate gross locomotion (Cheatum & Hammond, 2000). The extra pyramidal tracts are also mainly responsible for automatic actions and postural control (Sherrill, 1993).

Neurological pathways are constantly being created and lost throughout life. As long as a child can see, feel, hear, or move, sensations are being sent along pathways to and from the brain or spinal cord. When a child attempts a new movement experience they will have many partial successful and unsuccessful attempts. Once success has been reached, the child will repeat the skill over and over. This repetition creates additional connections between the neurons and establishes a more secure pathway (Cheatum & Hammond, 2000).

Learning to perform skills automatically, is important to developing motor skills. If for some reason, the child, due to illness, stress or injury stops after the first few tries in learning a new skill and never again tries to learn the new skill, the dendrites would disappear and the connections would be lost (Pyfer,1983).

2.1.3 The Nervous System and Development Readiness

Motor development is often classified as *phylogenetic* (activities such as creeping, walking, and running that evolve naturally, without instruction, in normal children) and *ontogenetic* (activities that are more or less culturally determined and require instruction and practice even in normal children). The theory of normal motor development holds that phylogenetic activities occur as the result of maturation, whereas ontogenetic activities are believed to result from teaching/learning/practice. Motor development is intricately related to the growth and maturation of the nervous system (Sherrill, 1986).

The development of complex motor skills depend upon the nervous system's growth, a process sometimes called readiness, maturity or developmental level. Even though babies have billions of neurons at birth, they lack the ability to perform goal-directed skills. As early as the first few days after birth, however, the nervous system begins to develop in a manner that allows the child to perform different actions intentionally. Growth or a change in the nervous system must precede the development of new movement or motor skill. The first obvious sign of a change in the growth of the nervous system occurs when a baby is about four to five months old and starts reaching for objects. From then until the end of the third year, many changes occur, allowing the baby or toddler to progress through skills such as rolling over, sitting up, walking, and eventually running. This growth of the nervous system cannot be rushed. This means that the set sequence for developing motor skills cannot be easily altered. Children cannot walk if the changes in the nervous system necessary for walking, have not occurred. More advanced movement patterns and motor skills appear as the nervous system matures (Cheatum & Hammond, 2000).

Development occurs through plasticity, the ability of neurons in the brain to make new connections with a new set of neurons and to create new pathways. Through plasticity, each response of a child to a new stimulus or a more difficult demand of the environment increases the number of dendrites between the neurons. Neurons also have the ability to change neurological pathways. After a neurological pathway has been interrupted through injury, stroke, or disease, some connections can be re-established or new ones can be created. The creation of a new pathway is referred to as sprouting, much like a branch of a tree. When one branch of a tree is lost through disease or surgical removal, the remaining tree fills the vacant area by sprouting new branches, this action is also true in the brain. Sprouting, in the brain of a child, is a direct result of the demands of the environment and the child's response to these environmental demands. These experiences force the individual's neurons to 'sprout' new connections to perform the lost skills and activities. Replacing old pathways with new ones is not necessarily easy. This involves getting the individual to repeat the new techniques so often that when she/he starts the skill, the new pathway takes over. If she/he does not concentrate or is stressed, she/he will slip back into the old pathway and will repeat the incorrect skill. Plasticity depends on both having a stimulating environment and persistently repeating the activities (Cheatum & Hammond, 2000).

The mature, healthy CNS is characterized by a multiplicity of synaptic connections and rich neuronal interactions. Approximately 5 months before birth, myelination begins. This is the development of the fat like protein and lipid substance that forms the covering of axons and influences their ability to conduct impulses. Myelination continues rapidly from birth until 3 to 4 years of age, when it is mostly complete except for the association areas of the brain. Myelination in these areas is finished between ages 20 to 30 years. Motor milestones, such as head lifting, sitting, creeping, standing, and walking, cannot be achieved until myelination in the related nerves and CNS parts is completed. Likewise, certain kinds of complex reasoning cannot occur until the association areas of the cerebral cortex are fully myelinated (Sherrill, 1993).

2.1.4 Motor Development Stages

Motor development is intricately related to the growth and maturation of the nervous system. Development is the continual, sequential process by which an individual changes from one life phase to another (Sherrill, 1993).

Normal motor development is governed by eight principles (see table 2.2). When these principles are violated, the child is described as exhibiting abnormal motor development.

Table 2.2: **Principles of Motor Development**

	Principle
1	**Continuity:** Development is a continuous process, from conception to death.
2	**Uniform sequence:** The sequence of development is the same in all children, but the rate of development varies from child to child.
3	**Neurological maturation:** Development is intricately related to the maturation of the nervous system. No amount of practice can enable a child to perform a motor task until myelination has occurred.
4	**General–to-specific activity:** Generalized mass activity is replaced by specific responses of individual body parts. The child gains control of large muscle groups before achieving fine motor coordination.
5	**Cephalocaudual direction:** Gross motor development begins with head control (strength in neck muscles) and proceeds downwards.
6	**Loss of reflexes:** Certain primitive, such as grasp reflex and Moro reflex, must be lost before the corresponding voluntary movement is acquired.
7	**Proxi-modistal co ordination:** Muscle groups near midline become functional before those farther away (distal) from the midline do. For example, a child learns to catch with shoulders, upper arms, and forearms before catching with fingers. Movements performed at midline are easier than those that entail crossing midline.
8	**Bilateral-to-cross lateral motor control:** Bilateral movement patterns are the first to occur in the human infant, followed by unilateral movement patterns, followed by cross lateral patterns.

(Source: Sherrill, 1986)

After birth, certain stages of development are common to most children. They will, enter and pass through stages in approximately the same order and at about the same time as other children. By studying the stages of development, the point at which a particular child experienced some development difficulties that are now limiting his/her academic, behavioural or motor abilities may be identified (Cheatum & Hammond, 2000). Knowledge of motor development stages and their implications guide the physical educator in their assessment and instruction process(see Table 2.3).

Table 2.3: **Motor development implications for physical education**

Characteristics	Implications for physical education
Two to Seven Years	
Hand-eye coordination shows steady improvement.	Provide for manipulation of balls of various size. Gradually increase speed, use of small objects, and distance as skill develops.
Reaction time is slow but shows persistent increase. Locomotor and manipulative skills show continuous improvement.	Encourage participation in numerous activities involving a change of speed, direction , and level.
Static and dynamic balance shows steady improvement.	Provide opportunities to practice balance and agility movements on small and large apparatus.
Rhythmic and dance skills show increase in complexity of movement.	Provide a variety of rhythmic folk, and creative dance activities.
Seven to Nine Years	
Eye-hand coordination continues to improve, along with major improvements in manipulative skills.	Introduce basic sports skills and lead-up games.
General improvement in reaction time.	Stress form rather than speed, distance or accuracy.
General improvement in rhythmic and dance skills.	Provide more complex rhythmic and folk dance activities.

Characteristics	Implications for physical education
Nine to Twelve Years	
Muscle coordination continues to improve in both sexes.	Provide organized and competitive individual and team sports.
Boys and girls begin to show major differences in level of skill in same sport activities.	Both sexes, require extensive practice in the refinement of throwing, catching, and kicking skills, Provide more complex challenges in small and large apparatus activities.

(Adapted from Kircher & Fishburne, 1995))

The importance of motor development cannot be overemphasized, for it pervades all of child behaviour and development. Accomplishments based on motor development contribute to intellectual development, for example, the active infant modifying his/her grasping reflex. Motor development also contributes to social development. Human development and motor development are inherently entwined, and when motor development is deficient it can have a pronounced influence on the rest of development (Morrison, 1990).

2.1.4.1 <u>From conception to 2 years of age</u>

Infants begin to exercise their movement capacities prior to birth, and levels of fetal activity are roughly predictive of later motor competency. The earliest movement that can be elicited in newborn infants, consist of reflexes, involuntary actions triggered by various kinds of external stimuli (Cheatum & Hammond, 2000).

During the first year of life a child is a reactive agent. That is, automatic built-in, reactions to stimuli dictate the child's movement responses. A series of reflexes enables it to lift its head, balance on all fours, grasp objects, and turn its head toward an outstretched hand. At this time the physical control of the child's movement is centred in the lower portions the central nervous system (CNS). Reflex arcs are mediated at the spinal cord, brain stem, and midbrain levels. A child is able to lift its head, roll over, sit, and eventually stand only if environmental demands and neurological integrity permits the stimulus-response to occur. By the end of the first year cortical control is beginning to develop. The child, although somewhat nearsighted, can use both eyes in unison to eventually visually track moving objects with ease. The child can now grasp and release objects at will, can stand and in most cases, can walk. These functions are possible only if the CNS has been stimulated enough to permit development of motor pathways from the spinal cord through the cortical level (Arnheim & Pestolesi, 1978; Morrison, 1990; Pyfer, 1983).

2.1.4.2 From 2 to 7 years of age

Motor development plays a significant role in toddlers' and pre-schoolers' lives because it enables them to be autonomous and contributes to their independence. Toddlers spend much of their time practising and expanding their ever-emerging motor skills by walking, running, climbing, and kicking. Pre-school children are whirlwinds of energy as they practice and perfect their emerging large muscle physical skills. In addition, fine motor skills play an increasingly significant role in children's cognitive development and academic activities (Morrison, 1990; Pyfer, 1983).

There are significant advances in motor control during this period. These advances depend both on physical maturation of brain and body systems and on the increasing skill that comes with practice. They involve both the large muscles such as those used in running, jumping, climbing, and the small muscles such as those used in drawing and tying a knot. Several factors contribute to the growth in motor development. In the first instance, this development reflects the gradual transition from reflex behaviour of the newborn to the voluntary actions of the pre-schooler. A second factor is the child's increasing ability to accurately perceive body size, shape and position of its parts. Increasing bilateral co-ordination, the co-ordination of the two halves of the body, also contributes to increased motor performance. Virtually every motor skill requires some sort of co-operation between the two sides of the body, moving in some kind of alternatively timed relationship (Arnheim & Pestolesi, 1978; Landers, 2000; Morrison, 1990).

The capacity to perform activities such as walking, running, and jumping does not necessarily imply the ability to perform them smoothly or with skill. For example, the young toddler's steps are awkward. Yet by the end of toddlerhood, walking becomes a skilled activity. The stride lengthens, speed increases, balance stabilizes, and the child can walk for long periods without resting. By the age of 4, the child's walk is essentially the same as the adult's. In most cases the development of motor skills involves the gradual integration of existing movements into a smooth, continuous pattern (Arnheim & Pestolesi, 1978; Morrison, 1990).

In contrast to large muscle skills, fine muscle skills, also known as eye-hand coordination is the ability to co-ordinate or regulate the use of the eyes and the hands together in efficient, precise, and adaptive movements. This co-ordination enables the development of a wide variety of skills including writing, and the manipulation of small objects and or instruments. Pre-school children learn to manipulate objects through visual feedback which indicates whether or not they are doing what the child wants the objects to do. Thus the pre-school period is an important time for the development of manipulation skills which in turn prepares the child to deal successfully with the challenges of primary school. Motor control develops in cephalo-caudal and proximo-distal directions; that is control of the head precedes control of the trunk and legs, and control of the trunk precedes control of the arms, hands, and fingers. This directional progression must occur to enable the child to move about with ease and to use the hands with skill (Arnheim & Pestolesi, 1978; Morrison, 1990; Pyfer, 1983.)

2.1.4.3 From 8 to 12 years of age

When children reach school going age, they have already been exposed to a variety of experiences that can influence their future success. Without sufficient stimulation during this period, children can, from an educational perspective, be described as at risk cases (Broadhead & Church, 1985). As children develop during this period, large and fine motor skills continue to improve. Normally developing children become very competent during this time. They can separate head and trunk motion and demonstrate enough body stability to work very capably and efficiently with their hands. Thus as a child becomes stronger and taller, they become more capable of improved performances in these areas. Dramatic performances in physical skills are observed in tasks involving timing and co-ordination. These increased skills enable children in the primary school to participate in many physical activities involving throwing, catching, hitting and kicking. During these years, children are noticeably more proficient in being able to time the swing of a bat and to judge distances that balls are hit and thrown, making it much easier for them to succeed in sport activities. (Arnheim & Pestolesi, 1978; Morrison, 1990). Gabbard (1998) mentions that one of the aspects of prior learning and education that has been identified as of critical importance during this stage is the optimalization of development in physical movement activities. According to the research done by Gabbard (1998), future programmes must inevitably include movement activities in syllabi and programmes that are presented.

2.1.4.4 Factors affecting Motor Development

The exact timing of when a particular early locomotor milestone, fundamental motor skill, or specialized movement skill is first observed in a given individual may depend on one or more performer or environmental factors.

Performer factors which are most likely to affect the emergence of particular movement skills include body size and physical growth, strength relative to body weight, and the maturity of the nervous system (Espenschade & Eckert, 1980; Zaichkowsky, et al., 1980).

According to Illingworth (1971) the environment (the home, the neighbourhood, the school) has a profound effect of the child's development. The concept of the sensitive or critical period described by ethologists may be applied to the developing child. Evidence is adduced to the effect that the child should be enabled to learn when he/she is first ready to learn. The role of nutrition in the early years, of love and security, of the opportunity to practice and to develop independence, are all emphasised as environmental factors that could cause increases or delays in motor development.

2.2 How children develop movement skills

Teachers of physical education need to understand the development of children's motor skills, from primitive reflexes to fundamental motor skills to specific sport skills. At birth the child has a repertoire of movements that can be used in the new environment which include sucking, swallowing, crying, head-turning, grasping and moving the arms and legs. Both the Moro and tonic neck responses occur as a result of stimulation. These early reflexes are soon replaced by postural reactions so the child can control body movements. During early childhood fundamental skills develop, including running, jumping, hopping, throwing, striking, kicking and catching. These fundamental skills are the basis of the development of specific sport skills in the higher primary school (Thomas et al., 1988).

Developing the motor skills important for our daily living is a complex process that involves both inherent abilities and considerable practice over childhood and adolescence. The ultimate goal of physical education is to equip children with motor skills that contribute to independent living. To plan physical education programmes systematically, it is desirable to distinguish clearly between the levels of function that contribute to the acquisition of the many specific motor skills (Auxter, et al., 1993).

Auxter, et al., (1993), indicates that there are three levels that make a unique contribution to independent functioning:

- Basic input functions (reflexes, reactions and the sub-systems of sense)
- Motor abilities (rudimentary skills of sitting, crawling etc)
- Motor skills (fundamental motor and specific skills)

Basic input functions depend on the integrity and operation of the sensory input systems. These systems include primitive reflexes and the sensory sub-systems of vision, audition, and the tactile and kinesthetic systems. Before the information can reach the central nervous system for processing these systems must be intact and operational.

The second level of functioning is made of motor abilities. Like basic input functions, these prerequisites enhance the acquisition of skill. If the sensory input systems are functioning, abilities develop concurrently with movement experiences. Abilities prerequisite to skills, include the rudimentary skills of sitting, crawling, creeping, standing and walking.

rudimentary skills of sitting, crawling, creeping, standing and walking.

The uppermost level of functioning is skill. Skills are motor behaviours that are either specific to a sport or specific to functional living. Proficiency at either fundamental or specific sport skills are usually developed through repetitious practice of the skill itself.

2.2.1 Basic input functions: Reflexes and Reactions

Each one of us is born with a set of primitive reflexes, which should be inhibited or controlled by a higher part of the brain during the first year of life (Haywood,1986). The appearance of primitive reflexes is taken as a sign of an intact nervous system. A baby who is missing any of these reflexes may have some damage to his/her nervous system. Primitive reflexes disappear during the first year, or perhaps are taken over by learned control processes as the baby's nervous system matures (Auxter, et al., 1993).

If primitive reflexes are not inhibited at the correct time, they remain "active" in the body, and might impede subsequent motor control, eye functioning, eye hand coordination and perceptual skills (Sherrill, 1993).

Individual reflexes impair specific areas of functioning. For example, one reflex will prevent automatic hand control every time the head is moved, so that writing can never become fluent. Another reflex will affect the balance mechanism.

During the development of the fetus there are a group of reflexes which emerge called the primitive reflexes. These reflexes should be present at birth as they provide an indication of the status of the Central Nervous System. These reflexes should slowly be inhibited during the first year of life (Haywood, 1986).

Primitive reflexes are automatic reactions that enable the child to lift the head, prop up on two hands, turn the face toward the extended hand, assume an all fours position, and eventually crawl. Most of these reflexes are under muscle spindle control (Pyfer,1983).

Other primitive reflexes are under control of the labyrinthine portion of the inner ear. When a child moves his or her head against gravity, the labyrinthine is activated and a neuronal impulse is sent to a muscle group. The muscles, in turn, contract and cause movement. Should any of these primitive reflexes fail to develop at the proper time, the child is unable to demonstrate movement patterns expected at that age and also will be limited to further movement development. That is, children who cannot lift their heads will not learn to control head movement, which will limit their ability to sit, stand, and eventually walk (Cheatum & Hammond, 2000; Pyfer, 1983).

Primitive reflex action tends to promote development of the neuro-muscular system. As these pathways and muscles are used and developed, control of higher levels of the CNS are facilitated. As higher control levels develop, the primitive reflexes are phased out, so to speak (Pyfer, 1983).

Reflexes are innate responses that all "normal" children develop. Reflexes that affect movement are of interest to the physical educator because learners whose reflex maturation is delayed have inefficient movement patterns. In general there is a series of reflexes that should appear and disappear during the first year of life. These early (primitive) reflexes are layered over by (integrated into) voluntary movement patterns. *As a child begins to experience movement, a different set of* reflexes or responses appears. These later responses are known as the equilibrium reflexes or responses(Auxter, et al., 1993).

Children should begin to show equilibrium reflexes near the end of the first year of life. As their name suggests, equilibrium reflexes affect our ability to maintain balance, particularly moving balance. During movement as our centre of gravity shifts over our base of support, equilibrium reflexes enable us to alter our posture in such a way that we are able to remain in an upright position. Equilibrium reflex development is necessary if a child is to control movement while running, jumping, hopping, and performing other active movement patterns. Most of these reactions are also activated by muscle spindles; however, mediation between the sensory impulse and the motor neuron occurs at the cortical level. The child who does not develop equilibrium reflexes is clumsy and tends to fall often. They also have difficulty with any agility movements requiring sudden shifts in direction (Pyfer, 1983).

As the infant begins to grow and mature during the first six months of life, so the Central Nervous System also begins to mature. Higher, more sophisticated regions of the brain begin to supercede the primitive reflexes. As this occurs early survival patterns are inhibited or controlled to allow more mature patterns of response, or reflex, to develop in their place. These mature reflexes, *the spinal reflexes*, the *tonic reflexes* and the *equilibrium reflexes* (see table 2.4) which have replaced the primitive reflexes function throughout life and become more important for motor control, and it is only as they replace primitive reflexes that the infant begins to gain control of the body and body movements (Haywood, 1986).

Table 2.4: **Reflexes**

Reflex	Function
Spinal Reflexes: The Stretch Reflex The Withdrawal reflex The Crossed Extensor Reflex The Extensor reflex	Coordinate the flexion and extension of muscles so that one can perform smooth, precise actions.
Tonic Neck Reflex The Tonic Neck reflex The Tonic Labyrinthine Reflex	Establishes certain spatial relationships between the head and the body.
Equilibrium reflexes The Labyrinthine Righting Reflexes The Neck Righting Reflexes The Optic Righting reflexes	Maintains the body's orientation to gravity.

(Source: Haywood, 1986)

Some children fail to gain control of their postural reflexes in the first six months of life and continue to grow up in a reflexive "no man's land". It is not uncommon among primary school children with learning and behaviour problems to have retained some of their primitive reflexes. Retained primitive reflexes will also affect a child's sensory perceptions, causing him/her to be hypersensitive in some areas and hypo-sensitive in others. If both sensory input and motor response are impaired, conceptualisation of certain movements becomes impossible. This can affect not only arms and legs, but eye functioning, visual perception, balance and the processing of auditory information (Cheatum & Hammond, 2000).

Sherrill (1993) indicates that there are four primitive reflexes which commonly affect learning and behaviour problems:

- Tonic labyrinthine reflex prone
- Tonic labyrinthine reflex supine

- Asymmetrical tonic neck reflex
- Symmetrical tonic neck reflex

2.2.1.1 The Asymmetrical Tonic Neck Reflex (ATNR)

The ATNR reflex emerges at around 18 weeks in utero. After birth it is suppressed while the child is awake. Until the child is three or four this reflex can be activated whilst the child is sleeping. The ATNR fulfils many purposes, one of which is to assist in the birth process- the rotation of the head allows the shoulders to move, and therefore the baby moves in a spiral down the birth canal. The ATNR is the first training ground for eye-hand coordination. When a baby is born it can only focus its eyes at about 5 cm. Outside of that the baby can see movement and shadow, but it cannot focus. Through the ATNR, the baby slowly extends the vision from near point fixation to distance, and therefore this is vital for eye-hand coordination training (Cheatum & Hammond, 2000; Sherrill, 1993).

The stimulus for the ATNR is head rotation to either side. This causes the arm and leg on the same side as the turned face to straighten, while the arm and leg of the other side bends. This is one of the first steps toward the alternating movement pattern of the two sides of the body used in creeping, crawling, walking, and running (Sage,1984).

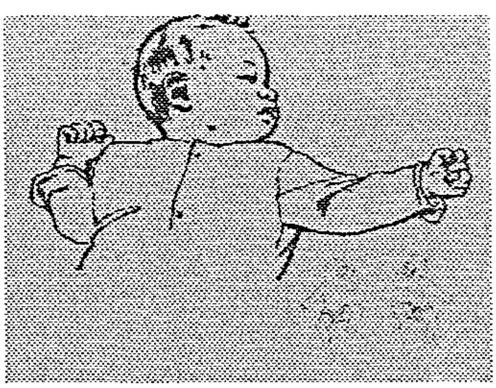


Figure 2.4: Asymmetrical tonic neck reflex (Wade, 1992)

If the ATNR remains present it might affect vision in that the hand will not want to cross the midline, and as the eyes are focussed on the hands, they will not want to cross the midline either. This may mean that, when reading for example, when the eyes get to the midline, they "jump" and the child may lose their place. The ATNR also prevents a child from using two hands to do any activity, such as catching a ball, or from using one hand to throw a ball. In older children, retention of the ATNR may interrupt classroom activities, especially writing. Every time the child looks at the pen, there is a slight extension of their arm. When they look away, the arm flexes. It is as though there is an invisible force which causes the arm and hand to straighten whenever the head is turned to one side. The child may have to exert a great deal of conscious control when writing- something that should be automatic. In addition to the fatigue caused by the effort of fighting the reflex, the child's comprehension can suffer due to the cortex being involved in movement (Cheatum & Hammond, 2000; The Institute for Neurophysiological Psychology, 2001; Primitive reflex activity: http://www.mulhollandinc.com.reflex.htm).

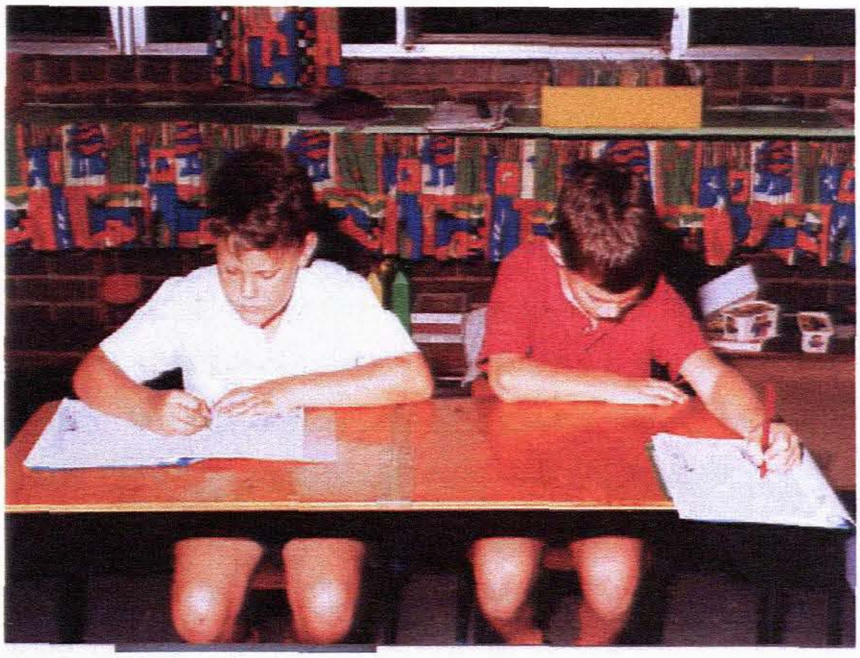


Figure 2.5: The effect of the retention of the ATNR on writing

2.2.1.2 The Tonic Labyrinthine Reflex (TLR)

The TLR reflex first emerges when the fetus is in flexion around 3-4 months in utero and reappears during the first and second month after birth when the baby is in extension, and should disappear by the fourth month (Sherrill, 1993).

This reflex is the baby's way of responding to gravity. In extension, the TLR helps the baby to straighten out from the flexus habitus position, and it therefore plays a role in the development of muscle tone, a process which also helps train balance and proprioception (Sage, 1984).

This reflex is activated when the head is moved above and below the level of the spine. The *prone tonic labyrinthine reflex* occurs when a child is placed on their stomach and gravity acts on the labyrinthine (inner ear). The baby's body seems to be curling toward the ground with its chin tucked toward the chest and its knees trying to pull under the stomach. The *supine tonic labyrinthine reflex* is also a combination of the position of the baby's body and gravity. Placing the baby on its back allows gravity to act on the labyrinthine. This pulls the baby's trunk, head, arms and legs toward the ground (Cheatum & Hammond, 2000).

There can be drastic effects on many functions if the TLR remains present. Head movement can affect muscle tone, and this can cause a distortion in the centre of balance. The brain will lack a secure reference point which to judge space, depth, distance and speed, and this, in addition to causing problems with directions such as left, right, up, down, can lead to difficulty. The ability to track smoothly and evenly with the eyes only comes as the TLR in extension is inhibited. The continued presence of the TLR prevents the proper emergence of the Head Righting Reflexes (Cheatum and Hammond, 2000., The Institute for

Neurophysiological Psychology, 2001 Primitive reflex activity: http://www.mulhollandinc.com.reflex.htm).

Children with learning and behavioural problems may have some carryover from the TLR (either supine or prone). It may be so pronounced or noticeable that these children have trouble doing any movement or academic activity that requires them to move the body or limb against the pull of gravity. Some children can remain in an upright sitting position for only a short time before collapsing. Other children seem to sprawl across the desk with their head on their arms when they are writing or reading. It is also suggested that the child could have difficulty in aligning numbers, could have spatial difficulties and be poorly organised (Cheatum & Hammond, 2000).

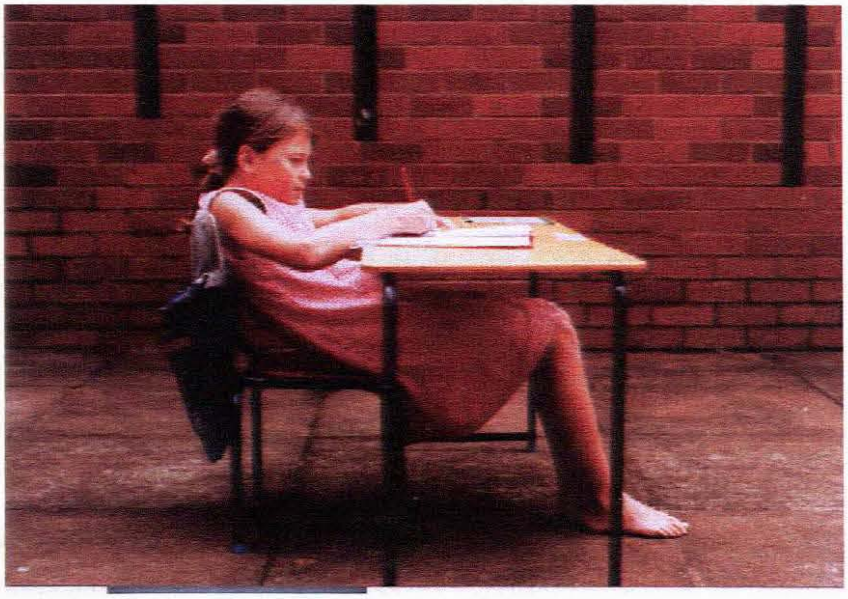


Figure 2.6: TLR-prone child. Gravity pulling on the child.

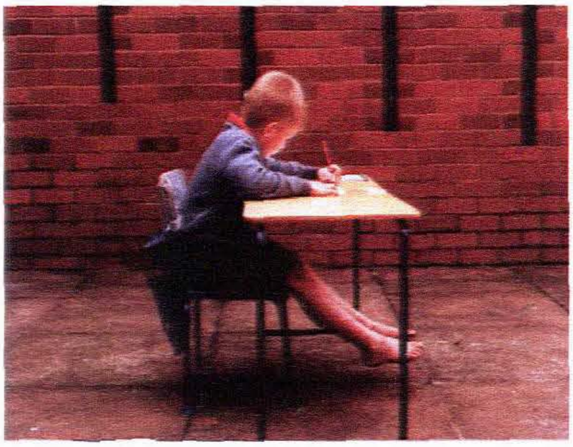
2..2.1.3 The Symmetrical Tonic Neck Reflex (STNR)

The STNR is active during the fourth to seventh months after birth, and is inhibited or suppressed at about one year (Sherrill, 1993).

The sole task of the STNR is to get the child to begin to defy gravity. Stimulus for the STNR is the positioning of a child's head acting on receptors in the neck. As the child's head is bent forward (toward the chest), its arms will flex and legs will extend. As the child is bent backward , its arms will extend and the legs will flex (Sherrill, 1993).

Retention of this reflex causes problems. Children are unable to progress to activities in which they use the arms separately or in opposition. It is impossible to crawl if the STNR persists. When attempting to creep or crawl, they may have to use both arms to pull the body forward, and then push with both legs (Cheatum & Hammond, 2000).

One of the main concerns of teachers is that retention of the STNR will restrict a child to mostly *bilateral movements*. If a ball is thrown toward the middle of the body, the child can catch it since it can use both arms. If a ball is thrown over to one side, the child will usually not be able to catch it unless he moves over and uses both hands. The bilateral movement of the STNR also affects writing ability. Every movement of the head causes forward and backward movements of the arms, which makes fine motor control of the wrist and fingers nearly impossible. The STNR has been associated with reading and concentration problems. It will also affect copying and spelling and has a definite, noticeable effect on posture and movement (Cheatum and Hammond, 2000., The Institute for Neurophysiological Psychology, 2001 Primitive reflex activity: http:// www.mulhollandinc.com.reflex.htm).



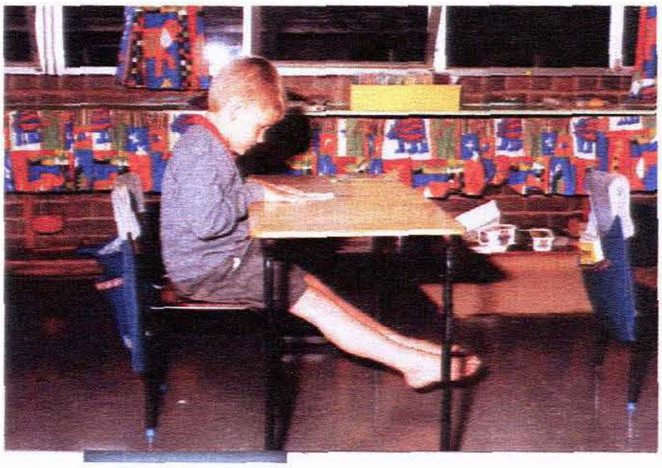


Figure 2.7: The effect of retention of the STNR on writing and reading

2.2.2 Basic input functions: The Sensory System

Our sensory systems play a crucial role in motor learning and performance. Our simplest movements, the reflexes, are initiated by the senses and complex movements are regulated by our senses. The senses are of fundamental importance to the development of perception. Human perceptual potentialities can develop only in the presence of functional sensory systems (Sherrill, 1998).

All our ongoing daily activities are responses to environmental and internal stimuli. In order for our behaviour to be effectively directed toward these stimuli we are equipped with neural mechanisms for sensing these stimuli, coding them into electrical impulses, and transmitting these impulses through the neural pathways to the receptive areas of the brain. The various neural mechanisms which are responsible for these functions make up our sensory systems (Cheatum & Hammond, 2000).

The five basic senses are the:

- Vestibular
- Proprioceptive
- Tactile
- Visual
- Auditory

Each have sense organs through which information is gained and primary actions are initiated. These systems seldom, if ever, operate in isolation. They are dependant on each other for interpretation of information and movement.

Each sensory system has its own neurological networks, pathways, and location or site within the brain.

2.2.2.1 The Vestibular System

The vestibular system is the sensory system considered to have the most important influence on the other sensory systems and on the ability to function in everyday life. It is the unifying system in our brain that modifies and coordinates information received from the visual, proprioceptive, auditory and tactile systems. The vestibular system should be of great interest to the physical educator inasmuch as it is involved with kinethesis, balance, and postural reflexes (Bell, 1970).

The vestibular system informs the nervous system where it is in relationship to the pull of gravity so that a person can maintain equilibrium. In combination with the proprioceptive and visual systems, it helps a person know when they are upright, upside down, or lying down. Controlled movements, whether rolling over, crawling, sitting still, standing, moving through space, or performing sport skills, all rely on information received from the vestibular system. The vestibular system consists of the inner ear, the vestibular nerve and the vestibular nuclei. Structurally the inner ear includes a labyrinth composed of three parts; the semicircular canals, the vestibule and the cochlea (Bell, 1970; Sage, 1984).

The semicircular canals, utricle, and saccule are often referred to as the balance sense organs. Overall, their purpose or action is to communicate a sense of where the body is in space and to maintain the posture and equilibrium that is necessary for the individual to be able to perform motor acts. To do this, the vestibular receptors, along with the eyes, muscles, and joint, constantly monitor movement. The vestibular receptors let the person know whether he/she is maintaining balance against the pull of gravity, or moving fast or slow (Sage,1984).

The vestibular system has a strong influence on the muscles that control posture. This includes muscle tone and the strength needed to sit in a chair, hold the neck in the correct position for class work, or compete in sport or recreational activities. Tonic muscle control is established when children can contract a muscle or a group of muscles and hold them in that position for several seconds. Skeletal muscle and static muscle control are essential for the child to be able to maintain a variety of positions in the classroom and in physical education. In some actions, as in turning rapidly, children receive a forceful stimulation that causes the postural muscles to have an automatic reflex response against the pull of gravity. This response is so strong that they cannot stop it voluntarily. The vestibular system has yet another important feature, its influence on the pre-arousal part of the brain. In a child this part of the brain controls alertness and the ability to focus. Depending on the type of vestibular stimulation, the influence can arouse or calm a child's nervous system. Vigorous movements, such as spinning or jumping, excite the youngster's brain and enable it to focus (Cheatum & Hammond, 2000).

Slow vestibular activities, and particularly movements in a straight line, have a calming effect on the nervous system of children. Activities such as swinging or rocking are calming. Some children may seem sleepy when they come back into the classroom from the play ground (Cheatum & Hammond, 2000)

The vestibular system plays a key role in controlling eye movements and fixation of the eyes. Each eye is controlled by six pairs of muscles that receive stimulation from the vestibular system. Movement of the head will cause some corresponding movement or readjustment of the eyes. During academic tasks, such as reading or writing, the vestibular system helps students keep their eyes focussed on the teacher or assigned school work.

Injury to or dysfunction of one of the semicircular canals causes a child's vision to become distorted or jumbled when he moves his head (Cheatum & Hammond, 2000; Sherrill, 1998).

There are two basic types of vestibular problems namely *hypervestibular* and *hypovestibular*. Both conditions usually result in neurological and motor development problems for different reasons. Hypervestibular reactions to vestibular stimulation occur when a child's neurological system cannot regulate the amount of information bombarding the central nervous system. Too much stimulation reaching the semicircular canals or the utricle and saccule could cause a sensory overload. Children who are hypervestibular are very good at describing exactly how to do an activity, but avoid actual participation, as they fear the onset of dizziness. Coordination problems arise from a lack of experience in physical activity. Since they avoid movement and may become dizzy, they often have poor balance, hand-eye coordination, and locomotor skills (Cheatum & Hammond, 2000).

When a child has a hypovestibular problem, his central nervous system does not receive or correctly process information about movement, changes of direction, or relationship to gravity. Neurologically the vestibular system has trouble telling the child whether he is lying down or standing up. Hypovestibular problems are common among children with learning disorders. In the classroom they lack the internal reference to gravity and space, causing the child to be unaware of the difference between up and down, top and bottom, or left and right. In playing sport they puzzle over which hand to use to catch, throw or hit a ball (Cheatum & Hammond, 2000; Sherrill,1998.)

2.2.2.2 Proprioceptive System

In order to move effectively, the individual must be able to monitor his/her own movements by knowing the relative position, the different parts of the body and by being able to maintain a particular orientation toward gravity. These functions are performed by complex sensory receptors called proprioceptors which are located in muscles, tendons, joints, and the labyrinth of the inner ear (Sage, 1984).

Proprioception applies to the actual awareness of sensations that come from receptors in the muscles, joints, skin, tendons, and underlying tissue (Sage, 1984).

The proprioceptive mechanism in muscles is the *muscle spindle* which consists of specialized muscle fibres interspersed among the main skeletal muscle fibres of the body. The sensory receptor which is responsible for the detection of tension on a tendon and the extent of muscle contraction is called the golgi tendon *organ.* Its location is the tendon near the ends of muscle fiber. Three types of receptors are located in the tissue around the joints. The Ruffini endings which resemble those found in the skin are by far the most common, are found in the connective tissue capsule of the joints. A second receptor which resembles the golgi tendon organ is located in the ligaments. Modified Pacinian corpuscles form a third type of joint receptor (Bell, 1970).

Each of the proprioceptive receptors provides specific information about the body. This information includes the relationship of the body parts and joints to each other in both stationary and moving positions. At any one time, the proprioceptive system sends information to the brain concerning the

(a) location of the joints and body parts;

(b) movement of the joints and muscles;

(c) pressure on the skin and underlying tissue;

(d) pain felt in the joints tissue, or muscles; and

(e) temperature.

This information helps children to subconsciously judge the amount of force to use when throwing a baseball, serving a volleyball, balancing on skates, reaching for a pencil, writing or just sitting still in a chair (Cheatum & Hammond, 2000).

The proprioceptive system plays a key role in helping a child maintain equilibrium, progress though the motor development stages, and later perform motor skills. It acts, in cooperation with the vestibular and visual systems, to keep the body upright and balanced. These three systems are so intricately related that when one system is not working, the other two systems can provide sufficient information to the brain to keep the body in an upright position (Sherrill, 1993).

Feedback is as critical for improved academic performance in the classroom as it is for motor skill development. As a child learns new academic skills that involve movement of the body, the proprioceptive system comes into play to perform the movements and record the action (Bell, 1970).

Typically, a proprioceptive problem is related to body awareness, laterality, or directionality, or poor motor planning or to some combination of these concepts. A child who cannot identify the parts of its body usually finds it difficult to co-ordinate its body. This lack of body awareness blocks the development of body schema. Without body schema there is little hope that it can progress through the developmental stages of laterality, directionality, and directional discrimination. If a child is unable to "motor-plan" it is prevented from being able to plan and perform a purposeful movement or motor skill. The inability to motor-plan makes a child appear clumsy or uncoordinated. One of the most critical problems that is associated with a child's inability to motor-plan is that the neurological system is not developing a store of movements that can be used to create additional movements. In other words, there is no reference pool in the CNS because no sets of connections have been made among neurons. A child's inability to motor-plan and develop age-appropriate skills can be frustrating and lead to behaviour problems that carries over to the classroom (Cheatum & Hammond, 2000).

2.2.2.3 The Tactile System

The receptors or sense organs for the tactile system lie within the various layers of the skin. There are seven different types of skin receptors that are simulated by touch, pressure, temperature, and pain. Stimulation of the touch
receptors occurs most often as children use their hands, feet, and other parts of their bodies. Both handling objects and moving across a surface involve active touch. In contrast, when someone or something makes contact with a part of the body, passive touch occurs. The hands and fingers in humans contain a lot of tactile receptors that makes them highly sensitive to pressure (Sage, 1984).

Information gained through stimulation of the skin receptors is important for learning about the environment and protecting our bodies. The tactile system is one of the first sensory systems to develop in a baby, functioning in the fetus as early as seven and a half weeks after conception. One of the major responsibilities of the tactile system is to enable a child to tell the difference between such things as the size, shape, weight, and texture of objects touched or held in their hands. Discrimination is especially important when using the hand of a child whose vision is blocked, they can feel the weight of the ball and the texture of the surface (Haywood,1986).

An intact tactile system acts as a warning device, which is essential for the protection of a child's body. The receptors are sensitive to stimulation that has the potential to damage or injure the skin.

Children who have a dysfunctional tactile system have many of the following symptoms; restlessness, hyperactivity, a short attention span, poor attitude, and poor academic achievement (Cheatum & Hammond, 2000).

2.2.2.4 The Visual System

The eyes are the receptors for the visual system. Information gained through the eyes enables children to distinguish between people and objects that are close by, across the room, or even miles away in the sky. The eyes are able to tell the approximate size, shape, and colour of objects and to see these in three dimensions. Children use their eyes to guide them in almost every action they take, including crawling, walking, playing, reading, writing and participating in motor skill development (Cheatum & Hammond, 2000).

Images gained through the eyes depend on a pathway known as the vestibular-ocular reflex (VOR). The purpose of the VOR is to combine images gained through the eyes with information received from the rest of the sensory systems. When there is interference with sensory information of the vestibular system, it reduces functioning of the VOR arc, and function may even be lost. This results in blurred vision, when a child moves his head or body for example. Damage to any one of the semicircular canals of the vestibular system result in distorted vision. Visual perception also depends on several visual skills: binocular fusion, accommodation (Convergence and divergence) fixation, visual pursuit, depth perception, visual memory, and visual sequential memory (Sherrill, 1993).

Success in school demands not only acuity but also vision. Unfortunately, each problem with accommodation, fixation, binocular fusion, perception, or visual tracking can provide a stumbling block to children trying to see accurately or understand their classroom materials and assignments (Cheatum & Hammond, 2000).

2.2.2.5 The Auditory System

Receiving and processing sound include a stimulation being received through the peripheral receptors and then transmitted to the central auditory nervous system. The visible parts of the peripheral auditory receptors are the outer ears. Auditory canals and the tympanic membranes lead into the head from the outer ears. Three small bones called the hammer, anvil, and stapes form the middle ear. The inner ear comes after these bones, and includes the cochlea as well as the various parts of the vestibular apparatus. The eustachian tube maintains the appropriate air pressure surrounding the eardrum.

The auditory nerve transmits sounds to the central auditory nervous system to complete the system's components (Bell, 1970; Sage, 1984).

Sound is often a critical cue to initiate or time movements. In addition to hearing sound, a child must learn to judge the characteristics of various sounds in order to decide whether or not to react to them. Auditory processing influences many components of motor development, including the following:

- Location of the source of sound
- Patterns of rhythms of sounds
- Auditory discrimination`
- Auditory separation of foreground-background
- Auditory sequential memory

Problems with the auditory system can adversely affect some components of efficient movement. The symptoms of auditory problems include:

- Poor attention span
- Delayed reactions to sounds or instruction
- Not following directions
- Poor balance
- Overly sensitive to loud or sudden noises
- Difficulty in changing activities
- Not knowing where to look to find sounds
- Always speaking loudly
- Poor speech and language ability (Cheatum & Hammond, 2000).

2.2.3 Motor Abilities: Rudimentary skills

A child's motor development depends on its total physical development. In order to crawl, walk, climb and grasp it must first have reached a certain level of skeletal, neural and muscular development (Louw,1995).

At birth infants have a repertoire of movements that can be used in their new environment. This can be seen from the infant's ability to turn their head, suck, swallow and cry. They can perform complex movements such as grasping, moving their legs and arms in a swimming motion, and make stepping movements when held upright on a surface. They also exhibit certain movements in response to stimulation. The early movement responses are replaced by postural reactions that allow the child to gain some control over body movements. These include *righting reactions* so the child can roll the body over, *parachute reactions* used to catch oneself when falling, and *equilibrium reactions* used to maintain balance. The collection of movement responses exhibited by the infant and young child are used to build later movement patterns. Figure 2.8 maps out the stages through which a infant must progress to walk alone. The ages listed are averages of many children and are not indicators of the age or period at which thê child will carry out the movement. This diagram is merely to show the sequence that the child must follow.

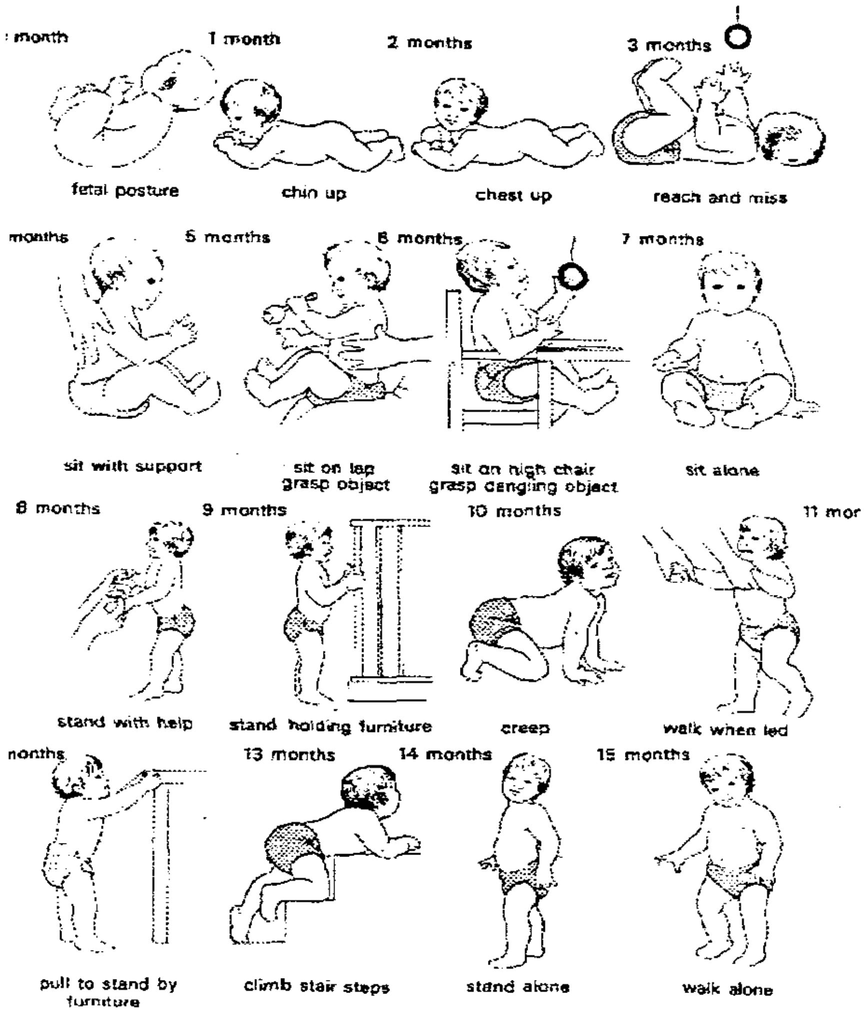


Figure 2.8: Developmental sequence in mastering locomotion.
(Sage, 1984)

A newborn baby should both move and sleep a lot. The first movements are called *global movements*, and they involve moving the whole body at the same time. By interacting with the environment, babies progress through several stages of motor development until they manage to use the cross-lateral movements patterns found in creeping, crawling and walking.

When children start to become mobile, they go through a series of movement patterns performed with all four limbs. They will typically progress from homologous to homolateral movements and then to cross-lateral patterns during creeping and crawling. Homologous creeping and crawling is like a rabbit. Both arms move forward, and then the two legs follow. In homolateral creeping and crawling, the baby moves the arm and leg on the same side forward and then move the opposite limbs forward. Cross-lateral creeping and crawling precede the movements a child will use in walking. Here the baby's right arm and left leg move forward together, as the left leg and right arm move back in opposition.

Cheatum & Hammond, (2000), indicate that frequently the developmental delays in the movement patterns of children who have LD are related to problems they had during the various earlier stages of creeping and crawling. Some children never progress to the cross-lateral stages but instead remain frozen at a stage in which both arms and legs were used together or first one side of the body moved and then the other. Cheatum & Hammond, (2000) further point out that some six to nine year old children with LD seem frozen at the stage of development in which they still use all four limbs together, which is called quadrilateral movement. This is most obvious when they play games involving catching of a ball. As a ball nears a child with quadrilateral movements, one leg and both arms move toward the ball, which folds their body in the middle. A quadrilateral movement during a kick looks like the child is swinging both legs and arms towards the ball while the rear end retreats. Other children with LD seem locked in the stage of development in which both legs or both arms must be used together. These are the same children who consistently used their two arms together and then their two legs when they where creeping and crawling. This pattern becomes so ingrained in their systems that catching a ball or writing without the opposite hand moving is difficult for them. This is referred to as a bilateral movement. Children who favour bilateral movements have some major problems, in that they have trouble developing right and left side awareness, preference for one side of the body, and cross-lateral movements.

Children typically progress through an orderly, predictable sequence of development. One stage in the sequence leads to another. Gross motor skills are developed before fine motor skills.

2.2.4 Motor Skills

Understanding the various groups of skills that children need to learn is important. These skills set the foundation for adult activity and when learned correctly, performers move with confidence and style. All individual, dual, and team sport activities use fundamental and specialized (specific) skills of one type or another. If children feel incompetent in performing movement pattern, they will be hesitant to participate in various leisure activities throughout their life span. Motor skills can be grouped under two sections namely, Fundamental Movement Skills and Specific skills. Although the skills are presented here individually, they are performed in an infinite number of combinations depending on the sport or activity (Dauer & Pangrazi, 1989).

2.2.4.1 Fundamental Movement Skills

Fundamental skills are those utilitarian skills that a child needs for living and being. This group of skills is sometimes labelled basic or functional. The designation fundamental skills is preferable to other labels because the skills are normal, characteristic attributes necessary for the child to function in the environment. Fundamental skills include the movement patterns for running, jumping, throwing, catching, striking and kicking. Developing these patterns of movement is important for success in daily movement experience, both in and out of the school setting. Children need to develop good basic mechanics for each of these patterns and to use the movements repeatedly under many different circumstances. Fundamental skills are further divided into three categories:

- **Locomotor skills**

Locomotor skills are used to move the body from one place to another or to project the body upward, as in jumping and hopping. They include walking, running, skipping, leaping, sliding, and galloping. They form the foundation of gross motor coordination and involve large muscle movement.

- **Non-locomotor skills**

Non-locomotor skills are performed without appreciable movement from place to place. These skills are not as well defined as locomotor skills. They include bending, and stretching, pushing and pulling, raising and lowering, twisting and turning, shaking, bouncing and circling.

- **Manipulative skills**

Manipulative skills come into play when the child handles some kind of object. Most of these skills involve the hands and feet, but other parts of the body can also be used. The manipulation of objects leads to better hand-eye and foot-eye coordination, which are particularly important for tracking items in space. Manipulative skills are the basis of many game skills. Propulsion (throwing, batting, kicking) and receipt (catching) of objects are important skills that can be taught by using beanbags and various balls. Rebounding or redirecting an object in flight (such as a volleyball) is another useful manipulative skill
(Dauer & Pangrazi, 1989).

2.2.4.2 Specific movement skills

Specific skills are those used in various sports and in other areas of physical education, including apparatus activities, tumbling, dance, and specific games. In developing specific skills, progression is attained through planned instruction and drills. Specific skills are usually a combination of locomotor, non-locomotor, and manipulative skills. Specific skills are situation-specific and involve a high level of refinement. (Dauer & Pangrazi, 1989). The transition from activities that use the fundamental skills to the more complex sport skills and the situations in which they are used is a difficult one. More than development of the sport skill itself is involved. The sport knowledge base becomes essential. This includes rules and strategies of the game.

2.2.5 Motor learning breakdowns

In order to better understand how children's innate abilities affect their learning and performance at any time, those abilities are divided into neuro-developmental learning constructs. Constructs are groups of related neuro-developmental functions. They help to organise thinking and communicate about learning differences by focussing on the roles and interactions of neuro-developmental functions with regard to specific behaviours. They also allow for flexibility in the ways that differences in learning are evaluated, while at the same time, pinpointing areas of learning breakdown and creating very specific plans for helping children succeed (All kinds of Minds, 1999 http://allkindsofminds.org/perspective/neuroview,html).

The constructs used to organise children's abilities are listed below:

- ATTENTION: Attention is more than just 'paying attention'. It includes such aspects as the ability to concentrate, to focus on one thing rather than a other, to finish tasks one begins, and to control what one says and does.

- TEMPORAL-SEQUENTIAL ORDERING: Whether it's being able to recite the alphabet or knowing when to push a button, being able to understand time and sequence of various items or pieces of information, is a key component of learning.

- SPATIAL ORDERING: Closely related to the functions of time and sequence, spatial ordering is the ability, for instance, to distinguish between a circle and a square or use images to remember related information. On a more complex level, spatial ordering helps musicians, for instance, to be able to "see" a piano keyboard, and enables architects to "image" the shape of a particular room.

- MEMORY: This is the ability to store information and then later recall that information. Should the person have difficulty in recalling this information their performance often suffers dramatically.

- LANGUAGE: Being able to articulate and understand language is central to the ability to do well as children and learners. Developing language functions involves elaborate interactions between various parts of the brain since it involves so many separate kinds of abilities.

- NEUROMOTOR FUNCTIONS: Whether children are trying to write their first words, catch a ball, or punch away at a computer keyboard, their brains' ability to co-ordinate their motor or muscle functions are key to many areas of learning.

- SOCIAL COGNITION: One of the most often overlooked components of learning is the ability to succeed in social relationships with peers, parents, and teachers. Children may be strong in other construct areas, and yet have academic difficulties because of an inability to make friends, work in groups, or cope effectively with peer pressure.

- HIGHER ORDER COGNITION: Higher order cognition involves the ability to understand and implement the steps necessary to solve problems, attack new areas of learning and think creatively. (All kinds of Minds, 1999, http://allkindsofminds.org/perspective/neuroview,html).

Specific breakdowns in learning manifest themselves in observable phenomena. Observable phenomena are behaviours that are seen every day- both in the classroom and at home. For example, learners may have trouble finding words to express their ideas or have difficulties with handwriting because of poor muscle control.

Such behaviours may or may not show up in a series of test scores, but observable evidence proves they exist.

By becoming aware of the critical observable behaviours of children in a content area or at a grade level, educators will be better able to recognise and attend to learning breakdowns. Looking for observable phenomena avoids labelling children, classification and loss of individual richness.

Cheatum & Hammond, (2000) indicated that the major breakdown areas of interest to physical educators are:

- Tactile integration
- Postural or Bilateral Integration
- Laterality and directionality
- Crossing the midline
- Visual and Auditory perception
- Body awareness
- Spatial and Object Awareness
- Temporal Awareness
- Agnosia
- Balance
- Coordination
- Motor planing (Praxis)
- Imitation
- Ataxia, Apraxia, and Aphasia

2.2.6 Testing to determine motor functioning levels

Sherrill, (1993) states that the primary goal of adapted physical education is functional competence in motor skills and patterns. Knowledge of assessment and instruction in motor performance must extend beyond that of the regular physical educator to include all kinds of individual differences, including all delays, abnormal muscle tone, structural deviations, and learning problems caused by perceptual motor deficits.

Adequate physical education assessment for the child with special needs requires use of test items that will assist in the design of appropriate educational environments and instructional procedures for the child (Auxter, et al., 1993).

Motor assessment instruments provide different types of information. Each can contribute in some way to enhancing our selection of appropriate educational environments and instructional procedures for the individual with special needs. It is important to match the selection of the instrument with the purpose of the assessment.

Auxter, et al., (1993) indicates that the appropriate tests to use for children with learning disorders, include the Purdue Perceptual Motor Survey, the Frosting Developmental Test of Visual Perception, and the Bruininks-Oseretsky Test of Motor Proficiency. It is further stated that the Bruininks-Oseretsky Test would probably provide the greatest number of clues as to the motor functioning level of the child with a specific learning disability.

2.2.6.1 <u>The Bruininks-Oseretsky Test of Motor Proficiency (BOTMP)</u>

After a review of possible and available test instruments, the researcher opted to use the Bruininks- Oseretsky Test because it adhered to most of the testing criteria required to test children with learning disorders (LD).

The Bruininks-Oseretsky Test of Motor Proficiency is commonly used in the USA to assess children suspected of having LD . Burton & Davis (1992) stated that the most commonly used multipurpose motor assessment tool is the BOTMP. In numerous surveys, this statement has proven to be true for physical educators (Sherrill, 1998) and for pediatric, occupational and physical therapists (Crowe, 1989; Gowland et al., 1991; Rodger, 1994; Yack, 1989). This test has wide clinical and educational acceptance because it measures skills important to children's development, it is perceived to have good psychometric properties, and, until recently, few other tests existed for the school age child (Wilson et al., 2000).

The Bruininks-Oseretsky test is an individually administered test designed to assess motor skills in children in age from four and a half to fourteen and a half years of age (Bruininks, 1978).

It has been described as the most outstanding instrument of its kind, and one which fills a clinical void (Sabatino, 1987). Sattler (1992), concludes that the test is useful in assessing gross and fine motor skills. King-Thomas & Hacker (1987), describe it as a useful test for assessing retarded, learning disabled and normal children.

The BOTMP was developed for use by clinicians, educators, and researchers. Recommended uses include: making decisions about educational placement, screening as part of psychological test batteries, and for assessing neurological development (Wilson, et al., 2000).

The original form of this test was developed by Oseretsky in Russia in 1923, after extensive observations of children. The tests underwent revisions resulting in the Lincoln-Oseretsky Motor Development Scale (Sloan, 1955), and finally the Bruininks-Oseretsky Test of Motor Proficiency (Bruininks, 1978) which was based on the original Oseretsky Test.

This individually administered test includes 46 items, grouped into eight sub-tests. Sub-tests include: running speed and agility, balance, bilateral coordination, strength, upper-limb coordination, response speed, visual-motor control, and upper-limb speed and dexterity. Items are arranged into three composites, and yield a comprehensive index of motor proficiency as well as separate measures of gross and fine motor skills. For each of these composites, normalized standard scores are available. Age equivalents are also available for the sub-test scores. The entire battery takes about one hour to administer, or a short form can be administered in 20 minutes (Bruininks, 1978).

2.2.6.2 Problems associated with the measurement of motor proficiency of disabled and non-disabled children

Thomas, (1984) and Johnson & Nelson (1986) indicated some problems associated with the measurement of motor proficiency of disabled and non-disabled children. The problems are listed as follows:

- The problem of specificity is a major factor confronting perceptual motor programmes. No evidence shows that experiences in one type of gross motor skill will transfer to another. This problem pervades in any attempt to measure perceptual motor abilities. The results are thus limited in that the performance being assessed is specific.

- Since quality of performance is of great importance in perceptual motor evaluation, the scoring of tests in this area is complicated.

- Practice trials might also be interwoven into the measurement of perceptual motor performance.

- Norms of perceptual motor performance are practically nonexistent.

- The role of the tester is different and much more important in the measurement of the disabled than in that of the non-disabled. The tester must take the time to get acquainted with the child prior to testing. The creativity, sensitivity, patience and insight of the tester may well be the most critical aspect of the test's validity.

- It is much more difficult to obtain reliable measurements on young children and on certain disabilities than on older non-disabled children .

- More practice trials and test trials are often needed by the disabled to give an accurate performance.

- The tester must be careful in the use of terms in the test instructions, and should be alert to the need for simplified expressions, demonstrations, and manual guidance. A child who does not perform well because of obvious misunderstanding should be retested.

2.3 LEARNING DISABILITIES

In 1963, Samuel A Kirk, a prominent psychologist and special educator in the United States, questioned the appropriateness for educational purposes of the many medically oriented terms such as dyslexia, congenital word blindness and minimal brain dysfunction. Instead Kirk proposed the term 'learning disabilities'.

This term has gained acceptance but the rapidly developing area of special education has been marked by considerable uncertain ties, especially with regard to the development of an accepted definition and methods of assessment for the identification of the condition (Hammill 1990).

In recent years, the terms 'learning difficulty', 'learning disability', 'specific learning difficulty' have been used interchangeably to refer to the same population and at other times, to refer to completely different groups. In an attempt to avoid confusion the term 'learning disabilities' will be used throughout this study. For the purposes of brevity, the term will be abbreviated to LD when referring to the subjects of this study.

Since 1963, when Kirk coined the term 'learning disabilities', eleven major definitions have been proposed by leading authorities and key committees and numerous others have been provided by researchers and writers (Hammill, 1990).

For the purpose of this study one general definition was identified which sums up the main idea behind the meaning of learning disabilities.

Learning disability is a broad term that may be applied to children who have a wide range of characteristics, including problems with reading, spoken and written language, difficulty with maths, reasoning or organisational skills. Other traits that may be present in a child with a learning disability include unpredictable impairments, motor problems, and behaviours such as impulsiveness, poor attention span and difficulty in social situations. Learning disability is a lifelong disorder which affects the manner in which individuals with normal or above average intelligence select, retain, and express information (Silver, 1999). An important part of the definition of LD is its exclusions: learning disabilities cannot be attributed primarily to mental retardation, emotional disturbance, cultural difference, or disadvantage. Thus, the concept of LD focuses on the notion of discrepancy between a child's academic achievement and their apparent capacity to learn (Reid, 1996).

While there is no widely accepted definition of learning disabilities, Sherrill, (1993) has highlighted five common elements between most definitions:

- neurological dysfunction
- uneven growth patterns
- difficulty in academic and learning tasks
- discrepancy between achievement and potential
- clear distinction between learning disability and concomitant conditions.

In South Africa, statistics for learners with LD are unreliable because the criteria applied for learning disabilities vary from Province to Province and include learners with mental retardation, Attention Deficit Disorder and Attention Deficit Hyperactive disorder (Loubser, 2001)

2.3.1 Types of learning disabilities

All children differ in their psychomotor, cognitive, and behavioural characteristics. Likewise, learning disabled children differ from one another. However, there are some similar group characteristics that differentiate learning individuals from one group to another.

2.3.1.1 Academic skills disorders

Dyslexia a language based disability in which a person has trouble understanding words, sentences, or paragraphs. Signs include a child: asking for repeated information; misunderstanding directions, having trouble remembering and following directions; having trouble expressing themselves; and using incorrect grammar beyond an appropriate age.

Dyscalculia a mathematical disability in which a person has a very difficult time solving arithmetic problems and grasping math concepts.

Dysgraphia a writing disability in which a person finds it hard to form letters correctly or write within a defined space. Writing disabilities may be caused by underdeveloped muscles in the hands or trouble with the combination of senses used to write. Arts and crafts, as well as hand-eye games such as jumping and marbles, are excellent ways to develop the skills required for writing.

2.3.1.2 Developmental Speech and language disorders

Auditory and Visual Processing Disabilities

a sensory disability in which a person has difficulty understanding language despite normal hearing and vision.

Speech Disabilities

These include slurred speech, stuttering and lisping which can all affect a child's ability to communicate by making them hesitant to speak because of embarrassment. Depending on the problem, the specific diagnosis may be:

- *Developmental Articulation Disorder*: Children may have trouble controlling their rate of speech and speech sounds.

- *Developmental Expressive Language Disorder*: Children have trouble expressing themselves in speech.

- *Developmental Receptive Language Disorder*: Children have trouble understanding certain aspects of speech.

(Learning Disabilities Brochure from NIMH, 2000 http:// fly.hiwaay.het/¬garson/learnd_nimh.htm)

2.3.1.3 "Other" disorders

Attention deficit hyperactivity Disorder (ADHD):

There are four main features of ADHD:

- hyperactivity
- inattention
- impulsiveness
- distractive

Attention deficit disorder:

Children have problems with concentration and are easily distracted. (Loubser, 2001).

2.3.2 Causes of Learning Disabilities

Kranowitz, & Chrolstock, (1998) state that researchers remain uncertain about what causes learning disabilities. One leading theory is that learning disabilities result from subtle disturbances in the brain structure and function. The brain somehow short-circuits so that information cannot flow in a normal pattern.

Super, (1976) and The Learning Disabilities Association of America, (1999) indicate that environmental factors may play a role in the development of learning disorders. The following have been indicated as possible causes:

- abnormalities in fetal brain development
- genetic factors
- tobacco, alcohol and other drugs used by pregnant mothers
- toxins in the child's environment
- lag in nervous system development
- lead poisoning
- poor nutrition
- low birth weight

2.3.3 Characteristics of Learning Disabled Children

The criteria and characteristics for diagnosing learning disabilities appear in a reference book called the DSM (short for the *Diagnostic and Statistical Manual of Mental Disorders)*. The DSM IV states that:

Learning disabilities can be divided into three broad categories:

- Developmental speech and language disorders
- Academic skills disorders
- "Other," a catch-all that includes certain coordination disorders and learning handicaps not covered by the other terms

The Learning Disabilities Association of America (1999) list the following as general characteristics of learning disabled children:

- restless
- poor at copying
- math problems
- disorganization
- difficulty in telling time
- pronunciation problems
- left-right confusion
- spelling problems
- omitting letters and words
- letter reversals
- social immaturity
- low achievement in some areas, high in others
- inability to follow instructions
- clumsy
- impulsive
- hyperactivity

- few or no friends
- poor pencil position

Seldin, (1998), lists the following characteristics related to general functioning and social-emotional development:

- immature emotionally and socially
- can't make choices
- can't stay with an activity
- knows rules but does not apply
- shifts blame
- socially off-base. Unaccepted by the group
- easily frustrated. Won't take risks
- doesn't take pride in work or accept compliments
- excessively rigid; cannot abide change
- artistic, sensitive and mechanically inclined

Sherrill, (1993) states that learning disabled children frequently experience problems in sensory integration, perception, imagery and memory. Characteristics seen in such children often includes:

- awkwardness or clumsiness
- problems with laterality and or directionality
- generalized inadequacy of perception motor function
- poorly developed body awareness
- poorly developed kinethesis
- lack of fine motor coordination

The Learning Disabilities Association of America, (1999) list the following as specific problems found in children with LD:

Visual Perception

- Visual Discrimination. The lack of ability in determining size, shape, colour, and texture of objects.
- Figure Ground Discrimination. This is where the child is unable to discriminate between the object and the background.
- Depth Perception. This is the inability of the child to determine distance and distinguish between objects that are near and far away.
- Object Constancy. This is the term given to the child's ability to identify an object no matter which side or angle it is approached from.
- Object Identification. Visual agnosia is a disorder thought to be caused by lesions in the cortex which prevents the child from being able to identify objects.

Auditory Perception

- Inability to differentiate between different pitches, intensifies and tonal qualities.
- Figure Ground Discrimination. Difficulty in picking out a sound from the background noise.
- Directionality of Sounds. Difficulty in determining where a sound originated from in terms of direction.
- Problems with Temporal or Rhythmic reception.

Kinesthetic Perception

- Balance. The child appears to have poor static and dynamic balance often characterised by protective stances and low motor proficiency movements that enhance stability and balance.

- Body awareness. This is the ability of the child to be able to identify and name the parts of the body.
- Laterality. This is the child's ability to recognize sides based on a persons' body.
- Directionality. This is the child's ability to recognize the position of objects and bodies in relation to one another

With reference to fig 1.1 (pg. 3) it can be assumed that by presenting one of the above mentioned problems the child with LD will have some problems with the ability to read, write or perform with adequate success at school.

2.3.4 Indicators of Learning Disabilities

Problems similar to those with defining learning disabilities exist for the recognition of indicators or learning disabilities. There are no generally accepted or precise indicators of learning disabilities (Gajar 1992; Quiros,& Schrager,1979).

The most commonly used indicators in an educational setting are: severe and prolonged difficulties with reading, spelling, written expression and/or mathematical calculations and reasoning.

The following section lists a number of difficulties and describes the effect of learning disabilities on each one. The list is not comprehensive. It should also be emphasised that not all characteristics apply to any one learner and that each learner will reveal a different pattern of difficulties. In fact, a learner may appear to have deficiencies in one or several of academic and general ability areas and strengths in others (Sykes, 1982; Smith, 1991).

2.3.4.1 Academic Difficulties

These refer to difficulties in the acquisition and development of academic abilities. Performance is usually slow and/or irregular in one or more areas. The most frequently reported difficulties are listed below:

- **Reading:** underdeveloped word attack skills; comprehension and retention difficulties; slow reading rate and/or difficulty in modifying reading rate. Some learners with LD may experience apparent blank spots on the page or words merging or moving when reading. Such occurrences result in significant difficulties in completing reading tasks and comprehending and retaining large amounts of unfamiliar written material.

- **Spelling**: underdeveloped visual memory for words; limited recall of spelling patterns; letter sequencing errors. Students with LD at higher education level have usually developed strategies for mastering new course-specific terminology. However, the fatigue or stress which often exists under examination conditions may result in misspelling of common words.

- **Written expression**: inability to copy accurately; inconsistent syntax, sentence formation and paragraph construction; incorrect use of punctuation; restricted vocabulary. Learners with LD may display poor written expression in the form of incorrect sequencing of words and/or an apparent disregard for writing conventions such as the use of upper and lower case letters.

- **Mathematical**: difficulty recalling the sequence of problem solving steps; slow calculation rate; difficulties in visual-spatial perception and organisation. Despite gaining entry to the higher education sector, students with LD may continue to have difficulty with setting out problems coherently and have difficultly in distinguishing between mathematical signs such as (-) and (+)

- **Serial Learning**: difficulty in recalling sequences of events or procedures. This problem affects the ability of the student to gain a sense of the order of events or to follow instructions, a formula or an experiment.

- **Handwriting**: incomplete letter formation; inappropriate spacing of words; slow writing rate. LD may cause learners to develop a faulty pen grasp or awkward writing position. These may contribute to fatigue and lack of confidence in written exercises.

- **Study skills and organisation**: slow rate of task completion; daily and long term- management difficulties; inadequate note-taking and summarising skills; difficulty locating and integrating information; difficulties memorising material. Learners with LD may have difficulties assessing how long a task or journey will take. For tertiary students, this may result in lateness with assignments or for lectures or examinations. Limited study and organisation skills may also contribute to stress levels, anxiety and/or variable test performance.

As a result of any one or a number of these academic difficulties, learners with LD may have problems maintaining consistent performance rates.

2.3.4.2 Associated Difficulties

These refer to problems in the acquisition or retention of cognitive abilities, psycho-dynamic functions and social skills. Typically, once again, development is slow and/or irregular in one or several areas. The more frequently reported difficulties are listed below:

- Motor; balance and rhythm difficulties; apparent clumsiness. Learners with LD may display poor coordination and, as a result, have severe difficulties with practical and laboratory exercises.

- Speech; unclear articulation of words; rhythm and fluency difficulties. Although not as common as other characteristics, learners with LD may display motor-related problems with maintaining appropriate speech intonation and patterns.

- Perception; visual-spatial difficulties; auditory difficulties; directional uncertainty. Learners with LD may find it difficult to comprehend spoken language or respond to a visual stimulus such as is required when copying information or reading a map or graph.

- Conceptual; slowness in grasping concepts; conceptual confusions, particularly regarding time and space. Learners with LD may find problems in processing and retaining new concepts and in identifying essential task requirements or comprehending systems such as library catalogues.

- Communication; difficulty comprehending verbal nuances and non-verbal cues.

- Attention; short attention span; selective attention difficulties; impaired ability to concentrate; distractable. LD may affect learners' ability to concentrate for long periods of time.. In addition, they may fatigue easily.

- Social and emotional; inappropriate social behaviour; limited eye contact; uneasiness in relating to authority figures; low self-esteem; low frustration tolerance and sensitivity to criticism; problems expressing thoughts and feelings.

- Positive attributes; although most studies of learners with LD focus on the problems they may experience and exhibit, it is important to recognise that LD are variable. Consequently, these learners are often strong performers at a higher education level because of their high overall intellectual level and/ or creative ability; remarkable persistence, task commitment and endurance (Silver, 1981; Sykes, 1982; Gajar, 1992).

2.3.5 Diagnoses of Learning Disabilities

The Learning Disabilities National Information Centre for children and youth with disabilities, fact sheet No. 7. (1999), states that learning disorders may be informally flagged by observing significant delays in the child's skill development. Actual diagnosis of learning disabilities, however is made using standardised tests that compare the child's level of ability to what is considered normal development for a person at that age and intelligence.

Lerner, (1971) indicates that the major disciplines contributing to the diagnostic evaluation of children with LD can be grouped into five categories: medicine, language, education, psychology, and other professions, (see tables 2.5 and 2.6)

a. Medical evaluation:

This is done to evaluate the general physical status and neurological functioning of the child. The developmental aspects of neurologic integration are of primary importance for this evaluation, especially with reference to integrated motor acts, as opposed to simple reflexes.

b. Psychological evaluation:

Psychologists are primarily concerned with three areas in their evaluation namely: intellectual, visual-motor-perceptual, and personality functioning.

c. Linguistic evaluation:

The linguistic evaluation is concerned with all areas related to language: listening, oral language, reading, writing and spelling.

d. Educational evaluation:

The training and experience of educators permit teachers, reading specialists, special educators, physical educators and curriculum developers to focus on the learning behaviour of the child. The educators expertise includes knowledge about subject area sequences, and understanding of the relationship of curricular areas.

Table 2.5: **Medical professional and conditions they diagnose**

Professional	Medical Conditions
Pediatricians	Disease, structural problems
Family GP	Disease, structural problems
Psychologists	Psychological disorders, behaviour problems, attention deficit disorder or attention deficit hyperactivity disorder, intelligence, autism or pervasive developmental disorder
Psychiatrist	Psychological disorders, neuroses, psychoses, chemical imbalance, attention deficit disorder or attention deficit disorder, intelligence, autism or pervasive developmental disorder
Neurologists	Seizure activity, abnormal brain activity, brain injury
Optometrists/Ophthalmologists	Vision problems, including near-sightedness, far-sightedness, astigmatism, binocular and other optical problems
Audiologist	Hearing loss, auditory processing, receptive language
Speech language pathologist	Speech articulation problems, receptive and expressive language, language use

(Source: Cheatum & Hammond, 2000)

Table 2.6: **Educational Professionals who determine the need for Special Education**

Educational Professional	Areas of educational problems
School psychologist	Almost all special testing, intelligence testing, behaviour problems, learning disabilities, autism
Classroom teacher	Observational information, progress in school
Special education teacher	Area of suspected disability
Adapted physical education teacher	Physical ability, fundamental motor skills, motor development level, fine and gross motor ability affecting ability to learn
Occupational and Physical therapists	Fine and gross motor ability affecting functioning in school and in learning situations

(Source: Cheatum & Hammond, 2000)

2.4 FACILITATING SKILL DEVELOPMENT: APPROACHES TO REMEDIATION

Learning disabilities constitute the most prevalent and urgent medical problem afflicting children not only in South Africa but in most countries of the world. (Loubser, 2001).

If adequate intervention is not made into these disabilities, the child's potential will never be realised and the effects on their life will be more devastating than those of most other childhood disorders with which they might be afflicted. The earlier the diagnosis is made, the more rewarding will be the response to remedial therapy (Densem, 1989).

When children are having difficulty with a particular academic skill, the task of parents, and clinicians is to pinpoint the areas of difficulty, to specify the weak sub-skills, and create a plan for strengthening areas in need of improvement.

2.4.1 Medical approaches

Drug therapy is a common medical intervention technique used in the treatment of behavioural, emotional, and attention deficits associated with the education of learning disabled children (Auxter, et al, 1993).

Although the reported use of drug treatment with children with specific learning disabilities varies, Amen & Rojahn, (1992) suggest that 10% of children with learning disorders may be taking prescribed psycho-tropic drugs.

There are numerous behavioural and cognitive symptoms associated with specific learning disabilities. It is indicated in Auxter, et al (1993) that there are a variety of drugs used with this population. These include:

- neuroleptics (major tranquillizers)
- anti-convulsive
- sedative hypnotics
- antidepressant/antimonic
- central nervous system stimulants

The most frequently prescribed drugs are the central nervous system stimulants, which include methlyphenidate (Ritalin) and dextroamphetamine (Dexadrine). When prescribed for children who have attention-deficit disorders (ADD or ADHD), they stimulate parts of the brain which affect the neurotransmitters that are not working as well as they should. They are not tranquillizers or sedatives.

2.4.1.1 How can these medicines help?

Law, (2001) indicates that the stimulant drugs can improve attention span, decrease the lack of concentration, increase ability to finish tasks, improve ability to follow directions, decrease hyperactivity, and improve ability to think before acting (decrease impulsiveness). Legibility of handwriting and completion of school work and homework can improve. Aggression and stubbornness may decrease in youngsters with ADD. Stimulant medication plays a small but important part in the treatment of ADD. The medicine often works best when used in conjunction with special help in school and behaviour modification procedures at home and school. Stimulant medications help approximately 8 out of 10 patients. If one type does not work, then one of the others may be effective. If these stimulant medications do not help, or cause side effects that are a problem and ongoing, there are other non-stimulant medications which may be prescribed. Non stimulant medication include drugs like Dixarit, Tryptanol, Tofranil and Aurorix (last two are anti-depressants).

2.4.1.2 Effects, side-effects and duration of the medication

The effects, side-effects and the duration of the medication is summarized in tabular form in table 2.7.

Table 2.7: **The effects, side-effects and duration of medication**

Effects	Side-effects	Duration
Stimulants: **Ritalin**	* headache and abdominal discomfort * Decreased appetite * stunting of growth * hyperactivity increases * can aggravate epilepsy	Tablets are short acting lasting3-4hours. Ritalin (S-R) may last for 6-8 hours
Dexedrine & Dynalert	* increased heart rate * nervousness * disturbance of liver function	Long lasting between 6-8 hours
Non-stimulants: **Tryptanol & Aurorix**	* sedation * dry mouth * constipation * increased heart rate * blurred vision * retention of urine * emotional upset and confusion	Long acting -can be given once a day
Dixarit	* sedation * sleepiness * confusion * headaches	Generally used in combination with a stimulant. Can take up to 2 weeks to have an effect. Long lasting.

(Source: Law, 2001, Patton, 1990 and ADHD Fact Booklet, 2000)

Chandler, et al., (1988) and Swanson, et al., (1992) suggest that most drugs produce substantial behavioural changes in children with specific learning disabilities when properly prescribed and managed. There are reports that stimulant drugs that lessen hyperactivity and improve short term memory can improve academic learning performance. However, much of the literature does not support long term academic gains due to the use of stimulants.

The side effects of drug treatment vary depending on the individual, the nature or type of drug, the length of time the student has been taking the medication, strength of the dose, and other variables (Patton, 1990). There are no medical problems should the medication be stopped suddenly. A few children may experience irritability, trouble with sleeping, or increased hyperactivity for a day or two if they have been on medication for a long time. It is recommended that the medication gradually be tapered off over a week or so. There is no way to know how long a person will need to take the medicine. The parent, doctor and the school will work together to find out what is right for each young person. Typically the child takes medication so that the drug is active during peak school hours, such as when reading and maths are taught (Patton, 1990; Law, 2000).

2.4.2 Educational approaches

It has been established that twenty percent of school children at some point, experience significant learning disabilities and require special education (Cheatum & Hammond, 2000).

Special education is required when a child has a significantly greater difficulty in learning than most children their age or a disability which either prevents or hinders them from making use of the educational facilities of a kind generally provided in school. Special education today focuses primarily on attention, memory, and cognition and direct their instruction towards specific reading, writing, spelling and maths disabilities.

Special education uses an individual approach (not necessarily individual teaching) where the child's specific difficulties are recognised and appropriate teaching programmes are provided through the means of multi-sensory techniques.

2.4.2.1 Special Education in South Africa

Special Education is defined by the Education and Training Act, Act 90 of (1979) and Act No 3 (1986) section 1, as follows:

"Special Education means such education of a specialized nature including:-

a) psychological, medical, dental, paramedical and therapeutic treatment (including the performance of operations).

b) provisions of artificial medical aids and apparatus

c) care and maintenance in a hospital, school hostel, and other institutions, and

d) The provision of transport , escorts and other services, as are provided to meet the needs of a handicapped child." (p2279).

Special education is provided for children who are classed as exceptional when they are so different in mental, physical, emotional or behaviour characteristics that in the interest of equality of educational opportunities, special provision must be made for their proper education. Provision is provided for the following groups:

1. Intellectually Disadvantaged
2. Emotionally Disturbed children
3. Children with Learning disabilities
4. Socially and Economically Disadvantaged children (at risk children)
5. Visually Impaired children
6. Speech Impaired children
7. Hearing Impaired children

8. Physically Disadvantaged children
9. Intellectually Superior children

Some form of Special education for exceptional children exists in every province. Schools are given the power to provide such education with financial assistance being provided by the state (The South African Association for Learning Disabilities, 2000).

2.4.2.2 <u>Outcomes based education</u>: <u>Life Orientation</u>

The national core-curriculum (Curriculum 2005- macro level) based on an outcomes based approach to education was submitted to the Minister of Education and Parliament in March 1997. Outcomes based education (OBE) teaching in schools emphasizes concept development rather than the simple acquisition of facts and knowledge. Accompanying this emphasis is an effort to individualize and personalize the learning process in order to respond to individual differences and to provide a learning atmosphere that will enhance positive relationships. Helping the child achieve his full intellectual, physical, and creative potential can be reached only through an informal learning atmosphere where the responsibility for learning is shared by the teacher and the child. A child learns new skills and concepts when he is capable of exploring alternatives (Curriculum, 2005). Within the national core-curriculum Physical Education resorts under the learning area, Life Orientation.

According to Curriculum 2005 (1997:221) the specific outcomes of Life Orientation are as follows:

- Understand and accept themselves as unique and worthwhile beings
- Use skills and display attitudes and values that improve relationships in family, group and community

- Respect the rights of others to hold personal beliefs and values
- Demonstrate the value of and respect for human rights as reflected in *Ubuntu* and other similar philosophies
- Practice acquired life and decision-making skills
- Understand and accept themselves as unique and worthwhile beings
- Access career and other opportunities and set goals that will enable them to make the best use of their potential and talents
- Demonstrate the values and attitudes necessary for a healthy and balanced lifestyle
- Evaluate and participate in activities that demonstrate effective human movement and development.

Although it seems as if only the last two specific outcomes relate directly to the unique content of Physical Education, the other outcomes are part and parcel of formal and non-formal education settings within Physical Education (Curriculum 2005, 1997: 219-221).

Physical education is traditionally defined as a school-based programme designed to help children develop their potential in all of the educational domains. Abernathy & Waltz (1964) associated physical education with the achievement of objectives in all the learning domains.

According to Sherrill (1986) the physical education of an individual takes place through three learning domains: the cognitive domain, the affective domain and the psychomotor domain. She maintained that physical education experiences can be provided that will allow students to meet objectives in each of these domains. Objectives in the cognitive domain include the acquisition of knowledge, the formulation of ideas and concepts, problem-solving and the analysis, synthesis and evaluation of information. Objectives in the affective domain deal with the development of interests, attitudes and values. Objectives in the psychomotor domain include the development of physical fitness and motor proficiency in terms of the acquisition of motor skills.

Although there is agreement that physical education can be taught to meet objectives in one or more of the educational domains, this does not mean that all of the domains are given the same importance, when designing a programme. Metheny (1975), who described physical education as "learning to move" while "moving to learn", identified the number one priority of physical education to be the active participation of students in physical activities. She identified a reasonable degree of competence in the performance of motor skills as the unique contribution that physical education could make to students' lives and the key to achieving objectives in all the other domains.

Sherrill (1993) supported the relationship between moving and learning when she stated that "The primary purpose of physical education instruction is to change psychomotor behaviours, thereby facilitating self-actualization" (p.4).

Rink (1993) was also strong in her support for the priority on motor skill development objectives in physical education:

> Although physical education has the same concerns relative to the domains of learning as do other educational programs, the primary and unique contribution is the psychomotor areas. Motor skill acquisition is the primary responsibility of physical education and the goal in teaching motor skills is the development of skilful performance for participation (p.60).

There seems to be agreement, then, that in order for a educational programme to be a physical education programme, the achievement of motor skill development objectives must be a primary concern. Wade, (1992) points out that programmes and activities that develop the motor ability of the child during his/her development years constitutes an indispensable aspect of the normal development process. Control over the body forms a very important part of the socio-emotional development of the child, and is also an important access to the cognitive handling of environmental demands (Nelson, 1988). Activities that help the child to control its body, provide it with self-confidence and contributes to accepting challenges easier. Young children with motor problems, whether it be a result of slow maturing, too little experience or other origins, often are alienated at a early age from motor participation, since they feel that they cannot comply with the expectation of the adult (Nichols, 1986). Nelson, (1988) is of opinion that the movement scope of the young child is just as important as the expansion of word and reading ability, and according to Gabbard,(1998) it is a very important building stone for intellectual productivity and quality of life in the child's later stage of life. The importance of motor skills in the development of cognitive abilities cannot and should not be underestimated. Firstly, physical skills contribute to representational thought by enabling children to act on and experiment with their environment. In the process they learn names for things, begin to understand how things work, and are simultaneously practising their emerging language skills. Secondly, children learn as they act on their environments and objects in that environment. For example, as children walk, run, climb and throw, they learn about space, time, and cause-and-effect relationships, all of which are important concepts in intellectual development. Thirdly, as children play and interact with others they learn others' points of view and are involved in learning the rules that govern the games they play. Fourthly, as children develop fine motor skills, they can be involved in many forms of representation in addition to language. Some of these are drawing and painting, modelling with clay, cutting and pasting, and construction activities involving wood, and cardboard (Morrison, 1990).

2.4.2.3 Motor learning interventions

Motor learning interventions are believed to remediate children's motor problems (Sherrill,1998; Sugden & Chambers, 1998).

Three approaches guide pedagogical beliefs about assessment and remediation. Each approach emphasises different areas of breakdown in learning (Sherrill, 1993) .

- The Perceptual motor or neuro-developmental approach implies that age appropriate reflexes, postural reactions and perceptual motor abilities all underlie functional motor skills and conceptual development. Intervention consists mainly of facilitation of balance training and other physical abilities (Kavale & Mattson, 1983; Kephart, 1971; Hallahan & Cruickshank, 1973; Sherrill, 1998)

- The Sensory Integration Approach is associated mainly with the sensory integration therapy method (Ayres,1972; Ottenbacher,1988) and kinesthetic training (Sherrill, 1998). In this approach it is assumed that development of cognition, language, academic ability and motor skills depend on sensory integrative ability. Provision of proprioceptive, tactile, and vascular stimulation requires activities that consist of full body movement and training in specific motor skills (Ottenbacher, 1988; Polatajko, et al., 1991).

- The motor-learning approach, which emphasises central processing rather than input, has typically been used in regular physical education (Sherrill, 1993)

The two types of motor learning intervention approaches commonly used with specific learning disabled learners, are the perceptual-motor and sensory integration models. Some research studies support the value of these programmes and others give reasons to question their value. Until more evidence is available, it is reasonable to conclude that each of these programmes has some value for some specific learning disabled children (Auxter et al., 1993).

- **Perceptual Motor Intervention programme(top-down approach)**

Perceptual-motor training has been used by both special educators and physical educators for the remediation of movement problems. From the 1930s through the 1960s, special educators used the perceptual motor training model more than any other pedagogy (Hallahan & Cruickshank, 1973). It is important to understand that physical educators and special educators define perceptual motor training differently. Physical educators, define perceptual motor programming as the use of activities believed to promote the development of balance, body image, spatial awareness, laterality, and directionality(Auxter et al., 1993). Special educators define perceptual-motor training as the use of motor activities to promote academic learning and/or improve cognitive and language function (Auxter et al., 1993). Kavale & Mattson, (1983) indicated that special educators became disenchanted with perceptual-motor remediation as an approach to cognitive learning and soundly reject the perceptual-motor training model. Physical educators continue to use the perceptual motor model as an approach to motor learning and control (Burton, 1987; Sherrill & Montelione, 1990). Special educators in the 1990s, have focussed primarily on attention, memory, and cognition and direct their instruction toward specific reading, writing, spelling, and math disabilities. Physical educators are also concerned with attention, memory, and cognition because these processes obviously are important in learning motor skills, rules and strategies.

Over the past few decades, educationalists, therapists and medical professionals have been studying the causes and effects of problems with motor proficiency on the physical, educational, social, psychological, and behavioural dimensions of children's lives (Causgrove , et al., 1994; Cermak, et al., 1990). Recently, the emphasis has been shifting from identification and assessment of movement problems, to providing adequate intervention programmes that are designed to try and help children overcome their lack of adequate motor proficiency (Brown, 1987).

The perceptual-motor theory of learning disabilities put forth by Kephart (1963, 1967) postulates that normal perceptual-motor development helps a child establish a solid and reliable concept of the world about him. This approach examines the normal sequential development of motor patterns and motor generalizations and compares the motor development of children with learning problems to that of normal children.

Lerner, (1971) indicates that a normal child is able to develop a rather stable perceptual -motor world by the time he encounters academic work in school at the age of six. For many children with learning problems, however, their perceptual-motor world is unstable and unreliable. These children encounter problems when confronted with symbolic materials because they have an inadequate orientation to what Kephart, (1971) calls the basic realties of the universe which surrounds them. Auxter, et al., (1993), indicates that a perceptual motor programme is usually made up of activities believed to promote development of balance, body image, spatial awareness, laterality, directionality, cross-lateral integration. Very often these activities are taught via an indirect approach such as movement education.

Sherrill,(1993) stated that perceptual motor training requires an individual to direct attention to performance of a specific task.

- **Sensory integration Intervention programme Bottom-up approach)**

Learning is presumed to be a function of the brain, and disorders of learning reflect a deviation in neural function. Sensory input plays a critical role in brain function. Sensations from hearing, vision, taste, smell touch, pressure, and movement provide the input to the brain which is organised for movement, cognition and learning. The richness of the sensory environment and the interactive experience of the individual with the environment contribute to the growth of intelligence (Morris & Schultz, 1990).

About 5-10% of children have enough problems with sensory integration to cause them to be slow learners, have specific learning disabilities, or have behavioural problems. Children with the poorest sensory integrative abilities usually have great difficulty functioning in our complex sensory world and may fall within the diagnostic categories of severe mental retardation and autism. (Morris & Schultz, 1990).

Sensory integrative therapy programmes follow the neuropsychological process approach to remediating learning disabilities. Sensory integrative therapy programmes places greater emphasis on the central nervous system than do other programmes (Densem, 1989).

Sensory Integrative treatment was developed out of the extensive research of Ayres, an occupational therapist with a strong interest in the sensory systems and sensory integrative dysfunction (Ayres, 1972).

Therapy provides controlled sensory input (especially from the vestibular, tactile and proprioceptive systems) in a way that allows the child to make an adaptive response that integrates the sensations and enhances the organisation of the brain. Treatment includes activities that allow sensory integration to occur primarily at the brain stem level. As integration at this level increases, the child is better able to organize the sensory information required for skills such as language, fine motor coordination and reading (Morris & Schultz, 1990).

Sensory integrative programmes are concerned with how humans develop the capacity to organize sensation for the purpose of accomplishing self-directed, meaningful activity. Clark & Porsch (1978), stated that a sensory integration programme is made up of activities believed to promote processing of sensory stimuli. The activities used in this programme are based on Ayres' theory of sensory integration. This theory, which has been evolving over the past 20 odd years, proposes that sensory input systems such as kinesthetic, vestibular, and tactile systems must be fully developed and integrated before an individual can build cognitive structures needed to accurately interpret the environment. This theory further refers to the neurologic sequence of sensory input, followed by the integration and sorting-out process which occurs at various levels of the nervous system. Activities included in a sensory integration programme include rolling, spinning, turning, balancing on unstable bases, rubbing the body with different textures, and many activities with scooter boards.

Sherrill, (1993) indicated that sensory integration emphasizes activities to promote functioning at sub-cortical levels. Neural impulses arising from reflexes, postural reactions, and senses must be integrated if efficient movement is to occur.

Auxter, et al., (1993) stated that motor development is a progressive process for each of us to learn to move efficiently, but in order to do this we must first be able to take environmental information into the central nervous system. Then it must be processed or integrated so that it can be used to direct movement patterns and skills. Only after the information is received and processed can the brain direct the muscles to work. Advocates of the sensory integration approach agree that the ultimate goal of education is to produce productive adults who can function independently in their communities. To achieve this goal the educator would intervene in a child's life as early as possible to determine whether age-appropriate basic input systems were found to be deficient when the child was tested.

Parts of the sensory integration model have been challenged (Arendt,et al., 1998) and defended (Cermak, 1988: Ottenbacher, 1988). Sherrill, (1993) indicated that most activities recommended by Ayres have been used in elementary physical education for many years. Sherrill, further stated that the activities appear sound, although researchers are still trying to explain neurologically how and why they work.

2.4.2.4 Application of the two intervention approaches

Each of the two intervention approaches are briefly summarised in Table 2.8 as too how they relate to different growth and developmental principals.

Table 2.8: **Summary of the two intervention approaches.**

Principle	Sensory (Bottom-up)	Perceptual (Top-down)
Each individual is unique	Test for sensory input deficits and intervene to eliminate those before programming for higher level abilities and skills. Select activities that appeal to the child and use until the deficits are eliminated.	Test for specific functional motor skill deficits. If some are found, probe down into specific abilities that contribute to those skills. Program activities at the highest level of dysfunction.
Children advance from one stage of development to a higher, more complex stage of development	Select activities that are appropriate for the stage of development the child demonstrates	Select activities specific to the skill deficits the child demonstrates. Begin an intervention programme at the developmental level the child demonstrates.
Children learn when they are ready	It is assumed that children will learn fastest if instruction begins at the developmental stage at which the child is functioning.	Analyze a specific task from the top down until present level of educational performance is found.
Development proceeds from simple to complex	Eliminate reflex and sensory input delays before teaching higher level abilities and skills	Functional skill deficits are identified. The pattern of the skill is analyzed to determine contributing components. Behavioural programs are constructed and implemented to develop pattern deficits.
Generalization procedures	Activity is selected to develop sensory input systems, reflexes, and abilities that are believed to be prerequisite to many skills that could be used in a variety of environments	Functional age-appropriate activities are selected to promote appropriate skills in a variety of natural environments

Principle	Sensory (Bottom-up)	Perceptual (Top-down)
Generalization process	At the basic levels the environment is controlled only to ensure that the basics are learned. No attention is paid to the type of environment the eventual skills will be used in.	Skills are practised in environments that correspond closely to the environment in which the skill will be used
Provide the appropriate stimulation	Make the activities enjoyable so that the child will want to continue the task.	Use precise, detailed instruction that is designed around eliciting attention through the use of visual and verbal input, later combine visual, verbal and kinesthetic instruction.
Impose limits for use of equipment, facilities and student conduct.	Learners are not permitted access to equipment and areas unless they have been given permission by the teacher.	The equipment and facilities a learner has access too are specified in the behavioural program.
Control the social interaction among children	The teacher must consider the performance level and emotional stability of each child when grouping children for activities.	Tasks and environments are structured to reduce adverse interaction with peers

(Auxter, et al., 1993)

2.5 SUMMARY

One of the most important aspects of childhood development is the development of motor skills. Motor skills and thus physical activity is vital for a healthy lifestyle for children with and without disabilities. Physical activity offers a variety of benefits for individuals with LD. Cheatum & Hammond (2000) state that children who perform moderate aerobic activity can experience increases in attention span, on-task behaviour, and levels of correct responding. A physical activity-based programme is easy to implement and has been shown to be effective in controlling many types of inappropriate behaviours associated with LD.

When difficulties are experienced with the development of motor skills many diverse problems can be encountered. The children could develop problems with their social, emotional, behaviour and educational development. When a child has any of the above problems it experiences difficulties with its class work and life on the playground. If the problem can be identified in the early stages of the child's education and the appropriate steps are taken to initiate remedial work, the potential to improve or even overcome the disability is there.

It has therefore become imperative to try and understand and be able to identify the scope of the problem in order help the children affected. Any physical education programme for children with LD should be developed with the purpose of not only enhancing overall physical activity, but also managing inappropriate behaviours. The purpose of this study was to investigate which of two physical education programmes would be the most effective programme to use for children with LD.

CHAPTER THREE

METHODOLOGY

This study explored the influence of participation in differentiated movement intervention programmes on the motor proficiency, self concept and class room behaviour of children with learning disabilities. This study was initiated with a pilot study to determine the effectiveness of instructional strategies.

3.1 STUDY DESIGN

The primary aim of the study was to evaluate the effect of a twelve-week programme on the motor proficiency of children with LD. In order to achieve this goal a randomized experiential group design, with three groups of the dependant variable, was adapted for the study. Subjects were randomly assigned to one of the following three groups:

a. Group Sen (N=20) - Sensory Motor Programme
b. Group P Mot (N=20) - Perceptual Motor Programme
c. Group Con (N=20) - Control group

This study involved the administration of a pre-test measuring the dependent variables, the provision of intervention programmes, and the administration of a post-test and six weeks later a post post test measuring the dependent variables again.

3.1.1 Research Variables

a.	*Independent variable:*	The Perceptual Motor and Sensory Motor Programmes
b.	*Dependent variable:*	Motor Proficiency, Self Concept, Classroom Behaviour and Body Composition
c.	*Categorical variable:*	Occupational Therapy programme, home language, gender, age and academic ability
d.	*Control variable*	Children with Learning disorders
e.	*Extraneous variable:*	Use of medication by participants

3.2 PILOT STUDY

The purpose of the pilot study was to explore the assessment strategies, the type of activities to be included in the primary study and, lastly to train the research assistants in the use of the Bruininks Oseretsky Test. Ten Afrikaans speaking children with Learning Disabilities from the Empangeni Area, were identified to be subjects for the pilot study. The subjects in this pilot study then participated in a six week programme,(two sessions per week, 45 min session).

Decisions about the assessment tools, type of activities and instructional strategies to be used in the intervention programme were made based on the experience gained by the researcher during the pilot study. The following is a summary of the decisions made about the instructional strategies (see Table 3.1)

Table 3.1: Instructional strategies

Strategy	Description
Create routine, regularity and repetition	Use of a whistle to gain children's attention was used (This is also used by all class teachers during breaks). Children were collected and handed over at the same place by the researcher for each PE class. A routine of carrying and packing away of equipment was established.
Reward children for "good" behaviour	Gold stars were awarded to children with good behaviour. These were then added to the stars on their star chart in their classrooms.
Teach in an environment where distractions are kept to a minimum	The children were easily distracted by objects laying around or people passing by. A small area of the school hall or playing field was used
Use actives that emphasize slow movements	The children had the tendency to be competitive in doing activities. The children were reminded that the correct method of doing activities was far more important than speed.
Use relaxation exercises guided by imagery or progressive relaxation	Three to five minutes of relaxation instruction/practice was introduced into each lesson (at the end of the lesson).
Use a buddy system to assist the individual in maintaining attention	Children where encouraged to help each other when difficulty was being experienced in doing a motor skill
Avoid comparison with other children	Recognition of an individual's good performance was rewarded with a small certificate.
Be aware of medication being taken and its effect on the individual	Notice was taken of the children on medication. Some of the medication made the children "drowsy" and impaired their balance.
Where appropriate, use regular strong prompts to gain attention	Brief instructions where given before starting an activity. Children where asked to repeat the instructions. Keywords from the instruction where prompted to regain children's attention.
Encourage responsible behaviour and, when necessary, impose limits with regard to conduct and the use of equipment and facilities	Children where instructed from the first day as too what was excepted of them in terms of behaviour, handling of equipment and interaction with peers.
Do not overdo the desire for control in all situations	Children where encouraged to add their own creativity to the activities.

Strategy	Description
Discourage inappropriate interaction.	If children "misbehaved" , a "time-out" was given to the children.
Reduce interference from hyperactive tendencies	Select a larger number of different activities and spend less time on each than one would with other children of the same age.

3.3. PROCEDURE OF THE PRIMARY STUDY

The researcher approached the principal from a Special School located in the Empangeni area of KwaZulu/Natal. A full discussion took place which included an explanation of the purpose of the research project and a description of what the study entailed and what was hoped to be achieved. A proposal of this study was then forwarded to and discussed at a School Governing Body meeting. A letter was received by the researcher from the Principal and School Governing Body in which they indicated their support for the project. A letter seeking authorization was sent to the Dept. of Education. A proposal of the study was presented before the Faculty of Science Research Committee and co members of the Department of Human Movement Science, University of Zululand. After authorization and approval was granted for the study by the Dept. of Education, University of Zululand Ethics Committee, Faculty of Science Research Committee, Zululand Remedial School, and School Governing body, a letter was sent to the parents of the subjects.

This letter explained the nature and procedures of the study and procured parental and subject approval in an informed consent document (see Appendix A). On approval of the parents and children the study commenced.

3.3.1 Subjects

The most accurate method of data collection appears to be direct personal contact between the researcher and the subject (Vincent, 1995). In cognizance of this motivation, it was decided to confine this study to one local school catering for the special needs of children with learning disabilities. The chosen subjects were children between the ages of eight and 12 years, diagnosed with learning disorders attending the Zululand Remedial School situated in Empangeni, Kwa Zulu/Natal. The division of the children into one of three groups (See table 3.2) was done by the Class Teacher and Occupational Therapists. Three subjects (one for each of three groups), were matched according to their gender, age (within four months) type of occupational therapy programme, home language, academic ability and use of medication. On completion of this administration the researcher randomly assigned one member of each match to either the sensory motor group, perceptual motor group or the control group. Each group consisted of 20 children. The small size of the research population was due to the limited number of available subjects because of the special characteristic feature of the children to be included in this research.

Table 3.2: GENERAL DESCRIPTION OF SUBJECT MATCHING

Matched Subjects	Age	Gender	Home Language	Medication
1	10	Boys	English	None
2	10	Boys	English	None
3	9	Boys	English	Ritalin
4	9	Boys	English	Ritalin
5	10	Boys	English	None
6	10	Girls	English	None
7	9	Boys	Zulu	None
8	11	Boys	Zulu	None
9	11	Girls	English	None
10	12	Boys	Zulu	None
11	10	Girls	English	None
12	10	Boys	English	None
13	10	Boys	Zulu	None
14	12	Girls	English	None
15	11	Boys	English	None
16	12	Boys	English	None
17	12	Boys	Zulu	None
18	11	Girls	Zulu	None
19	10	Girls	English	Ritalin
20	11	Boys	Zulu	None

Table 3.3: **Mean and SD for Body mass, Stature and sum of skinfolds per group**

Variables	Control (N=20)		Sensory (N=20)		P Motor (N=20)	
	M	SD	M	SD	M	SD
Body Mass m(kg)	41.1	2.44	34.6	1.60	36	1.79
Stature (cm)	141.95	2.18	138.7	1.95	140.7	2.06
Sum Skinfold (mm)	11.1	0.08	10.8	1.10	10.9	0.94

3.3.2 Informed Consent

Prior to the study a covering letter was sent to parents of the subjects. This letter explained the nature and procedures of the study and procured parental and subject approval in an informed consent document. (see Appendix A).

3.3.3 Measurements

The following dependent variables were measured:

Table 3.4: **Dependant Variables measured**

Variable	Measure or test
a. Body Composition	Stature Body mass Skinfolds
b. Motor proficiency	8 tests from the BOMPT test
c. Classroom behaviour	Conner's Teacher's Questionnaire
d. Self-Concept	Cratty's test of Self Concept

3.3.3.1 <u>Body Composition</u>

Body composition refers to the degree of leanness/fatness of the individual. Although body composition is a factor in physical performance, it is also an indicator of the health of the individual. Typically, body composition is estimated by recording measures of height and weight and consulting tables to determine the appropriate weight for a particular height. Although easy to use, such tables have limitations because they do not take into account the build of the body and proportion of bone, muscle, and fat.

In assessment, it is possible for two individuals to have the same height and weight but differ in leanness/fatness.

Thus, it is considered helpful to determine measures of body fat and use these in the assessment of body composition.

Ideally, body fat is determined by hydrostatic weighing, however, the equipment necessary is not readily available to individuals in field-based situations. Therefore, skinfold measurements have been used to estimate body fatness. Skinfold measurements have reasonable validity when correlated with hydrostatic weighing procedures. The use of skinfolds is also substantiated by the fact that approximately 50% of the body's total fat lies directly underneath the skin.

In this study, five measurements were collected to help assess leanness/fatnes. The first two are measures of height and weight and provide the basis for checking appropriate height and weight tables. The next three include triceps, subscapular skinfold, and the sum of tricpes and subscapular skinfolds. The skinfold measurements are presented in percentile tables and can serve as a guide for determining leanness/fatness; however, these readings must be carefully interpreted (Winnick & Short, 1985) (See Appendix E). It is indicated that the criterion for the desired degree of fatness for children is above the 50^{th} pecentile. A skinfold at the 90^{th} percentile would indicate exceptional leanness (Winnick & Short, 1985).

- **Stature**

  Stature is a major indicator of general body size and bone length. It is an important variable in screening for disease or malnutrition and in the interpretation of body weight (Lohman et al., 1988).

The stature was measured with a calibrated height gauge. The subject stood barefoot, feet together and heels, buttocks, and upper part of the back touching the scale with head placed in the Frankfort plane, not necessarily touching the gauge. The Frankfort plane was considered as the orbital (lower edge of the eye socket) being in the same horizontal plane as the tragion (notch superior to the tragus of the ear). When so aligned the vertex was the highest point on the skull. The measurement was taken to the nearest 0,1 cm at the end of a deep inhalation.

- **Body Mass**

Body mass was measured with a Detecto beam balance scale to the nearest 0,1 kg, with the child clothed in their P.E togs, and taking care that the:

- scale was reading zero;
- child stood on the centre of the scale without support;
- child's weight distribution was even on both feet; and;
- child's head was held up and eyes looked directly ahead.

- **Skinfolds**

Skinfold measurements at two sites were used to assess body composition. The following measurement technique was applied for all site measures, using a John Bull skinfold caliper exerting a uniform pressure of 10g per mm^2 irrespective of the caliper opening. All measures were taken on the right hand side of the subject.

The thumb and index finger of the left hand were used to elevate a double fold of skin and subcutaneous adipose tissue one centimetre proximal to the site at which the skinfold was to be measured. Caliper jaws were applied at right angles to the site, approximately midway between the general surface of the body near the site and crest of the skinfold, and the handles fully released. Once full pressure was applied and initial needle drift had stopped or a maximum period of four seconds had passed, the measurement was taken. Two measures were taken and recorded to the nearest 0,5mm. If the difference was greater than 1 mm, then a third measure was taken and the mean of the closest two recorded.

The skinfold sites were carefully located using the following anatomical landmarks:

- **Triceps Skinfold**

The skinfold was measured in the midline of the posterior aspect of the arm, over the triceps muscle, at a point midway between the lateral projection of the acromion process of the scapula and the inferior margin of the olecranon process of the ulna. The skinfold was measured with the arm hanging pendant and comfortably at the subjects' side.

Figure 3.1: The measurement of the triceps skinfold

- Sub-scapular Skinfold

The sub-scapular skinfold was taken at a site approximately 2 cm, below the tip of the scapula (inferior angle) and 2 cm toward the midline of the body. The measurement was taken on the child's right side.

Research indicates that height, weight, and the muscle-fat ratio influence how children perform motor skills. Thus, all the above measurements where taken to determine how the child's body size affected their motor performance.

Figure 3.2: The measurement of the sub-scapular skinfold

3.3.3.2 Motor Proficiency

The Bruininks-Oseretsky Test of Motor Proficiency(BOTMP) (Bruininks, 1978) was used to assess the motor proficiency development of the subjects. The BOTMP is widely used in Adapted Physical Education (Miles, et al., 1988; Parker & Bradshaw, 1987) and is useful in assessing the motor proficiency of children with disabilities (Haubenstricker,et al., 1981: Stengel, 1991). It is considered to be fun and interesting to children (Roswal,et al., 1984), and the instructions and trials are useful in gauging the individual's understanding of the motor task to be assessed (Connolly & Michael, 1986). The standardised procedures permit replication and comparison between and within individuals in the study.

The BOTMP has a long and short form. Verderber & Payne (1987) suggests that the long form provides a more reliable measure of motor deficits than the short form, especially for children over 10 years of age. The BOTMP_LF assess eight variables with 46 separate tasks (see Table 3.5).

The eight sub-tests used are:

Table 3.5: **Subtest and Items for the BOTMP (Examiner's manual, 1978)**

Subtest	Item
STATION 1: Subtest 1: Running Speed and Agility	Running Speed and Agility
STATION 2: Subtest 2:Balance	1. Standing on Preferred leg on floor 2. Standing on Preferred leg on Balance beam 3. Standing on Preferred leg on Balance beam- eyes closed 4. Walking forward on walking line 5. Walking forward on Balance beam 6. Walking Forward Heel-to-toe on walking line 7. Walking forward Heel-to-toe on balance beam 8. Stepping Over Response Speed Stick on Balance Beam
STATION 3: Subtest 3:Bilateral Coordination	1. Tapping feet alternately whilst making circles with fingers. 2. Foot and finger on same side synchronized 3. Tapping foot and finger on opposite side synchronized. 4. Jumping in place - Leg and arm on same side synchronized. 5. Jumping in place - Leg and arm on opposite side synchronized. 6. Jumping up and clapping hands. 7. Jumping up and touching heels with hands. 8. Drawing lines and cross simultaneously.
STATION 4: Subtest 4:Strength	1. Standing broad jump 2. Sit-ups 3. Knee or full push-up

Subtest	Item
STATION 5: Subtest 5: Upper limb coordination	1. Bouncing a ball and catching it with both hands 2. Bouncing a ball and catching it with preferred hand 3. Catching a tossed ball with both hands 4. Catching a tossed ball with preferred hand 5. Throwing a ball at a target with preferred hand 6. Touching a swinging ball with preferred hand 7. Touching nose with index finger- eyes closed 8. Touching thumb to fingertips- eyes closed 9. Pivoting thumb and Index finger
STATION 6; Subtest 6: Response Speed	1. Response Speed
STATION 7: Subtest 7: Visual-Motor Control	1. Cutting out a circle with preferred hand 2. Drawing a line through a crooked path with preferred hand 3. Drawing a line through a straight path with preferred hand 4. Drawing a line through a curved path with preferred hand 5. Copying a circle with preferred hand 6. Copying a Triangle with Preferred hand 7. Copying a Horizontal Diamond with preferred hand 8. Copying a overlapping pencils with preferred hand
STATION 8: Subtest 8: Upper-limb Speed and Dexterity	1. Placing Pennies in a Box with Preferred hand 2. Placing Pennies in two Boxes with Both hands 3. Sorting Shape Cards with Preferred hand 4 Stringing Beads with Preferred hand 5. Displacing Pegs with Preferred hand 6 Drawing Vertical lines with Preferred Hand 7. Making Dots in Circles with Preferred Hand 8. Making Dots with Preferred Hand

For the purpose of this study the long form was used. . Reliability for the long form ranges from .80 to .94 and face validity has been accepted by adapted physical educators (Sherrill, 1993). A copy of the score sheet appears in Appendix B. Full details for the administration and scoring appears in the Examiner's Manual (available at the Department of Human Movement Science, University of Zululand).

3.3.3.3 Cratty Self-Concept Scale

The Cratty Self-Concept Scale measures the dimensions of self-concept that applies to feelings about the self, specifically in movement contexts. It consists of 20 questions, each of which is answered with a "yes" or a "no' answer, thus making it easy to administer to children. It is a screening instrument that is recommended for identifying children with low self-concept about themselves as movers (Longhurst, 1995 & Sherrill, 1993). A copy of the score sheet appears in Appendix C.

3.3.3.4 The Conner's Teacher Questionnaire

The Conner's Questionnaire is one of the most widely used children's rating scales in the world and is often used with children presenting behaviours typical of ADHD. This questionnaire is suitable for use by clinical psychologists, educational psychologists, child psychiatrists and teachers. It is particularly useful for measuring changes, evaluating intervention strategies, and monitoring remedial treatment. The assessment comprises of either a short form containing 28 items or a long form containing 39 items. The age range for the questionnaire is between three and seventeen years. It takes 15-20 minutes to complete the long form. (Health:Conner's rating scale, 1999, http://connorsteacherscale.html A copy of the questionnaire appears in Appendix D.

3.4 PRE TEST PROCEDURES

The pre test assessment was done over three days (two session per day of one and a half hours each). The allocation of test days and group session appears in table 3.5 below. All testing was conducted in the Remedial School hall. This venue was chosen as it was free from noise and other distractions (such as people walking by, the lighting and ventilation). The floor as well as the stage area was used.

Table 3.6: **Allocation times per group**

Day of Week	Time of day	Group Name and Number
Monday	10h30 - 12h00	Grade 3 (Wilson) = N9
Monday	12h00- 13h30	Grade 3 (Durham) = N12
Tuesday	10h30 - 12h00	Grade 4 (Sadler) = N9
Tuesday	12h00 - 13h30	Grade 4 (Cloete) =N9
Wednesday	10h30 - 12h00	Grade 5 (Myburg) = N12
Wednesday	12h00 - 13h30	Grade 5 (Kruger) = N9

On arrival at the School hall, subjects were seated at pre-placed desks and the hall doors closed. A "Testing - Please Do Not Disturb" sign was placed on the door. The first test item was the administration of the Cratty's Self Concept Scale. The researcher administered the test herself. The researcher read the question out loud and gave the children time to reply with a negative or positive answer on their individual score sheets. Any questions the children had during the session were answered individually by the researcher . The completion of the inventory took the children approximately 10 minutes. On completion of the questionnaire the children where handed a BOTMP individual score sheet. The child was requested to carry the sheet from test station to test station ,where the tester at each sub test station recorded the child's score on the score sheet. Each child first started with the anthropometric test items, moving on to the next test sub station, which was also the first sub test of the BOTMP, moving to the next sub station as they completed the previous test. Only one subject and the tester where at a sub station at one time. During the testing session all children wore their physical education uniforms, consisting of T-shirt, shorts and running shoes (takkies). Class teachers where requested to complete the Conner's Questionnaire and place the forms on the children's school file.

Before any testing was administered, an oral description of the test was given to the children by the researcher. During the actual testing, each item was demonstrated and where doubt existed, a trial attempt was given to ensure that the children knew what was required of them.

A thorough check was made to ensure that the children were free of any condition that could influence the results of the tests and thus invalidate the testing programme. Apparatus used during testing was carefully checked and rechecked before the testing sessions.

3.5 INTERVENTION PROGRAMME

To ensure that there was no disruption in the normal school programme, it was decided to offer the physical activity programme to the children during their assigned physical education classes. A period of 12 weeks was used to administer the intervention programmes. The 12 weeks was broken up into two sessions of 6 weeks each(see Table 3.6). This allowed for the set school terms. The physical education programmes were run twice a week for an hour during the normal times allocated. (See Appendix F for the School Time table). The intervention programme was administered by the researcher and trained assistant. For the first session, each was responsible for one of the Intervention groups (Sensory Motor and Perceptual Motor Group), after a six week period the researcher and assistant swopped groups. The purpose of this was to ensure that the results obtained was due to the type of intervention and not the individual administrating the programme. All lesson plans for both Intervention programmes was designed and drawn up by the researcher. (See appendix G). The class teacher was responsible for the physical education programme of the children in the control group.

Table 3.7: **A Schedule of the Study**

Date	Procedure	Week Number
18April-26 May 2000	Pilot study and training session for assistants	
12-16 June 2000	Pre Test testing	
19-30 June 2000	Assignment of children	
17-21 July 2000 28 - 01Sept 2000	Intervention PE Programme	One Seven
24-28 July 2000 04-08 Sept 2000	Intervention PE Programme	Two Eight
01-04 Aug 2000 11-15 Sept 200	Intervention PE Programme	Three Nine
07-11 Aug 2000 18-22 Sept 2000	Intervention PE Programme	Four Ten
14-18 Aug 2000 02-06 Oct 2000	Intervention PE Programme	Five Eleven
21-25 Aug 2000 09-13 Oct 2000	Intervention PE Programme	Six Twelve
16-20 Oct 2000	Post test testing	
27-30 Nov 2000	Post-Post testing	

3.6 POST TEST PROCEDURE

The subjects (N=60) completed the post test three days after the end of the intervention programme. The exact same procedures followed in the pre test were repeated for the post test. Teachers were requested to fill in a second Conner's questionnaire enabling the researcher to identify changes in classroom behaviour.

3.7 POST- POST TEST PROCEDURE

The subjects (N=60) completed the post- post test six weeks after of the assessment of the post test. The purpose of this was to establish if any subjects had regressed in the obtainment of motor proficiency. The measures of Self-concept and Class Room behaviour were not assessed during this phase. The procedure for the BOTMP followed the exact procedure as the pre and post tests.

3.8 STATISTICAL ANALYSIS

The following statistical procedures were used to process the data:

- Means and standard deviations were calculated to determine the distribution of scores for all tests.

- An analysis of variance (ANOVA) was used to compare the three groups' composite scores on (1) motor proficiency pre test, (2) motor proficiency post test, (3) motor proficiency post post test.

- The Scheffe' post hoc analysis was used to determine the significant differences between groups. An Omega squared (ω^2) was used to determine meaningfulness for independent *t* test calculations.

- Pearson product moment correlations were calculated to determine the correlation between (1) Motor proficiency and self concept, (2) Motor proficiency and classroom behaviour (3) Motor proficiency and body composition profiles.(All scores where standardized to z scores).

- Independent *t* tests were calculated to compare the motor proficiency scores of (1) Learning vs Non Learning disabled children and (2) Medicated vs Non Medicated children. (3) Post test scores of the Sensory vs P Motor sub test items.

- Dependent *t* test were calculated to compare (1) Group's motor proficiency pre vs post sub test items scores, (2) Group's motor proficiency pre vs post post sub test items scores, (3) Cratty's self concept questionnaire pre and post test scores, and (4) Conner's questionnaire pre and post test scores.

- Effect sizes were calculated for the following dependent *t test* scores (1) Each group's pre vs post test assessment (2) Pre vs Post Post test.

In all analysis the 95% level of confidence ($p < 0.05$) was applied as the minimum to interpret significant differences among sets of data (Vincent., 1995).

CHAPTER FOUR

RESULTS AND DISCUSSION

The acceptance of the value of physical education within the curricula of the new Curriculum 2005 led the author of this study to focus on the question of which type of physical education programme could be presented to best suit the needs of learners with learning disabilities. In order to answer this question, it was decided to present two programmes specifically designed to improve the motor proficiency of children with learning disabilities.

As the primary aim of this study was to evaluate the effect of different physical education programmes on the motor proficiency of children with learning disabilities, the following research questions were formulated to guide this study. a). Will children with LD who participate in structured physical education programmes show improvements in their motor proficiency? b). Which of the two intervention programmes (Perceptual Motor vs Sensory Motor) will bring about a greater improvement in motor proficiency ? The research hypothesis for the primary aim was that a twelve week intervention programme would have a beneficial effect on the motor proficiency of children with learning disabilities.

A secondary area of focus was to determine whether there was a relationship between motor proficiency, body composition profiles, self concept and classroom behaviour among children with LD. The following research questions were formulated to guide this focus area of the study: a) Will children with LD who participate in structured physical education programmes show improvements in their self-concept? b). Will children with LD who participate in structured physical education programmes show improvements in their classroom behaviour ? c). What effect does stature, mass and percentage body fat have on the children's motor performance? The research hypotheses for the secondary aims were: a). A twelve week intervention programme would have a beneficial effect on the self-concept of children with learning disabilities b). A twelve week intervention programme would have a beneficial effect on the classroom behaviour of children with learning disabilities. c). Stature, mass and percentage body fat, will have no significant effect on the motor performance of the children.

The results of the study are displayed in tabular and graphic form (Tables 4.1 - 4-12 and Figures 4.1-4.10) and are reported in the following categories of dependent variables.

- Motor proficiency
- Body composition profiles
- Self Concept
- Classroom behaviour

Henceforth each variable is discussed with respect to its response within and between the experimental groups and within the context of the relevant literature.

4.1 MOTOR PROFICIENCY

To find the answer for the primary aim of this study, the motor proficiency of the subjects was measured using the long form of the BOTMP, administered before and after the participation of the experimental groups in two different twelve week intervention programmes. The post post evaluation was done six weeks after the post test. After statistical treatments on this variable, the null hypothesis for the primary aim was rejected. The results of the statistical treatments are displayed and discuss in points 4.1.1 to 4.1.1.3.

4.1.1 Motor proficiency composite score results

Composite means, standard deviations and range of scores for each group are presented in Table 4.1 and Figure 4.1.

Table 4.1: **Mean, standard deviations and range of composite scores for the Motor Proficiency Test**

	Control (N=20)			Sensory (N=20)			P Mot (N=20)		
	Pre	Post	Post Post	Pre	Post	Post Post	Pre	Post	Post Post
Mean	122.45	122 4	124.3	122.1	134.29	124.8	122.95	164	134.5
SD	±15.91	±13.29	±13.53	±13.6	±12.46	±14.16	±19.43	±15.04	±8.95
Range	94-148	101-142	93-147	97-147	113-160	103-147	72-150	148-195	116-149

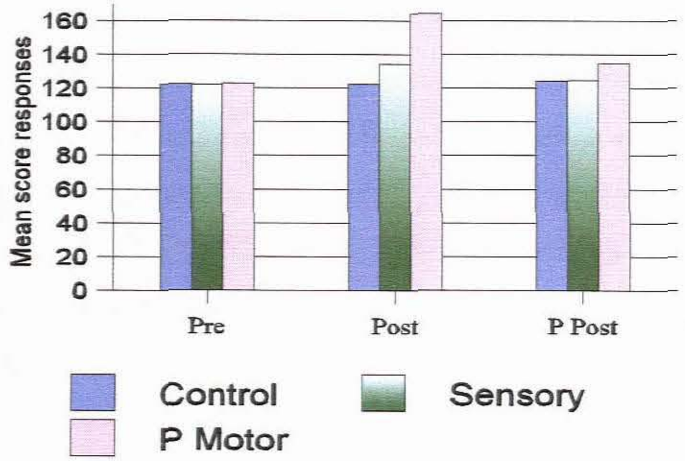


Figure 4.1 Distribution of mean scores on the Motor Proficiency test for the different groups

The following statistical calculations were done to determine the effects of different physical education programmes on the motor proficiency of children with learning disabilities.

- An analysis of variance(ANOVA) was done on the **Pre test Composite scores** to determine whether there were any differences between groups prior to the start of the intervention programmes.

This analysis revealed that there was no significant difference in the groups (see Table 4.1). This supports the validity of future comparisons between groups since the groups displayed equivalent levels of motor proficiency prior to the intervention programme.

- At the completion of the intervention programmes (a 12 week intervention period) an ANOVA analysis of the **Post test composite scores** revealed the following significant results. The intervention programmes brought about a significant improvement $F(2,57) = 53.54$, $p < .01$. In addition, a follow-up Scheffe' post hoc analysis (Vincent, 1995) indicated that the P Motor group had the best improvement and was significantly different $p < .01$ from the Sensory and Control groups. The Sensory group was significantly different $p < .05$ from the Control group. Computation of the effect size yielded a (ω^2) value of .64, an estimate that the improvement in motor proficiency scores accounted for 64% of the total variance.

Hence, it was concluded that the intervention programme used for the P Motor group brought about the best results and is believed to be the programme that best suits the needs of children with learning disabilities.

- An ANOVA analysis was calculated for the **Post Post test composite scores** (this assessment was done six weeks after the completion of the intervention programmes). This calculation revealed the following significant (F (2,57)= 4.27, p <.05) results. In addition the Scheffe' post hoc analysis (Vincent, 1995) indicated that the P Motor group was significantly different p < .05 from the Control and Sensory groups. The Sensory group, however, was not significantly different than the Control group. Computation of effect size yielded a (ω^2) of .10, an estimate that retention of motor proficiency scores accounted for 10% of the total variance.

Hence, it was again concluded that the P Motor programme used, best suits the needs of children with learning disabilities and best achieves the aim that the researcher set out to achieve, that being to find a programme that significantly improves the motor proficiency of children with learning disabilities.

As the researcher was also interested in the change that took place for the different test periods (post and post post) within the different groups, statistical calculations were calculated to determine whether the different programmes resulted in significant changes and whether these changes were still significant after six weeks after the completion of the intervention programmes.

4.1.1.1 Control group discussion

Means, standard deviations, t values (pre vs post and pre vs post post) and effect sizes for the **Control** group are presented in Table 4.2.

Table 4.2: **Means, standard deviations, *t* values and effect sizes for the Control group**

Control Group							
	Pre	Post	Post Post	*t* values Pre vs Post	ES	*t* values Pre vs P. Post	ES
M	122.45	122 4	124.3	0.39	-0.89	-0.72	-0.1
SD	±15.91	±13.29	±13.53				

✱Significant at $p<.05$ ▲ Significant at $p<.01$

The data analyses for the control group revealed that there was no significant difference between test periods, which was expected. Hence, no further discussion for the control group was deemed necessary.

4.1.1.2 Sensory Group result discussion

Means, standard deviations, *t* values (pre vs post and pre vs post post) and effect sizes for the **Sensory group's composite scores** are presented in Table 4.3.

Table 4.3: **Means, standard deviations, *t* values and effect sizes for the Sensory group**

Sensory Group							
	Pre	Post	Post Post	*t* values Pre vs Post	ES	*t* values Pre vs P. Post	ES
M	122.1	134.3	124.8	2.66 ✱	-0.89	0.75	-0.19
SD	±13.6	±12.46	±14.16				

✱Significant at $p<.05$ ▲ Significant at $p<.01$

Analysis of the data revealed that the post test was significantly different $p<.05$ from the pre test. The post post test was not significantly different from the pre test. To determine and/ or establish the cause of these results the researcher looked to the sub test items scores for answers.

The results of the Sensory group's Motor Proficiency sub test item scores are indicated in Table 4.4 and Figures 4.2.

Table 4.4: **Sensory Group's mean, standard deviation and *t* values on the Motor Proficiency sub-test items**

	Sensory (N=20)							
	PRE		*POST*		*P.POST*		*t Pre vs Post*	*t Pre vs Post Post*
Sub-test item	**M**	**SD**	**M**	**SD**	**M**	**SD**		
Run	10.45	±0.42	10.9	±0.36	10.15	±1.75	1.17	0.74
Balance	21.25	±0.68	22.5	±0.86	20.65	±4.13	1.47	0.66
Bil Coodr.	7.35	±0.44	9	±0.55	7.05	±1.7	3.00▲	0.54
Strength	23.45	±0.97	25.25	±0.77	25.95	±5.74	3.30▲	1.65
Response	9.4	±0.83	12.8	±0.7	12.4	±2.13	2.25*	1.8
Visual	11.05	±0.65	11.8	±0.73	11.25	±3.17	2.02	0.9
Up L. Cor	9.2	±0.47	10.15	±0.3	10.1	±1.33	1.46	2.03
UL.Speed	30	±0.85	32.15	±0.7	31.15	±4.28	2.38*	0.64

Key: ☐ **Decrease in score** ☐ **Increase in score**

***Significant at $p < .05$ ▲Significant at $p < 0.1$**

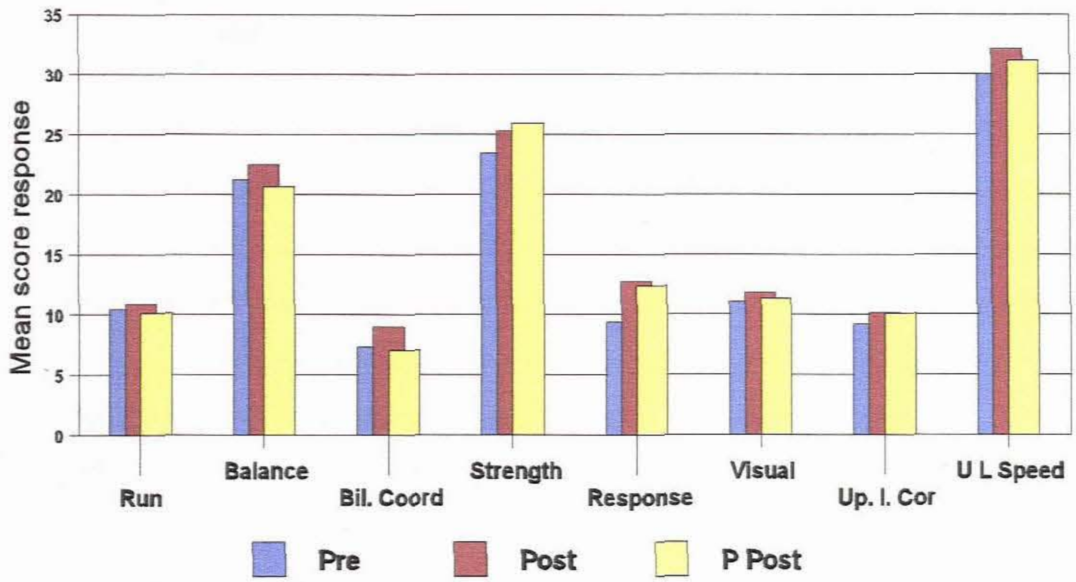


Fig 4.2: Distribution of Sensory group's mean scores per sub test item

Although the sub test item scores improved for all eight variables, the dependent *t* test analysis for the **pre vs post test** data revealed significant improvements of only four sub test items.

The largest significant ($p < .01$) increases in scores displayed were from the sub tests of Bilateral Co-ordination (t =3.00) and Strength(t =3.30). These t values surpass the t of 2.86 needed to be significant at the .01 level of probability. The t values of Response Speed (t=2.25) and Upper Limb Speed(t= 2.38) surpassed the t of 2.09 needed to be significant at the .05 level of probability.

Cheatum & Hammond (2000) indicate that children with LD have major breakdowns in the areas of a) Tactile integration b) Bilateral integration c) Laterality d) Crossing the midline e) Balance f) Motor planning g) Visual and Auditory perception (to name but a few). Sherrill (1993) states that children with LD frequently experience problems with awkwardness, have poorly developed kinethesis and are lacking in the area of fine motor control. The Sensory Intervention programme consisted of the following types of activities with the precise aim of addressing these limitations : a) Vestibular activities, b) Auditory activities c) Visual activities d) Kinesthetic activities e) Reflex activities and f) Tactile activities. These activities are strongly influenced by a cerebellar-vestibular basis. The cerebellum plays an important role in movement, balance and posture and the vestibular system plays a key role in controlling eye movements and the fixation of the eyes, and is also considered the unifying system in our brain that modifies and coordinates information received from the visual, proprioceptive, auditory and tactile systems. The vestibular system is involved with kinethesis, balance and postural reflexes. As the BOTMP test consists of the following test items: Running and agility, Balance, Bilateral Coordination, Strength, Response speed, Visual motor control, Upper limb Coordination and Upper limb speed, increases in scores were expected as many of the activities used in the Sensory intervention programme are similar to the items used in the BOTMP test (it must be stressed that no item from the BOTMP was used in it's exact format in the sensory programme), it was therefore concluded that increases in scores could be contributed to the intervention programme and the specific activities that were selected for the programme.

In research studies by, Hefley & Gorman (1986); Kerr & Hughes (1987), children with LD are documented as having deficits in response speed and bilateral co-ordination, but when treated through the means of interventions these deficits improve significantly. This interpretation appears to be supported in the present study as the children in the sensory group displayed improvements in their motor proficiency scores after participating in an intervention programme.

To determine whether the improvements of scores gained during the intervention programmes were retained after a six week period, a dependent *t* test was performed. Although the mean scores of the post post test indicate that five of the sub test items showed a retention of their improvement in scores the dependant *t* revealed that none of the changes where of a significant value.

The sub test items of Running, Balance and Bilateral Coordination displayed a decrease in scores from those obtained during the pre test assessment, these results were not expected. Wade (1992) states that motor tasks which were arranged in an organised sequence were remembered better than arbitrarily arranged tasks. . Taking the above mentioned statement into account, the researcher concluded that the decrease in scores were a result of the problems that children with LD have with balance, coordination and developmental delays in movement patterns. The activities of running, balance and bilateral coordination children with LD have shown problems with. Secondly it is believed that once the intervention programmes ceased to be offered, the children did not have the opportunity to practice learnt motor skills in a structured, organised and supervised environment thus resulting in a regression of learnt skills.

The results further support studies by Korkman & Pesonen (1994) and Rose (1997), in which decreases in scores were reported for items of balance, response speed and upper limb co-ordination. These researchers attribute the decrease in scores to deficits children with LD have in attention, motor planning and balance.

4.1.1.3 Perceptual Motor Group results discussion

Means, standard deviations, *t* values (pre vs post and pre vs post post) and effect sizes for the **P Motor** group are presented in Table 4.5.

Table 4.5: **Mean, standard deviations , *t* values and effect sizes for the P Motor group**

P Motor Group							
	Pre	Post	P Post	*t* values Pre vs Post	ES	*t* values Pre vs P. Post	ES
M	122.95	164	134.5	9.8 ▲	2.1	2.68 *	0.6
SD	±19.43	±15.04	±8.95				

*Significant at $p < .05$ ▲ Significant at $p < .01$

Analysis of the data revealed that the **pre vs post** test was significantly different $p < .01$. The **pre vs post post** test was significantly different $p < 0.5$ from the pre test. To determine and/ or establish the cause of these results the researcher looked to the sub test items scores for answers.

The results of the P Motor group's Motor Proficiency sub test item scores are indicated in Table 4.6 and Figure 4.3.

Table 4.6: **P Motor Group's mean, standard deviation and *t* values on the Motor Proficiency sub-test items**

	P Mot (N=20)							
Sub test Items	*PRE*		*POST*		*P.POST*		*t Pre vs Post*	*t Pre vs Post Post*
	M	**SD**	**M**	**SD**	**M**	**SD**		
Run	10.2	±0.57	15.35	±1.89	10.75	±2.07	12.49▲	0.99
Balance	20.2	±1.18	24	±4.55	21.55	±3.56	2.56▲	0.96
Bil Coord	8	±0.45	12.6	±1.60	7.8	±1.73	10.84▲	0.56
Strength	23.35	±0.92	29	±2.27	25.5	±4.03	5.50▲	2.25*
Response	10	±1.08	17.65	±2.24	10.65	±3.64	7.42▲	0.69
Visual	10.2	±0.74	14.7	±4.24	10.3	±3.18	9 ▲	0.33
U L Coord	8.8	±0.37	14.05	±1.43	10.45	±.94	11.60▲	4.00▲
U L Speed	32.05	±1.01	37.2	±2.28	33.85	±3.80	5.44 ▲	2.53*

Key: Decrease in score   Increase in score

***Significant at p <.05   ▲ Significant at p < .01**

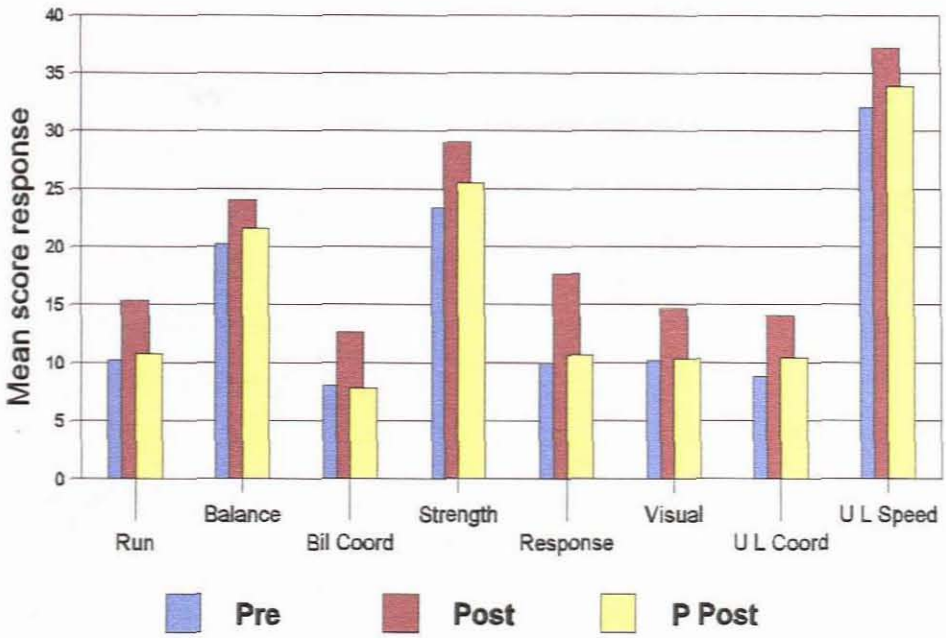


Fig 4.3: Distribution of P Motor mean scores for sub test items

Analysis of the **pre vs post test** results revealed that there was a significant improvement for all eight variables $p < .01$. The Learning Disabilities Association of America (1999) list the following as specific problems found in children with LD , a) Balance, b) Body awareness, c) Laterality, d) Spatial awareness, e) Coordination (to name but a few). To address these problem areas, the P Motor intervention programme consisted of the following activities: a) Ocular-Motor, b) Cross-lateral, c) Balance, d) Body awareness, e) Spatial awareness and f) Laterality activities. The types of activities used in the P Motor programme are similar to those used in the BOTMP, therefore increases in motor proficiency scores was anticipated. Secondly the activities within the P Motor programme stress the enhancement/improvement of motor planning, sequencing and ordering of movement (areas in which children with LD have problems with). These activities also placed emphasis on practice, practice and more practice.

Analysis of the **pre vs post post test** results revealed that although there was still a retention in the improvement of seven sub test item scores. Only the sub test items of strength ($t = 2.25$) and Upper limb speed ($t = 2.53$) surpassed the t of 2.09 needed for significance at the .05 level of probability. Upper limb coordination ($t = 4.00$) surpassed the t of 2.86 needed for significance at the.01 level of probability. The sub test item of bilateral coordination decreased in it's improvement , this was however not a significant change.

Sage (1984) indicates that the higher the proficiency attained on a motor skill during initial learning, the more slowly the skill is forgotten. This statement is supported in this present study, in that there were significant increases ($p < .01$) in scores after the intervention programme. These increases where retained after six weeks . The researcher therefore concludes that the retention of improvements gained after the intervention programme could be attributed to activities performed during the intervention programme.

At the end of the intervention period the school faced a staff shortage, this resulted in the Physical Education programme being run by an unqualified parent . The Physical Education programme taught after the intervention programme did not cater for specific areas of problems that children with LD have. The children were allowed to play during the Physical Education classes. The decrease in the Bilateral coordination score could have been a result of the lack of opportunity to practice skills learnt during the intervention period. The researcher feels that this caused negative implications for the children as the Physical Education programme was not given much thought and the type of activities done were not conducive to learning. This again stresses the point made that structured and well planned physical education programmes are required by children with LD, giving them the opportunity to reach their full potential.

4.1.1.4 Comparison of results for the Sensory and P Motor Post test assessment

From the above results it can be determined that both the intervention programmes (Sensory and P Motor) brought about increases in their motor proficiency scores. To ascertain which programme best suits the needs of the child with LD the researcher compared the post test scores of the Sensory and P Motor groups by means of a independent *t* test calculation. The means, standard deviation and *t* values for the sub test items are presented in Table 4.7 and Figure 4.4:

Table 4.7: **Post test means, standard deviations and t values of sub test items for Sensory and P Motor groups**

Sub-test item	***Sensory Post test (N=20)***		***P Motor Post test (N=20)***		***t values Sensory vs P Motor***	**Omega squared (ω^2)**
	M	SD	M	SD		
Run	10.9	±0.36	15.35	±1.89	7.44▲	0.58
Balance	22.5	±0.86	24	±4.55	1.389	0.02
Bil Coodr.	9	±0.55	12.6	±1.6	5.81▲	0.45
Strength	25.25	±0.77	29	±2.27	4.56▲	0.33
Response	12.8	±0.7	17.65	±2.24	5.32▲	0.41
Visual	11.8	±0.73	14.7	±4.24	2.49▲	0.12
Up L. Cor	10.15	±0.3	14.05	±1.43	8.64▲	0.65
UL.Speed	32.15	±0.7	37.2	±2.28	5.81▲	0.45

▲ significant at $p<.01$

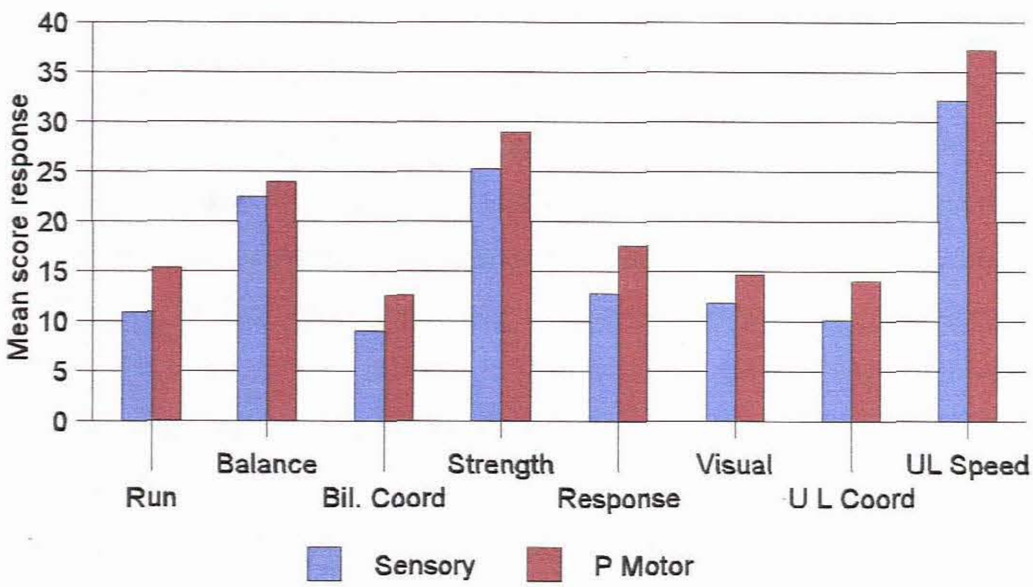


Fig 4.4: Distribution of mean scores for intervention groups on the post test assessment

Analysis of the independent *t* test results revealed that there were significant differences on seven of the eight sub test items. The *t* values each surpassed the *t* of 2.75 needed for significance at the .01 level of probability. To establish how much of the variance was accounted for, the differences in the two variables (Sensory vs P Motor) were subjected to an Omega squared (ω^2) treatment. For the sub test items the following variances were accounted for : a) Upper limb coordination 65%, b) Running 58%, c) Upper limb speed 45%, d) Bilateral coordination 45%, e) Response speed 41%, f) Strength 33%, g) Visual 12%, h) Balance 2%. Although these variances seem moderate, it should be remembered that any improvement no matter how moderate is regarded as important to the disabled population.

While it is apparent from the data analyses that the P Motor programme was the better of the two intervention programmes, the Sensory intervention programme should not be discarded. The Sensory programme also indicates that it has significant benefits for children with LD.

When designing the different intervention programmes the researcher took into account the list of motor problems identified by various researchers. Each programme was thus specifically designed to address these problems. The P Motor programme consisted of activities believed to promote the development of balance, body image, spatial awareness, laterality, cross-lateral integration and ocular-motor control which were taught via an indirect method. The Sensory programme consisted of activities believed to promote processing of sensory stimuli and was taught via a direct method. Improvement in all these areas occurred as a result of the participation in structured programmes. To determine how and when these different programmes (Sensory and P Motor) could be used to enhance the motor proficiency of children with LD, the researcher looked to the Pyramid of learning as proposed by Ayres (1972).

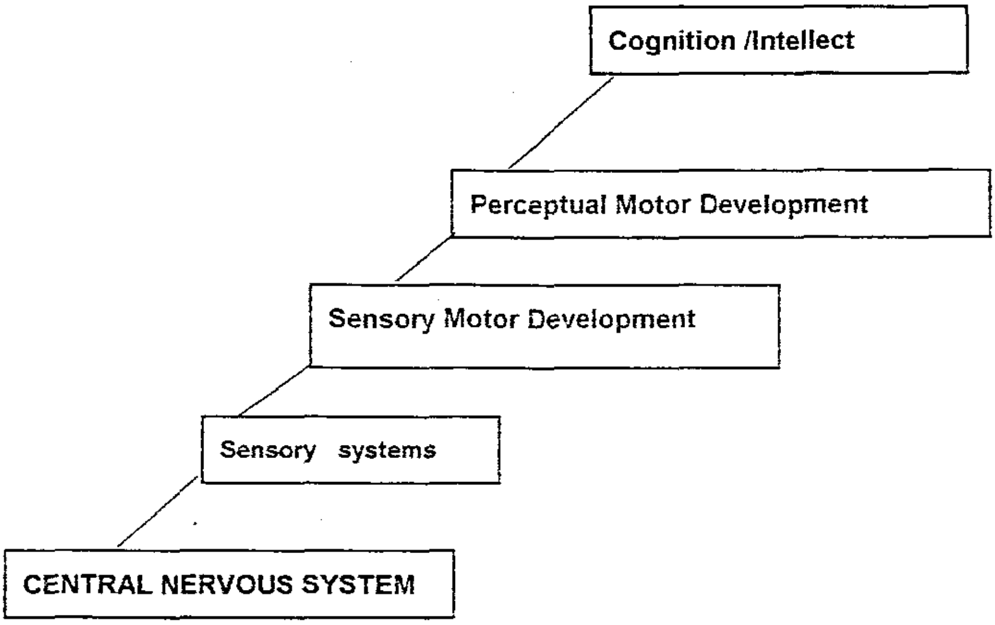


Figure 4.5: Pyramid of Learning (Adapted from Ayres, 1972)

The pyramid of learning begins in the nervous system (as shown in Fig 4.5). Each level must properly integrate with the previous level or levels in order to move on to the next level. The ultimate goal is to reach the cognitive level of functioning in order to attend to the tasks of daily living and learning.

The researcher therefore contends that the Sensory programme be a prerequisite to the P Motor programme. At the start of every year the Physical Education teacher should/must assess each child for their level of motor proficiency. Should the motor proficiency assessment results clearly indicate that the child has sensory or reflex deficits, the child should follow the Sensory programme. Once the child shows that the basic sensory and reflex systems are functioning, and that stimuli are being integrated, the advancement to the P Motor programme is advised.

4.1.2 Differences between non-medicated and medicated children

Research done by Cohen, et al, (1971) and Porges, et al, (1975) indicate that children diagnosed with learning disabilities on medication achieve similar scores on motor skill tests to those not taking medication.

During the initial (pre test) period, data was collected for children using Ritalin (N9) and children who were not using any medication (N51) at the time of testing. Analysis of the initial (pre test) data revealed some interesting results.

Means and standard deviations for each of the eight sub test variables are presented in Table 4.8 and Figure 4.6. Also presented in Table 4.8 are the *t* value differences between means and effect size values for each of the statistically significant comparisons.

Table 4.8 **Pre test means, standard deviations and t values of sub test items for Medicated and Non medicated children**

Sub test Items	**Medicated (N=9)**		**Non-medicated (N=51)**		***t* values Med vs Non Med**	**Omega squared (ω^2)**
	Mean	**SD**	**Mean**	**SD**		
Run	**15.6**	**±5.1**	**12.4**	**±6.2**	**3.0▲**	**0.62**
Balance	**14.0**	**±4.5**	**10.4**	**±6.5**	**3.0▲**	**0.80**
Bil Co-ordination	**14.6**	**±3.9**	**10.8**	**±3.8**	**5.2▲**	**0.97**
Strength	**16.1**	**±4.8**	**13.0**	**±5.6**	**3.1▲**	**0.64**
Response	**16.1**	**±3.9**	**11.8**	**±5.7**	**4.6▲**	**0.64**
Visual motor	**16.3**	**±4.1**	**15.7**	**±5.9**	**0.6**	**1.10**
U L Co-ordination	**12.3**	**±5.3**	**9.1**	**±5.5**	**3.1▲**	**0.14**
U L Speed	**14.0**	**±4.6**	**10.5**	**±6.0**	**3.4▲**	**0.60**

▲ significant at $p < .01$

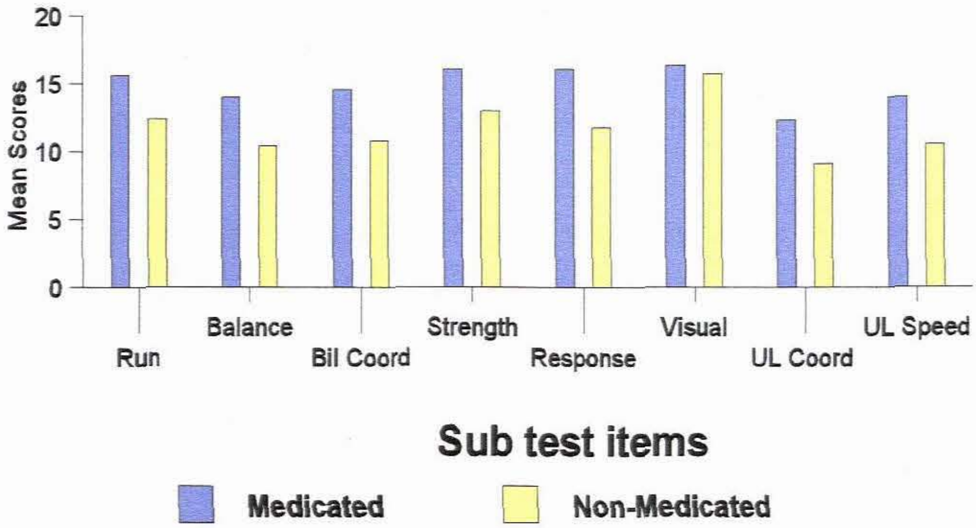


Fig 4.6: Differences in mean scores for Medicated and Non-Medicated children

An independent *t* test revealed that the medicated group performed significantly better on seven of the eight motor variables, which was not expected. The *t* values of the seven variables all surpass the *t* of 2.86 needed for significance at the .01 level of probability. Effect sizes for the significant comparisons were .62, .80, .97, .64, 1.10 and .60, respectively. These effect sizes can be interpreted as moderate to large.

The purpose of this data analysis was to determine if there were differences in motor proficiency scores that warranted different approaches for addressing the physical education movement needs of children on medication and children not taking medication.

The data analysis as stated above revealed significant differences between children taking medication and those not. The children taking medication performed significantly better in the areas of balance, running speed, upper limb speed and dexterity. These findings do not support previous research findings. A factor for consideration for these findings could be the role Ritalin plays in the treatment of children with learning disabilities. Ritalin is reported to increase the attention span of children with LD , which in turn results in more accurate motor control and balancing abilities (Wade, 1992). An additional factor that may have affected the results was the size of the sample groups. The small number of subjects in the medicated group could have caused the results to be biassed. It is therefore necessary to consider further research using larger sample groups to substantiate these findings.

From these results it is apparent that activities which include motor planning, motor control and balance are deemed necessary for inclusion into any physical education programme for children with learning disabilities.

4.1.3 Difference between Learning Disabled and Non disabled children

Research done by Haubenstricker , (1982) established that children with LD are weaker than children without LD on tasks of bilateral co-ordination. Miyahara, et al., (1995) contended that many children with LD display visual and spatial motor difficulties and can thus be considered "Clumsy". Lazarus , (1990) stated that children with LD showed more overflow movement, had difficult with visual-motor tasks, and were inferior to children without LD in spatial orientation and tasks requiring motor planning and sequencing of motor acts.

Prior to the start of the two intervention programmes, sixty non learning disabled children from a different school to the one where the research was to be conducted , were randomly selected and matched to the learning disabled children. This was done by age, gender and home language. The purpose of this was to determine if there were any significant differences in motor proficiency scores that warranted special attention when addressing the physical education movement needs of children with learning disabilities.

An independent *t* test indicated that the non-disabled children performed significantly better ($p < .01$) on all eight variables., which was to be expected. Effect sizes for the significant comparisons were .76, .2.74, .60, .2.64, .80, .64, 1.10 and 2.30. These effect sizes can be interpreted as moderate to large.

Means and standard deviations for each of the eight variables are presented in Table 4.9 and Figure 4.7. Also presented in Table 4.9 are the t values for differences between means and the effect size values for each of the statistically significant comparisons.

Table 4.9: **Means, standard deviations and *t* values of Sub test items for Learning Disabled and Non-Learning Disabled Children**

Subtest	Learning Disabled (N=60)		Normal (N=60)		t values LD vs Normal	Omega squared (ω^2)
	M	S.D	M	S.D		
Running	10.5	±6.0	14.0	±4.6	3.4▲	0.76
Balance	19.7	±2.6	48.8	±10.3	11.9▲	2.74
Bill Co-ordination	9.1	±5.5	12.3	±5.3	3.1▲	0.60
Strength	24.2	±9.2	49.1	±9.4	15.2▲	2.64
U.L. Co-ordination	10.4	±6.5	14.0	±4.5	3.0▲	0.80
Response Speed	13.0	±5.6	16.1	±4.8	3.1▲	0.64
Visual	11.8	±5.7	16.1	±3.9	4.6▲	1.10
U.L. Speed	26.9	±8.5	48.8	±9.5	16.8▲	2.30

▲ **significance at $p < .01$**

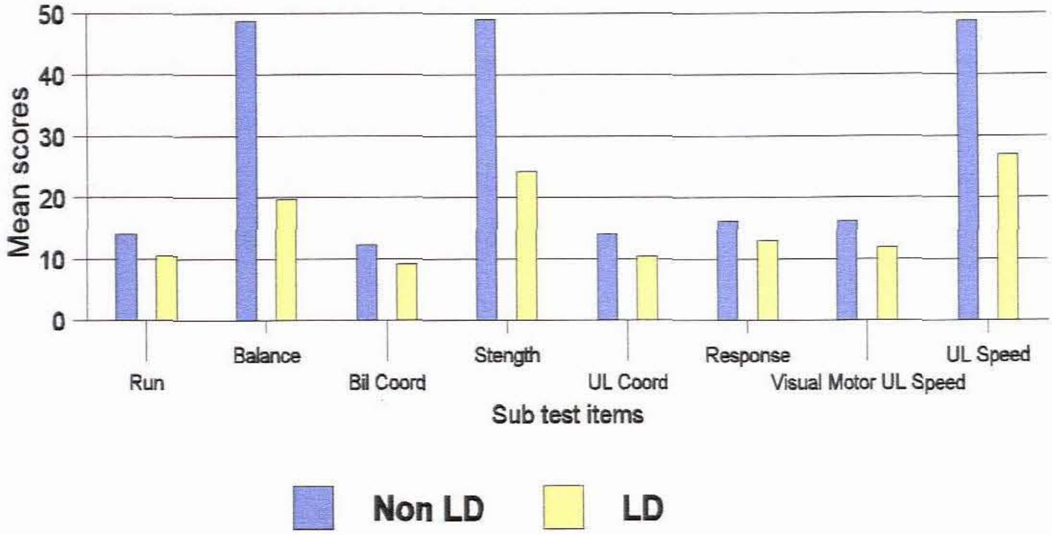


Figure 4.7: Scores for sub test items for Learning and Non-Learning Disabled children

The variables of balance (*t*=11.9), strength (*t*=15.2) and upper limb speed (*t* = 16.8) displayed the largest significant differences. The weaker performance by children with learning disabilities supports research findings that balance, upper limb speed and dexterity have often been associated with children with learning disabilities (Harvey & Reid,1997; Haubenstricker, 1982).

Based on these results, a physical education programme should contain activities that will enhance motor proficiency skills that seem to be inferior *in children with learning disabilities. Therefore activities should be* carefully selected to cater for the special needs of children with learning disabilities.

In conclusion the importance of developing motor skills of children goes beyond "opening the door" on the multiple benefits derived from participation in physical activity programmes, it is essential if children with learning disabilities are to achieve their potential level of functional autonomy.

4.2 BODY COMPOSITION PROFILES

Whatever our age or sex, our performance in sport and physical activity is influenced by, and to some extent influences, our physical growth. We differ from one another in height and weight, body proportions, physique, posture, distribution of various body tissues, and the speed at which various tissues grow. These factors help explain why we perform as we do in sport and physical activity (Bailey, 1976).

Thomas, *et al*, (1988) indicates that height, weight, and muscle-fat ratio influence how children perform motor skills. For example children who are taller, weigh less usually jump further and perform better on many muscular endurance tasks, like pull-ups and sit-ups. Sherrill (1993), indicates that differences between genders are minimal until puberty, when sex hormones become active and promote development of male and female characteristics. During puberty, girls add fat while boys add muscle, thus gender differences in motor performance increases because of boys' greater size and strength. Prior to puberty, performance differences should be related more to body size than to gender.

Although the collection of the body composition profile data did not serve as a selection criteria for the placement into group, it was analysed to ascertain how the children performed on the motor proficiency test in relation to their body composition profile data.

The calculation of a Pearson Product Moment correlation (see Table 4.10) established a co-efficient of r= 0.28 for height and motor proficiency a r= 0.24 for mass and motor proficiency and a r =0.11 for the sum of skinfolds and motor proficiency. This can be interpreted as a low relationship between the different variables. The null hypothesis was rejected.

Table 4.10: **Correlation values for Motor Proficiency vs Height, Mass and sum of skinfolds**

	Motor Proficiency
Height	r=0.28
Mass	r=0.24
Sum of Skinfolds	r=0.11

Hence, it was concluded that the body profiles of the children with learning disabilities did not play an important role in how the children performed on the motor proficiency tasks.

4.3 SELF CONCEPT

Self-concept refers to all the beliefs, feelings and intentions that a person holds in regard to him or herself (Sherrill, 1993).

Research to examine the difference in motor performance and self concept between children with disabilities and children without disabilities indicate that children with disabilities had significantly lower self concept than children without disabilities and performed significantly weaker in terms of their motor performance . Results further revealed a positive relationship between gains in motor performance and improvement in self concept (Martinek & Karper, 1982: Miller, 1971).

The purpose of the data analysis of the Cratty Self Concept Questionnaire was to ascertain to what degree improvement on motor proficiency scores improved the child's self-concept. It is the hope of the researcher to provide learning disabled children with a programme that will help them improve their motor proficiency as well as make an impact on their social and emotional development.

The scores displayed in Table 4.10 indicate that the pre test scores of the three groups were not similar before the start of the intervention programmes. The researcher did not conceive this to be problem, as the scores for the Cratty Self Concept Questionnaire did not form part of the selection criteria (for the formation of groups) and the scores of the groups were in no way compared to other groups. The purpose of statistical treatment on the Cratty Self Concept Questionnaire was to determine whether any improvement in self concept scores (per group)occurred as a result of participation in a intervention programme specifically designed to improve the motor proficiency of children with LD. A dependent *t* test was calculated in order to determine whether any improvement did indeed occur.

Means and standard deviations for each group are presented in Table 4.11 and Figure 4.8. Also presented in Table 4.11 are the *t* value differences between means and effect size values of each group. The effect sizes obtained can be interpreted as moderate.

Table 4.11: **Means, standard deviations and effect size for the Cratty Self-Concept Questionnaire**

	Test	**M**	**SD**	***t* values Pre vs Posts**	**ES**
Control	Pre	12.6	±3.33	0	0
	Post	12.8	±3.34		
Sensory	Pre	14.05	±3.50	7.6▲	0.60
	Post	16	±3.24		
P Motor	Pre	15.1	±2.46	5.18▲	0.64
	Post	16.75	±2.55		

▲ Significance at $p < .01$

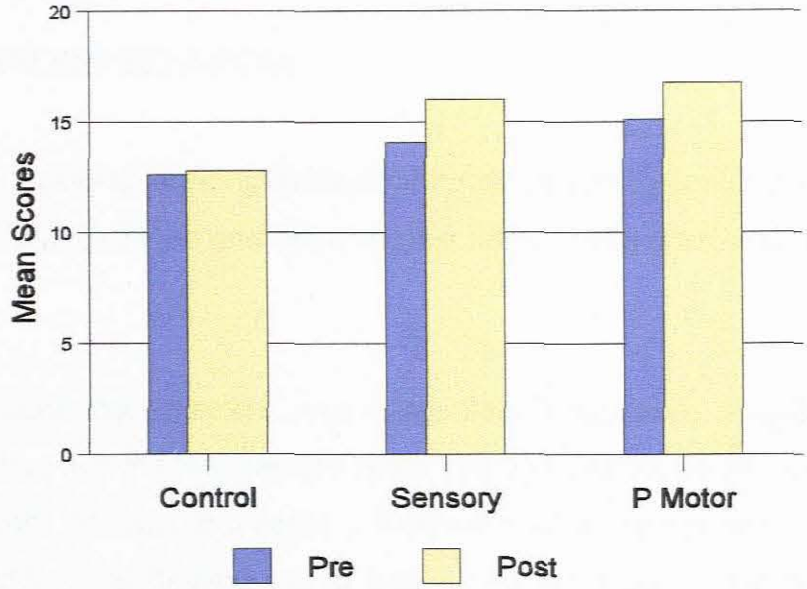


Fig 4.8: Mean scores for the Cratty Self Concept Questionnaire

The dependent *t* test results for the of the control group showed no significant differences (pre vs post)n scores. Both experimental groups however improved significantly $p < 0.1$. Both *t* values surpass the *t* of 2.86 needed for significance at the.01 level of probability and the null hypothesis was therefore rejected. It is concluded that participation in the intervention programmes significantly improved the self-concept of the children *and thus supports previous research findings*

Further data analysis was conducted to determine whether there was any relationship between self concept and motor proficiency. The calculation of a Pearson Product Moment correlation established a coefficient of $r=0.03$ for the pre test and $r=0.12$ for the post test. Although there was an improvement in results these were not significant. These results did not support previous research findings. The low relationship between motor proficiency and self concept shown by these results is a cause for concern, and needs to be investigated through the means of further research. As there is no scientific explanation for this phenomenon, the researcher speculated that the results could be due to the way children form perceptions about themselves and how others perceive them.

4.4. CLASSROOM BEHAVIOUR

The behaviour of learning disabled children frequently contributes to their being misunderstood and obtaining the label "a hand full" (Auxter, *et al*, 1993).

Behaviours that interfere with classroom instruction, impede social interaction with the teacher and peers, or endanger others are considered classroom conduct problems. Examples of inappropriate classroom behaviours are: "talking out of turn", fighting, arguing, swearing, and avoiding interactions with others. Auxter, *et al*, (1993), state that children tend to show inappropriate behaviour when they have not learned correct responses or have not found that acting appropriately is more rewarding than acting inappropriately.

The scores displayed in Table 4.12 indicate that the pre test scores of the three groups were not similar before the start of the intervention programmes. The researcher did not conceive this to be problem, as the scores for the Conner's Classroom Behaviour Questionnaire did not form part of the selection criteria (for the formation of groups) and the scores of the groups were in no way compared to other groups The purpose of the data analysis on the Conner's Questionnaire was to determine whether a specially structured, physical education programme could bring about improvement in classroom behaviour of children with learning disabilities

The results of dependent *t* tests revealed that there was a significant ($p < .01$) improvement in classroom behaviour of children from all the groups. The *t* values obtained surpass the *t* of 2.86 needed for significance at the.01 level of probability

Means, standard deviations, *t* differences between means and effect size values are presented in Table 4.12 and Figure 4.9:

Table 4.12: **Mean, standard deviations, *t* values and effect sizes for Pre and Post test data on the Conner's Questionnaire**

	Test	M	SD	*t* values Pre vs Posts	ES
Control	**Pre**	**14.7**	**±5.2**	**4.51▲**	**0.17**
	Post	**15.6**	**±4.9**		
Sensory	**Pre**	**14.0**	**±5.0**	**6.77▲**	**0.58**
	Post	**16.9**	**±5.4**		
P Motor	**Pre**	**16.5**	**±6.2**	**7.6 ▲**	**0.46**
	Post	**19.4**	**±6.2**		

▲ significance $p < .01$

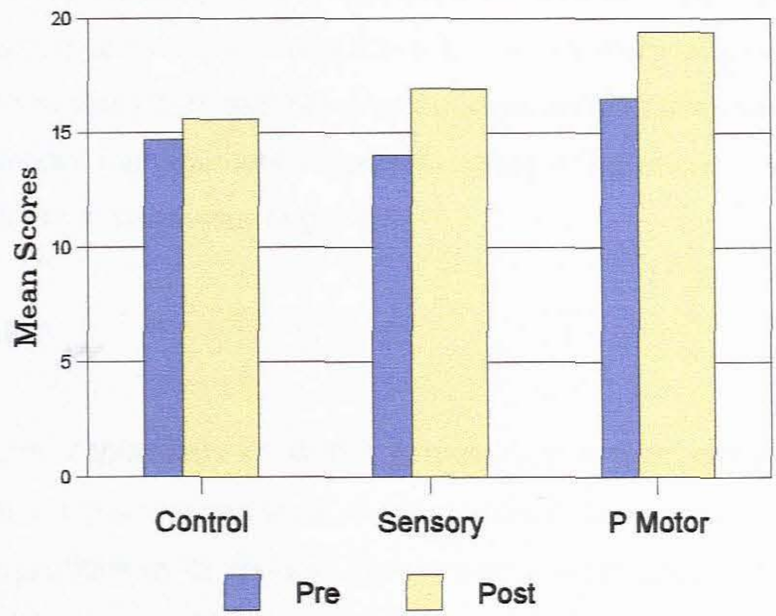


Figure 4 .9: Distribution of mean scores on the Conner's Questionnaire

From the results it can be seen that there were increases in classroom behaviour scores for all groups. The increases in scores obtained by all groups could have been a result of the instructional and management strategies that the researcher put into place for the physical education classes. Many of these strategies where carried over to the classroom environment by the classroom teacher, therefore all groups were exposed to changes in strategies which could have contributed to the increase in scores.

Hence, from the above results it was concluded that participation in a structured physical education programme can significantly improve the classroom behaviour of children with learning disabilities.

To establish if there was any relationship between the children's motor proficiency scores and their classroom behaviour a correlation analysis was done. The calculation of a Pearson Product Moment correlation established a coefficient of r= -0.17 for the pre test and a r= 0.12 for the post test. Although there was an improvement in results , these were not significant. As there is no scientific explanation for this phenomenon, the researcher speculated that the results could be due to the way in which the classroom teacher perceives the child. A closer working relationship between the classroom teacher and the physical education teacher and the behaviour management strategies could bring about a significant improvement in behaviour in general.

4.5 SUMMARY

The results of this study show that participation in a structured physical education programme can produce a significant improvement in the level of motor proficiency of children with learning disabilities. This can be considered a particularly important finding in that children with learning disabilities can be given the opportunity through the means of a structured physical education programme to improve not only their motor proficiency but their self concept and behaviour as well. More important, through the means of a well structured physical education programme the child will be given the opportunity to reach their full potential.

Chapter Five

CONCLUSIONS AND RECOMMENDATIONS

The results of this study demonstrated that children with learning disabilities who participate in a 12 week perceptual motor physical education programme can achieve significant improvement in their levels of motor proficiency, as well as improvement in their classroom behaviour and self concept.

5.1 CONCLUSIONS

The results of this study lead to three general conclusions:

a. Participation in a structured (perceptual motor) physical education programme can help children with learning disabilities improve their motor skills.

b. Participation in a structured physical education programme can have a positive affect on the self-concept of children with LD.

c. Participation in a structured physical education programme can have a positive affect on the classroom behaviour of children with LD..

Each of these general conclusions will be discussed separately in the following sections of this chapter.

5.1.1 Motor Proficiency

Participation in a structured physical education programme can result in a significant improvement in motor proficiency, one of the most important objectives of adapted physical education. This is a particularly important finding for facilitators who work within Remedial Schools, because physical education is not generally regarded as a valuable activity in these schools.

5.1.2 Self Concept

Participation in structured physical education programme can result in the improvement of motor proficiency, thus resulting in the improvement of the child's self concept.

5.1.3 Classroom behaviour

With the aid of a structured physical education programme the classroom behaviour of the child with a learning disability can be modified. With the child acting in an appropriate manner it becomes more acceptable to the teacher and its peers.

5.2 RECOMMENDATIONS

The following recommendations for both professional actions and for future research are made by the author based upon the results of this study as well as the entire experience of designing and implementing the intervention physical education programme that where the central focus of this study.

5.2.1 Professional Actions

The following actions are recommended to implement the results of this study in the education profession:

a. Representatives from the various Education Departments in conjunction with physical educators (Life Skill facilitators) should develop resource materials for teacher/facilitators that will show them how to teach various activities forming part of the Perceptual Motor Intervention Programme.

b. Just as there are coaching clinics that help people learn how to coach sport, there should be clinics/workshops offered to help facilitators learn how to teach physical education to children with Learning Disabilities.

c. Teacher Education programmes at universities should make sure they include the knowledge and skills necessary to teach life skill orientation for children with various disabilities in their professional preparation curriculum.

d. School Principals and others involved in decision-making about the education of children with learning disabilities in South Africa must be made aware of the potential of movement programmes to improve the levels of motor proficiency. They must also be made aware of just how important it is that these children have the opportunity to develop toward their full movement potential.

e. A code of conduct must be stipulated at the beginning of physical education programmes. These rules of behaviour must stay consistent through the programme, as children need routine and structure to develop their full potential.

f. The Sensory programme should be a prerequisite of the Perceptual Motor programme when the assessment results indicated that the child has problems with reflexes and sensory integration.

g. The instructional strategies described in Chapter Three were used in this study with great success. It is therefore recommended that teachers/facilitators use these strategies when conducting physical education programmes.

Table 5.1: **Summary of instructional strategies**

Strategy	Description
Create routine, regularity and repetition	Use of a whistle to gain children's attention was used (This is also used by all class teachers during breaks). Children were collected and handed over at the same place by the researcher for each PE class. A routine of carrying and packing away of equipment was established.
Reward children for "good" behaviour	Gold stars were awarded to children with good behaviour. These where then added to the stars on their star chart in their classrooms
Teach in environment where distractions are kept to a minimum	The children were easily distracted by objects laying around or people passing by. A small area of the school hall or playing field was used
Use activities that emphasize slow movements	The children had the tendency to be competitive in doing activities. The children were reminded that the correct method of doing activities was far more important than speed.

Strategy	Description
Use relaxation exercises guided by imagery or progressive relaxation	Three to five minutes of relaxation instruction/practice was introduced into each lesson (at the end of the lesson)
Use a buddy system to assist the individual in maintaining attention	Children were encouraged to help each other when difficulty was being experienced in doing a motor skill
Avoid comparison with other children	Recognition of the child own good performance was rewarded with small certificate.
Be aware of medication being taken and its effect on the individual	Notice was taken of the children on medication. Some of the medication made the children "drowsy" and impaired the balance.
Where appropriate, use regular strong prompts to gain attention	Brief instructions where given before starting an activity. Children where asked to repeat the instructions. Keywords from the instruction were prompted to regain children's attention.
Encourage responsible behaviour and, when necessary, impose limits with regard to conduct and the use of equipment and facilities	Children where instructed from the first day as too what was excepted of them in terms of behaviour, handling of equipment and interaction with peers.
Do not overdo the desire for control in all situations	Children where encouraged to add their own creativity to the activities.
Discourage inappropriate interaction.	If children "misbehaved", "time-out" was given to the children.
Reduce interference from hyperactive tendencies	Select a larger number of different activities and spend less time on each than one would with other children of the same age.

5.3 FUTURE RESEARCH

The results of this study also lead to recommendations about the focus of future research projects:

- Long term follow up studies need to be conducted to see if the motor proficiency gains that are achieved by a child after the 12 week intervention programme are permanent, or if the child slowly begins to lose those gains as soon as the programme ends.

- The entire issue of assessment of South African children, especially in terms of social and psychological variables, requires serious attention. To continue to use intenationally designed instruments, albeit translated, is not satisfactory and cannot produce dependable results. In addition to the problem of determining culturally-based meanings, there are many problems caused by the existence of differences between the traditional cultures most often in rural areas and the urban influenced cultures.

- A study to compare the outcomes of participation in a Perceptual Motor programme vs a Traditional Physical Education programme would be helpful in distinguishing the difference between these two different approaches to motor development in children with and without learning disabilities..

- Comparative studies on the perceived value of motor skill development programmes between children with and without learning disabilities could shed light on the similarities and differences between the two groups. Such information would help solve questions about when to pursue inclusion and when to purse separate physical education programmes.

- Comparative studies to establish the perceived value of medication in enhancing the motor proficiency of children with learning disabilities.

5.4 CONCLUDING REMARKS

In conclusion, levels of motor proficiency and behaviours of children with learning disabilities may be positively impacted through participating in structured physical education programmes. To enhance motor proficiency levels requires incorporating meaningful activities together with traditional behaviour management approaches. It must be remembered that structured physical education programmes may lead to a decrease in inappropriate behaviours, an increase in level of physical fitness, an improvement in academic work, as well as greater enjoyment of physical activities.

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APPENDIX A

PHYSICAL EDUCATION RESEARCH PROJECT

Dear Parents,

Physical Education has a major role to play in the development of children with learning disabilities. Physical Education should be an integral part of the total education of any child as it is closely allied to other creative and learning experiences.

As the South African Education curriculum and syllabus is in the process of being revised and renewed, it is the duty of professionals to ensure that the content of the curriculum and syllabus adequately reflects the needs of children with special needs.

This year your child, together with his/her classmates, are asked to participate in a physical education research project which has been approved by the Principal and the School Governing Body.

The purpose of this letter is two fold. Firstly, to notify you of the above project and the procedures that will be followed. Secondly, and very importantly, your approval for your child's participation in the project is required and must be indicated by signing the informed consent form attached.

It will be appreciated if you would ensure that this consent form is returned to the school on completion, so as to facilitate the successful completion of this project.

Yours sincerely

GK Scheepers
Project Leader

PHYSICAL EDUCATION RESEARCH PROJECT

GENERAL PROCEDURES

This project entails that the children will:

1. Be evaluated to determine their present level of motor performance before the start of the 12 week physical education programme; and

2. Complete a Self Concept Questionnaire;

3. Participate in a 12 week physical education programme;

4. Be re-evaluated to determine their level of motor performance after the completion of the 12 week physical education programme.

All the above phases of the project will be done in cooperation with:

1. Research Assistants from the Department of Human Movement Science at the University of Zululand.

2. The school's Physical Education teacher and child's class teacher;

3. Mrs GK Scheepers and Prof MF Coetsee of the Department of Human Movement Science at the University of Zululand, who have initiated and will coordinate the project.

CHILD ASSENT FORM

I, ..., understand that my parents (mom and dad) have given permission (said it's okay) for me to take part in a project about

....

....

Done by ....

I am taking part because I want to, and I have been told that I can stop at any time I want to and I won't get into trouble (nothing bad will happen to me if I want to stop).

______________________________ _______________

Signature Date

INFORMED CONSENT FORM

I, ..., having been fully informed of the nature of the research entitled *The effects of differentiated physical education on the motor proficiency of children with learning disabilities*, do hereby give my consent for my child .... to act as a subject in the above-named research.

I agree to any relevant findings being passed on to members of the research team, and to the use of this information in publication for research purposes with the name of the participant remaining confidential.

I realize that it is necessary for my child to promptly report to the researcher any signs or symptoms indicating any abnormality or distress.

I am aware that I may withdraw my consent and that my child can withdraw from participation in the research at any time.

I have read the foregoing and I understand it. Any questions which may have occurred to me have been answered to my satisfaction.

PARENT OR GUARDIAN OF SUBJECT

(Print name)	(Signature)	(Date)

PERSON ADMINISTERING INFORMED CONSENT

(Print name)	(Signature)	(Date)

PROJECT SUPERVISOR

(Print Name)	(Signature)	(Date)

APPENDIX B

Bruininks-Oseretsky Test of Motor Proficiency
Robert H. Bruininks, Ph.D.

INDIVIDUAL RECORD FORM
Complete Battery and Short Form

NAME ______________________ SEX: Boy ☐ Girl ☐ GRADE ______

SCHOOL/AGENCY ______________________ CITY ____________ STATE ________

EXAMINER ______________________ REFERRED BY ______________

PURPOSE OF TESTING ______________________________

Arm Preference: *(circle one)*
RIGHT LEFT MIXED

Leg Preference: *(circle one)*
RIGHT LEFT MIXED

	Year	Month	Day
Date Tested			
Date of Birth			
Chronological Age			

TEST SCORE SUMMARY

Complete Battery:

SUBTEST	POINT SCORE Maximum	POINT SCORE Subject's	STANDARD SCORE Test (Table 23)	STANDARD SCORE Composite (Table 24)	PERCENTILE RANK (Table 25)	STANINE (Table 25)	OTHER
GROSS MOTOR SUBTESTS:							
1. Running Speed and Agility	15						
2. Balance	32						
3. Bilateral Coordination	20						
4. Strength	42						
GROSS MOTOR COMPOSITE			☐ SUM	☐	☐	☐	☐
5. Upper-Limb Coordination	21		☐				
FINE MOTOR SUBTESTS:							
6. Response Speed	17						
7. Visual-Motor Control	24						
8. Upper-Limb Speed and Dexterity	72						
FINE MOTOR COMPOSITE			☐ SUM	☐	☐	☐	☐
BATTERY COMPOSITE			☐* SUM	☐	☐	☐	☐

*To obtain Battery Composite: Add Gross Motor Composite, Subtest 5 Standard Score, and Fine Motor Composite. Check result by adding Standard Scores on Subtests 1-8.

Short Form:

	POINT SCORE Maximum	POINT SCORE Subject's	STANDARD SCORE	PERCENTILE RANK	STANINE
SHORT FORM	[illegible]		☐	☐	☐

DIRECTIONS

Complete Battery:

1. During test administration, record subject's response for each trial.

2. After test administration, convert performance on each item (item raw score) to a point score, using scale provided. For an item with more than one trial, choose best performance. Record item point score in *circle* to right of scale.

3. For each subtest, add item point scores; record total in circle provided at end of each subtest and in Test Score Summary section. Consult *Examiner's Manual* for norms tables.

Short Form:

1. Follow Steps 1 and 2 for Complete Battery, except record each point score in *box* to right of scale.

2. Add point scores for all 14 Short Form items and record total in Test Score Summary section. Consult *Examiner's Manual* for norms tables.

SUBTEST 1: Running Speed and Agility

1. Running Speed and AgilitySF *

TRIAL 1: ______seconds TRIAL 2: ______seconds

Raw Score	Above 11.0	10.9-11.0	10.5-10.8	9.9-10.4	9.5-9.8	8.9-9.4	8.5-8.8	7.9-8.4	7.5-7.8	6.9-7.4	6.7-6.8	6.3-6.6	6.1-6.2	5.7-6.0	5.5-5.6	Below 5.5
Point Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

RECORD POINT SCORES FOR COMPLETE BATTERY

RECORD POINT SCORES FOR SHORT FORM

POINT SCORE SUBTEST 1 (Max: 15)

SUBTEST 2: Balance

1. Standing on Preferred Leg on Floor *(10 seconds maximum per trial)*

TRIAL 1: ______seconds TRIAL 2: ______seconds

Raw Score	0	1-3	4-5	6-8	9-10
Point Score	0	1	2	3	4

2. Standing on Preferred Leg on Balance BeamSF *(10 seconds maximum per trial)*

TRIAL 1: ______seconds TRIAL 2: ______seconds

Raw Score	0	1-2	3-4	5-6	7-8	9	10
Point Score	0	1	2	3	4	5	6

3. Standing on Preferred Leg on Balance Beam—Eyes Closed *(10 seconds maximum per trial)*

TRIAL 1: ______seconds TRIAL 2: ______seconds

Raw Score	0	1-3	4-5	6	7	8	9	10
Point Score	0	1	2	3	4	5	6	7

4. Walking Forward on Walking Line *(6 steps maximum per trial)*

TRIAL 1: ______steps TRIAL 2: ______steps

Raw Score	0	1-3	4-5	6
Point Score	0	1	2	3

5. Walking Forward on Balance Beam *(6 steps maximum per trial)*

TRIAL 1: ______steps TRIAL 2: ______steps

Raw Score	0	1-3	4	5	6
Point Score	0	1	2	3	4

6. Walking Forward Heel-to-Toe on Walking Line *(6 steps maximum per trial)*

TRIAL 1: ☐☐☐☐☐☐ = ______steps TRIAL 2: ☐☐☐☐☐☐ = ______steps

Raw Score	0	1-3	4-5	6
Point Score	0	1	2	3

7. Walking Forward Heel-to-Toe on Balance BeamSF *(6 steps maximum per trial)*

TRIAL 1: ☐☐☐☐☐☐ = ______steps TRIAL 2: ☐☐☐☐☐☐ = ______steps

Raw Score	0	1-3	4	5	6
Point Score	0	1	2	3	4

8. Stepping Over Response Speed Stick on Balance Beam

TRIAL 1: *Fail Pass* TRIAL 2: *Fail Pass*

Raw Score	Fail	Pass
Point Score	0	1

POINT SCORE SUBTEST 2 (Max: 22)

SUBTEST 3: Bilateral Coordination

1. Tapping Feet Alternately While Making Circles with Fingers[SF] *(90 seconds maximum)*

* Raw Score	Fail	Pass
Point Score	0	1

2. Tapping—Foot and Finger on Same Side Synchronized *(90 seconds maximum)*

* Raw Score	Fail	Pass
Point Score	0	1

3. Tapping—Foot and Finger on Opposite Side Synchronized *(90 seconds maximum)*

* Raw Score	Fail	Pass
Point Score	0	1

4. Jumping in Place—Leg and Arm on Same Side Synchronized *(90 seconds maximum)*

* Raw Score	Fail	Pass
Point Score	0	1

5. Jumping in Place—Leg and Arm on Opposite Side Synchronized *(90 seconds maximum)*

* Raw Score	Fail	Pass
Point Score	0	1

6. Jumping Up and Clapping Hands[SF]

TRIAL 1: ________ claps TRIAL 2: ________ claps

Raw Score	0	1	2	3	4	Above 4
Point Score	0	1	2	3	4	5

7. Jumping Up and Touching Heels with Hands

TRIAL 1: Fail Pass TRIAL 2: Fail Pass

Raw Score	Fail	Pass
Point Score	0	1

8. Drawing Lines and Crosses Simultaneously *(15 seconds)*

NUMBER OF PAIRS CORRECT: ________

Raw Score	0	1	2-3	4-5	6-7	8-9	10-11	12-14	15-17	Above 17
Point Score	0	1	2	3	4	5	6	7	8	9

POINT SCORE SUBTEST 3 (Max. 20)

SUBTEST 4: Strength

1. Standing Broad Jump[SF] *(record number from tape measure)*

TRIAL 1: ________ TRIAL 2: ________ TRIAL 3: ________

Raw Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Point Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

2. Sit-ups *(20 seconds)*

NUMBER: ________

Raw Score	0	1-2	3-4	5-6	7-8	9-10	11-12	13-15	16-18	19-20	Above 20
Point Score	0	1	2	3	4	5	6	7	8	9	10

3a. Knee Push-ups (For Boys Under Age 8 and All Girls) *(20 seconds)*

NUMBER: ________

Raw Score	0	1-2	3-5	6-7	8-9	–	–	10-12	–	–	13-15	–	16-18	–	–	19-20	Above 20
Point Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

3b. Full Push-ups (For Boys Age 8 and Older) *(20 seconds)*

NUMBER: ________

Raw Score	0	–	–	–	–	1-5	6-9	–	10-11	12-13	–	14-15	–	16-17	18-20	–	Above 20
Point Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

RECORD POINT SCORES FOR COMPLETE BATTERY

RECORD POINT SCORES FOR SHORT FORM

POINT SCORE SUBTEST 4 (Max. 42)

POINT SCORES FOR COMPLETE BATTERY

POINT SCORES FOR SHORT FORM

1. Bouncing a Ball and Catching It with Both Hands *(5 trials)*

NUMBER OF CATCHES: ______

Raw Score	0	1-2	3-4	5
Point Score	0	1	2	3

2. Bouncing a Ball and Catching It with Preferred Hand *(5 trials)*

NUMBER OF CATCHES: ______

Raw Score	0	1-2	3-4	5
Point Score	0	1	2	3

3. Catching a Tossed Ball with Both HandsSF *(5 trials)*

NUMBER OF CATCHES: ______

Raw Score	0	1-2	3-4	5
Point Score	0	1	2	3

4. Catching a Tossed Ball with Preferred Hand *(5 trials)*

NUMBER OF CATCHES: ______

Raw Score	0	1-2	3-4	5
Point Score	0	1	2	3

5. Throwing a Ball at a Target with Preferred HandSF *(5 trials)*

☐☐☐☐☐ = HITS

Raw Score	0	1-2	3-4	5
Point Score	0	1	2	3

6. Touching a Swinging Ball with Preferred Hand *(5 trials)*

NUMBER OF HITS: ______

Raw Score	0	1-2	3-4	5
Point Score	0	1	2	3

7. Touching Nose with Index Fingers—Eyes Closed *(90 seconds maximum)*

* Raw Score	Fail	Pass
Point Score	0	1

8. Touching Thumb to Fingertips—Eyes Closed *(90 seconds maximum)*

* Raw Score	Fail	Pass
Point Score	0	1

9. Pivoting Thumb and Index Finger *(90 seconds maximum)*

* Raw Score	Fail	Pass
Point Score	0	1

POINT SCORE SUBTEST 5 (Max: 21)

SUBTEST 6: Response Speed

1. Response SpeedSF

TRIAL	SECONDS TO WAIT	SCORE[1]	RANKED TRIAL SCORES[2]
Practice 1	1	XXXX	
Practice 2	3	XXXX	
1	2	____	HIGHEST ☐
2	3	____	☐
3	1	____	☐
4	3	____	MEDIAN ☐ →
5	2	____	☐
6	1	____	☐
7	1	____	LOWEST ☐

[1]Record number from response speed stick in this column.

[2]Rank all seven trial scores, highest to lowest, in boxes provided. The point score for Subtest 6 is the median (middle), or fourth, score from the top.

POINT SCORE SUBTEST 6 (Max: 17)

SUBTEST 7: Visual-Motor Control

1. Cutting Out a Circle with Preferred Hand

NUMBER OF ERRORS: ______

Raw Score	Above 10	10	8-9	3-7	0-2
Point Score	0	1	2	3	4

2. Drawing a Line Through a Crooked Path with Preferred Hand

NUMBER OF ERRORS: ______

Raw Score	Above 6	6	2-5	1	0
Point Score	0	1	2	3	4

3. Drawing a Line Through a Straight Path with Preferred Hand[SF]

NUMBER OF ERRORS: ______

Raw Score	Above 6	6	2-5	1	0
Point Score	0	1	2	3	4

4. Drawing a Line Through a Curved Path with Preferred Hand

NUMBER OF ERRORS: ______

Raw Score	Above 6	6	2-5	1	0
Point Score	0	1	2	3	4

5. Copying a Circle with Preferred Hand[SF]

SCORE: ______

* Raw Score	0	1	2
Point Score	0	1	2

6. Copying a Triangle with Preferred Hand

SCORE: ______

* Raw Score	0	1	2
Point Score	0	1	2

7. Copying a Horizontal Diamond with Preferred Hand

SCORE: ______

* Raw Score	0	1	2
Point Score	0	1	2

8. Copying Overlapping Pencils with Preferred Hand[SF]

SCORE: ______

* Raw Score	0	1	2
Point Score	0	1	2

SUBTEST 8: Upper-Limb Speed and Dexterity

1. Placing Pennies in a Box with Preferred Hand *(15 seconds)*

NUMBER OF PENNIES: ______

Raw Score	0-5	6-10	11-13	14-15	16-17	18-19	20-21	22-23	24
Point Score	0	1	2	3	4	5	6	7	8

2. Placing Pennies in Two Boxes with Both Hands *(50 seconds maximum for seven correct pairs)*

PAIRS CORRECT: ☐☐☐☐☐☐☐☐☐☐☐ TIME IN SECONDS: ______

Raw Score	Above 49	41-49	31-40	26-30	21-25	18-20	16-17	14-15	12-13	10-11	Below 10
Point Score	0	1	2	3	4	5	6	7	8	9	10

3. Sorting Shape Cards with Preferred Hand[SF] *(15 seconds)*

NUMBER OF CARDS: ______

Raw Score	0	1-8	9-12	13-16	17-20	21-25	26-29	30-33	34-37	38-41	Above 41
Point Score	0	1	2	3	4	5	6	7	8	9	10

4. Stringing Beads with Preferred Hand *(15 seconds)*

NUMBER OF BEADS: ______

Raw Score	0-1	2-4	5	6	7	8	9	Above 9
Point Score	0	1	2	3	4	5	6	7

5. Displacing Pegs with Preferred Hand *(15 seconds)*

NUMBER OF PEGS: ______

Raw Score	0	1-5	6-7	8-9	10-11	12-13	14-15	16-18	19-20
Point Score	0	1	2	3	4	5	6	7	8

6. Drawing Vertical Lines with Preferred Hand *(15 seconds)*

NUMBER OF LINES: ______

Raw Score	0	1-3	4-6	7-9	10-12	13-16	17-20	21-24	25-35	Above 35
Point Score	0	1	2	3	4	5	6	7	8	9

7. Making Dots in Circles with Preferred Hand[SF] *(15 seconds)*

NUMBER OF CIRCLES WITH DOTS: ______

Raw Score	0	1-10	11-15	16-20	21-25	26-30	31-35	36-40	41-50	51-60	Above 60
Point Score	0	1	2	3	4	5	6	7	8	9	10

8. Making Dots with Preferred Hand *(15 seconds)*

NUMBER OF DOTS: ______

Raw Score	Below 10	10-25	26-35	36-45	46-55	56-65	66-75	76-85	86-95	96-105	Above 105
Point Score	0	1	2	3	4	5	6	7	8	9	10

RECORD POINT SCORES FOR COMPLETE SUBTEST

RECORD POINT SCORES FOR SHORT FORM

POINT SCORE SUBTEST 8 (Max: 72)

NOTES/OBSERVATIONS

______

______

______

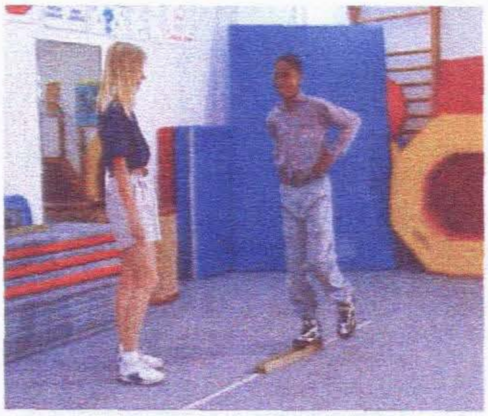

Fig 1: Standing on Preferred leg on balance beam (Subtest 2)

Fig 2: Tapping foot and finger on Opposite side synchronized

Fig 3: Walking forward heel-to-toe on Balance Beam

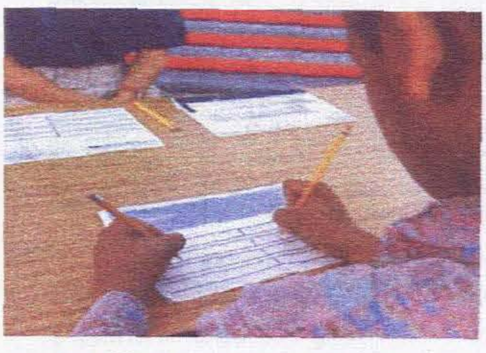

Fig 8: Drawing lines and Crosses simultaneously

Fig 4:Jumping in Place-Leg and arm of opposite side synchronized

Fig 5: Jumping up and Clapping Hands

Fig 6: Sit-ups

Fig 7: Full push-ups

Figure B.1: Photo's taken during the Bruininks Oseretsky test of Motor Proficiency

-APPENDIX C

CRATTY SELF-CONCEPT SCALE

Name ________________ Date _________ Grade _________ M____ F____

Scoring	Question	Yes?	No?
>	1. Are you good at making things with your hands?	yes	no
>	2. Can you draw well?	yes	no
>	3. Are you strong?	yes	no
>	4. Do like the way you look?	yes	no
	5. Do your friends make fun of you?	yes	no
>	6. Are you handsome/pretty?	yes	no
	7. Do you have trouble making friends?	yes	no
>	8. Do you like school?	yes	no
	9. Do you wish you were different	yes	no
	10. Are you sad most of the time?	yes	no
	11. Are you the last to be chosen in games?	yes	no
>	12. Do girls like you?	yes	no
>	13. Are you a good leader in games and sports?	yes	no
	14. Are you clumsy?	yes	no
	15. In games, do you watch instead of play?	yes	no
>	16. Do boys like you?	yes	no
>	17. Are you happy most of the time?	yes	no
>	18. Do you have nice hair?	yes	no
	19. Do you play with younger children a lot?	yes	no
>	20. Is reading easy for you?	yes	no

Scoring: Do not print the scoring key on any questionnaires given to the children. Score 1 point for each response expected. Deduct 1 point for each positive expected answer which was circled **NO** and each negative expected answer which was circled **YES**. The score is the number of expected responses given for the 20 items.

Objective: To estimate how children feel about their physical appearance and their ability to perform physical skills, and to identify children with low self-concept so that they can be helped.

Gender and Age:

Boys and girls ages 5 to 12

Reliability: Test reliability of .82 for 288 children.

Validity: Content validity with all items. Construct validity by method of known groups with every item discriminating between students with high and low scores on the total test.

Test description:

A test of 20 brief questions to which the student responds with a "yes" or a "no".

Test directions:

"You have a questionnaire that will determine how you feel about yourself. Each question will be read and you should then immediately decide how you feel and circle yes or no to the answer. The first question is ____________. Now, circle "Yes" or "No". (The questions is repeated and the instruction to circle yes or no given again). The second question is ____________ is. (Continue through the 20 items.)

APPENDIX D

CONNER'S TEACHER QUESTIONNAIRE

CHILD'S NAME________________ OBSERVED ON :____________

BY:___________

Listed below are descriptive terms of behaviour. Place a check mark on the column which best describes this child. Answer all items.

OBSERVATION		Degree of Activity			
		Not at all	Just a little	Pretty much	Very much
CLASSROOM BEHAVIOUR					
1	Constantly fidgeting				
2	Hums and makes other odd noises				
3	Demands must be met immediately - easily frustrated				
4	Co-ordination poor				
5	Restless or overactive				
6	Excitable, impulsive				
7	Inattentive, easily distracted				
8	Fails to finish things s/he starts - short attention span				
9	Overly sensitive				
10	Overly serious or sad				
11	Daydreams				
12	Sullen or sulky				
13	Cries often and easily				
14	Disturbs other children				
15	Quarrelsome				
16	Mood changes quickly and drastically				
17	Acts "smart'				
18	Destructive				

19	Steals				
20	Lies				
21	Temper outbursts, explosive and unpredictable behaviour				
GROUP PARTICIPATION					
22	Isolates him/herself from other children				
23	Appears to be unaccepted by group				
24	Appears to be easily led				
25	No sense of fair play				
26	Appears to lack leadership				
27	Does not get along with opposite sex				
28	Does not get along with same sex				
29	Teases other children or interferes with their activities				
ATTITUDES TOWARD AUTHORITY					
30	Submissive				
31	Defiant				
32	Impudent				
33	Shy				
34	Fearful				
35	Excessive demands for teacher's attention				
36	Stubborn				
37	Overly anxious to please				
38	Unco-operative				
39	Attendance problem				

APPENDIX E

PERCENTILE TABLE TO DETERMINE BODY FAT/LEANNESS: SUM OF THE TRICEPS AND SUBSCAPULAR SKINFOLDS

	AGE		AGE	
PERCENTILE	M 9-10	F 9-10	M 11-12	F 11-12
95	10	7	11	10
90	12	8	11	11
85	12	9	13	11
80	13	9	14	13
75	14	10	15	15
70	15	11	16	17
65	15	12	17	18
60	16	14	18	19
55	17	15	19	21
50	18	17	20	22
45	19	18	21	24
40	20	19	22	26
35	21	20	24	28
30	22	22	25	29
25	23	24	28	30
20	25	25	30	33
15	27	30	33	35
10	33	33	38	40
5	38	41	45	45

(Winnick & Short, 1985)

APPENDIX F

ZULULAND REMEDIAL CENTRE. P.T. TIME TABLE Year 2000.

* Attention: Glynis Scheepers

	7h45 1	8h15 2	8h45 3	9h15 4	10h00 5	10h30 6	11h00 7	11h30 8	12h30 9	13h00 10
M										
T/D							PT gr 4	Eng (11)	PT gr 3	Eng (26)
W										
T/D							PT gr 4	Eng (13)	PT gr 5	Eng (26)
F			PT gr 1	Eng 12	PT gr 2 gr R	Eng (21)	PT gr 1,2,3	Afr (26)	PT gr 4/5	Afr (26)

APPENDIX G

LESSON PLANS

MISSION STATEMENT AND GOALS

The mission statement of this research study programme is to provide a balanced quality programme which integrates physical skills, social development and fitness opportunities that encourage active healthy lifestyles.

The goal is to teach children the importance of fitness and involve them in regular, vigorous activity.

The purpose is for learners to learn to appreciate movement as an active and joyful experience.

OBE SPECIFIC OUTCOMES

Life Orientation (LO) Specific Outcomes(SO)

LO-SO#1 : Understand and accept themselves as unique and worthwhile human beings

LO-SO#2: Use skills and display attitudes and values that improve relationships in family, group and community

LO-SO#3: Respect the rights of people to hold personal beliefs and values

LO-SO#4: Demonstrate value and respect for human rights as reflected in *ubuntu* and other similar philosophies

LO-SO#5: Practice acquired life and decision making skills

LO-S0#6: Access career and other opportunities and set goals that will enable them to make the best use of their potential and talents

LO-SO#7: Demonstrate the values and altitudes necessary for a healthy and balanced lifestyle.

LO-SO#8: Evaluate and participate in activities that demonstrate effective human movement and development.

LO-SO#9: Use a range of skills and techniques in the human and social sciences context

INTERVENTION PROGRAMME OUTCOMES

- **Develop** knowledge, skills and values that will help learners achieve specific outcomes of the OBE system.
- **Develop** self-confidence and positive self-esteem through successful physical activities.
- **Perform** a range of skills which enhance an active healthy lifestyle.
- **Demonstrate** cooperation, fair play and safety.
- **Develop** and use simple problem-solving strategies.
- **Practice** decision making skills.

AREAS OF EMPHASIS

Understand that movement is related to fun

Develop healthy attitudes about exercise

Interact positively with all classmates

Demonstrate safety while participating in physical activity

Recognize that physical activity is good for personal well-being

Willing try new activities

Have opportunities to participate in personal enrichment activities

Accept and appreciate personal differences

Use simple problem-solving strategies

Physical Education intervention programmes

It is recognized that children are at different developmental levels with a variety of needs and interests. For this reason, an attempt has been made to provide all the children with learning experiences that are both beneficial and enjoyable.

The intervention programmes will place emphasis on the following types of activities

SENSORY MOTOR PROGRAMME	PERCEPTUAL MOTOR PROGRAMME
Vestibular Activities	**Ocular-Motor Activities**
Auditory Activities	**Body Awareness Activities**
Visual Activities	**Cross-Lateral Activities**
Kinesthetic Activities	**Balance Activities**
Reflex Activities	**Spatial Relations Activities**
Tactile Activities	**Laterality Activities**

Perceptual Motor Lesson Plans

Week 1: Lesson One

Station 1: Low walking boards

Performance objectives

By walking over an obstacle on the low board and walking forward with eyes focussed on teacher's hand , the learner demonstrates visual-motor control, dynamic balance and laterality.

Equipment

Low walking board and cross bar with mats.

Station 2: Mat Stunts

Performance objectives

By alligator crawling and creeping, learners demonstrate locomotor coordination, cross-laterality, and kinesthetic awareness.

Equipment

Mats

Challenges

1. Crawl on stomach using bent arms and legs to manoeuver body. This is called an alligator crawl.

2. Creep forward on hands and knees.

Stress: Cross-pattern movements, using opposite arm and leg in coordination. Speed is not important. Learners move down mats in one direction only!

Station 3: Bean Bag toss into tires

Performance objectives

By tossing a bean bag into tires with alternate hands, the learner demonstrates hand-eye coordination, laterality, and directionality.

Equipment

Bean bags and 6 bike tires or hoops.

Challenges:

1. From behind a restraining line, the learner is given 3 underhand tosses on each turn and attempts to get one bean bag into each tire. (The learner must get one bean bag into the first tire before trying for the 2^{nd} tire.

2. Learners successful with preferred hand may try opposite hand, or distance may be increased.

Stress: stepping forward with opposite foot from throwing hand to transfer weight into toss (cross-lateral movement), and following through toward target with tossing hand.

STATION 4 Jump Box

Performance Objectives

By jumping from jump box, onto mat or into tire target, the learner demonstrates dynamic balance, locomotor control, and space awareness.

Equipment

Jump box with incline board , tires/hoops and mats.

Challenges

1. *Walk up incline board onto jump box, take correct jumping position,* release with both feet at once and land on mat.

2. Run up incline board and jump from box onto mat.

3. Same ain 1 and 2 only add tire or hoop which the learner must land inside with good balance and control.

Stress:
Controlled landing (catch weight and freeze) with knees bent, Student lands "softly ' on front part of feet to cushion body. Arms are lowered to 'Break" movement as feet contact mat.

Lesson Two:

Station 1: Low walking boards

Performance Objectives

By balancing bean bag on head on low bard and stepping into and over obstacles on walking board, the learner will demonstrate dynamic balance, laterality, and visual-motor coordination.

Equipment

Low walking board , bean bags , cross bar 2 tires and mats.

Challenges

1. Forward to centre of board, pick up bean bag, place on head, walk to the end of the board.

2. Walk forward, step into tires, and over cross bar.

Stress: The learner should bend knees and lower body down to pick up bean bag, not stooping from waist. Eyes focus on bean bag, not down at feet. The eyes shift from one visual target to another, but do not watch feet Movements are performed slowly.

Station 2: Obstacle course

Performance Objectives

By going over, under, and through obstacles, the learner demonstrates body and space awareness,

Equipment

Mats, 2 cross bars, and car tire with holder

Challenges

1. Jump over cross bar from a stationary position. (Adjust height of bar to ability level of participants.

2. Crawl under low cross bar. (Student in prone position.)

3. Crawl through tire supported in tire holder.

4. After the learner has experienced success with the above challenges (2 or 3 repetitions), challenge the learner to find a different way of moving through the obstacles.

Stress: Learners attempts to go over, under, and through without touching any of the obstacles with his body.

Station 3: Coordination Ladder

Performance Objectives

By moving across the coordination ladder, the learner demonstrates foot-eye coordination, dynamic balance, and space awareness.

Equipment

Coordination ladder and mats.

Challenges

1. Balance walk forward on rungs of ladder

2. Run between the rungs of the ladder

3. Challenge the learner to create own pattern of movement.

Stress:

Eyes must guide movement. One student moves at a time on the ladder. Allow repetition of tasks. The learner moves only as fast as complete body control can be maintained.

Station 4 Ball bouncing with tires

Performance objectives

By bouncing and catching the ball while jumping and hopping across the tire pattern, the learner demonstrates hand-eye coordination, space awareness, and locomotor coordination.

Equipment

Ball and 5 hopes

Challenges

1. The learner bounces and catches ball once in each of 5 hoops followed by a jump into each of the hoops.

2. The learner hops through hoops on one foot and bounces ball into each hoop.(Bouncing of ball into hoop precedes the hop).

3. After the learner is successful on a few trails with challenges 1 and 2, challenge the learner to find a different way of moving through the hoops with the ball.

Stress: The learner bounces ball into the hoop followed by a jump into the same hoop. Both feet leave ground at the same time on each jump. Eyes focus on ball with hands and fingers forming a pocket to properly catch ball.

Week two : Lesson One

Station 1: Walking boards

Performance Objectives

By kneeling on one knee on the walking board and stepping over the coiled rope wrapped around the board, the learner demonstrates dynamic balance, laterality and visual-motor coordination.

Equipment

Walking board, rope and mats.

Challenges

1. Walk forward to middle of board, kneel on one knee, rise and walk to end.

2. Walk forward using "snake" rope as visual target. (The learner, attempts to step into spaces provided by rope which is coiled around the board.)

Stress: The learner kneels on each side of body (alternates knees). The learner places feet in spaces provided by rope and is careful not to step on the sleeping "snake" rope.

Station 2: Jumping with ropes and hoops

Performance Objectives

By jumping forward, sideways, and twisting body in mid-air for alignment in the tire patter, the learner demonstrates locomotor coordination, balance, space awareness, directionality, and motor planning ability.

Equipment

Six hoops and five ropes

Challenges

1. First have the learner jump forward and sideways through the pattern as indicated by the placement of numbers. (Sideways jump from 1 to 2, 3 to 4, and 5 to 6).

2. Next have the learner jump through the pattern in the same direction as before, but body position must be changed (twist body) during each jump so that landing is made facing in the direction of the next jump as shown by the arrows.

Stress: Bending of knees on take off and landing of each jump. Both feet leave floor.

Station 3: Coordination Ladder

Performance Objectives

By moving along a coordination ladder, the learner demonstrates locomotor skill and coordination, balance and space awareness.

Equipment

Coordination ladder and mats

Challenges

1. Jump between rungs of ladder placed on mats or rug.

2. Jump into every other space between the rungs.

3. Four legged walk between or on rungs of ladder.

4. Balance walk forward on side rails of ladder (One foot on each side).

Stress: Both feet leave ground at same time on jump. The learner carefully guides feet so that they do not trip on rungs of ladder.

Station 4: Ball dribbling with obstacles

Performance Objectives

By dribbling a ball around a cone pattern, the learner demonstrates hand-eye coordination, visual memory ability, and directionality.

Equipment

Three traffic cones and a ball.

Challenges

1. Dribble ball (using one hand) around obstacles in pattern as shown. If unable to control ball with one-hand dribble, the learner may try dribbling with both hands.

Stress: The learner attempts to follow the directed pattern. Finger tips control the ball by using a push and not a slap.

Lesson two

Station 1: Walking board

Performance Objectives

By walking backwards on a board while stepping over bean bags and turning, and by walking sideways, the learner demonstrates dynamic balance, and laterality.

Equipment

Walking boards, 2 bean bags, and mats.

Challenges

1. Walk backwards, step over first bean bag, make a complete turn at the centre of the board, continue to walk backwards and step over the 2nd bean

bag.

2. Walk sideways leading with the right foot to end of the board, and then return back to starting position leading with the left foot.

Stress: The learner "feels" for the board and bean bag with toes, and does not turn to look where going when moving backwards. Feet do not cross when moving sideways.

Station 2: Rebounder

Performance objectives

By jogging on a mini trampoline, the learner demonstrates locomotor control and laterality

Equipment

Mini trampoline and mats

Challenges

1. Knee slap jogging. The learner stands over the centre of the mini tramp with hands extended out in from of the body. The learner jogs (light running) with high knee action which results in slapping action against extended hands.

2. Cross lateral jogging. The learner jogs over the centre area if the tramp using cross lateral limb movements. That is, raising left arm with right leg and raising right arm with left leg.

Stress; Feet are placed approximately shoulder distance apart too begin all jogging challenges. Eyes focus on teacher, not down at the feet. Cross lateral jogging- Arms move in opposition to the leg movement. For safety: It is advisable to use "spotters" around the tramp. If mats are available, place on sides of tramp for added safety.

Station 3: Scooter board with obstacle

Performance Objectives

By moving a scooter board around an obstacle, the learner demonstrates bilateral coordination, balance, and kinesthetic awareness.

Equipment

Scooter board, traffic cone

Challenges

1. The learner takes prone position on a scooter board, and uses hands and arms to propel the scooter board around the traffic cone and back to starting position.

2. The learner takes a kneeling position on the scooter board and attempt the same challenge again.

Stress: Body is balanced on scooter board- feet do not touch the floor, and hands and arms work in rhythmic coordination

Station 4: Jump Box

Performance Objectives

By *jumping from a jump box into a hoop, and moving through the hoops and cross* bar pattern, the learner demonstrates locomotor skill, dynamic balance, foot-eye coordination, and space awareness.

Equipment

Jump box with incline board, 4 hoops (one of them red), cross bar and mats.

Challenges

1. Jump from the box, land in the red hoop, and then continue jumping into the hoops, over the cross bar, etc (use mats).

2. Jump from the box, land in the red hoops, and then hop through the pattern.

3. Jump sideways from box and land in tire, and then jump through the pattern moving sideways.

4. Hop from box, land on one foot in the red hoop and continue hopping through the pattern.

Stress: Controlled "Soft" landing in the red hoops. Use of arms to help left the body. *Modify height of cross bar on hopping challenge for successful* performance.

Week Three: Lesson One

Station 1: Walking board

Performance Objectives

By walking over a cross bar through the hoop on a board, and by walking forward and sideways, the learner demonstrates dynamic balance, directionality, laterality, and visual-motor coordination.

Equipment

Walking boards, cross bar, hoop and mats.

Challenges

1. Walk forward, step over the cross bar, make a full turn at the centre of the board, go through the hoop and walk to the end of the board. (Hoop must be held up by an aide),

2. Walk forward 1/3 of the way, walk sideways 1/3 of the way, and then walk backward to the end of the board.

Stress: Make turn slowly at the centre of the board, and then attempt to move through hoop without touching it.

Station 2: Jump Box

Performance Objectives

By jumping from the jump box and performing a mid-air quarter turn to land in the hoops, the learner demonstrates dynamic balance, body awareness, and space awareness.

Equipment

Jump box with incline board, for hoops, and mats.

Challenges

1. Walk up incline board onto the jump box, take a good jumping position, jump and perform quarter turn while airborne, and land facing in challenged direction either quarter turn left or quarter right.

2. Learner able to perform task in challenge 1 with good control, may be permitted to run up incline board and perform same task.

3. Place four hoops on mat and challenge learners to perform quarter turn to left or right with feet landing in correct hoops.

Stress: The learner jumps out away from the box and does not twist (turn0 body until after forward jump is made. For safety: Make sure mats are used to land on.

Station 3: Launch board

Performance Objectives

By catching, and launching bean bags with the use of a launching board, the learner demonstrates hand-eye coordination and foot-eye coordination.

Equipment

Launching board and set of bean bags.

Challenges

1. Step on board with preferred foot, launch, eye track, and catch the bean bag.

Stress; The learner should be given 5 to 10 trials on the launcher. The learner attempts to catch the bean bag 5 to 10 times in succession. The learner would successfully catches with 2 hands should be challenged to catch with one hand.

Station 4: Jumping and Hopping with Obstacles

Performance Objectives

By jumping through a hoop and cross bar pattern, and by hopping through a rope and hoop pattern, the learner demonstrates locomotor control, balance, space awareness, and eye-foot coordination.

Equipment

Two cross bas, 4 jump ropes and 7 hoops (2 red)

Challenges

1. Pattern 1: The learner jumps into a hoop, over first cross bar, stops in the red hoop, jumps into a hoop and over the 2nd cross bar and then stops in the second hoop.

2. Pattern 2: The learner hops over the rope and lands in first hoop and then continues hooping through the pattern. (Over, into, over, into, over).

Stress: Two patterns should be in operation at the same time. Pattern 1: Stopping in red hoop with complete body control. Bending knees and landing softly on front part of the feet. Use arms to help lift body on jump. Pattern 2: The learner takes off and lands on same foot. Arms are used to help maintain balance and left body.

Lesson Two

Station 1: Walking boards

Performance Objectives

By dribbling a ball in hoops along a board, and balancing hoops on each wrist , the learner demonstrates dynamic balance, hand-eye coordination, and laterality.

Equipment

Walking board, rubber ball, 4 hoops and mats.

Challenges

1. Walk forward, carrying a rubber ball, dribble ball 5 times in hoop places on left side of the board, then dribble the ball 5 times in the hoop placed on the right side of the board.

2. Walk forward to centre of the board while balancing a hoop on each wrist, make a ½ turn at the centre of the board, and walk back ward to the end of the board.

Stress; When dribbling the ball, the left hand is used on the left side of the board and the right hand is used on the right side of the board. Finger tips push the ball down on the dribble , no slapping.

Station 2: Jump box obstacle course

Performance Objectives

By moving up a coordination ladder, jumping from a jump box, and moving through a hoop and cross bar pattern, the learner demonstrates locomotor coordination, dynamic balance, body and space awareness, directionality, and motor planning ability.

Equipment

Coordination ladder, jump box, red hoop, 2 cross bars and mats.

Challenges

1. The learner dog walks (on hands and feet0 up inclined ladder to top of jump box.

2. The learner jumps from the box into the red hoop target which is placed close to the cross bar on mats.

3. The learner hops over the low cross bar with touching it.

4. The learner crawls under the low cross bar with out touching it.

Stress: Landing on "soft" part of the feet. With low bending of knees for good body control and balance.

Station 3: Rebounder

Performance Objectives

By bouncing on a tramp and catching a thrown ball, the learner demonstrates dynamic balance, body awareness, and hand-eye coordination.

Equipment

Mini trampoline, ball and mats

Challenges

1. The learner performs coordinated sequence of hopping and jumping by rebounding twice on: right foot, left foot, and both feet. Repeat in a series.

2. The learner rebounds and catches a ball thrown underhand by teacher. Learner tosses ball back to teacher while maintaining rhythmic rebounding. The learner rebounds while catching and tossing a ball 3-5 times

Stress: Eyes watch ball into hands on catch. Hands must prepare to receive ball. The learner must stay over Rebounder centre. The learner makes a catch whilst in the air. Proper timing on ball toss by teacher is important for successful performance.

Station 4: Hoop and Rope Maze

Performance Objectives

By moving through hoop and rope pattern in various ways, the learner demonstrates locomotor coordination, balance, space awareness, directionality, and motor planning ability.

Equipment

Two long ropes, 4 short jump ropes and 5 hoops

Challenges

1. Challenge the learner to jump through the maze using a jump, straddle jump, jump, straddle sump etc. First jump is into hoop 1, followed by a straddle jump with feet landing outside of parallel side ropes. Next jump is into hoop 2 followed by a straddle jump etc.

2. Challenge the learner to jump through the hoops by moving sideways with right side leading, then through again with left side leading.

3. Challenge the learner to hop through the maze on one foot moving forward and through again moving sideways.

4. Challenge the learner to find a different way of moving through the maze.

Stress: Controlled movements, not speed! The learner attempts not to touch hoops or ropes while moving through the maze.

Week Four: Lesson One

Station 1: Low walking boards

Performance objectives

By walking over an obstacle on the low board and walking forward with eyes focussed on teacher's hand , the learner demonstrates visual-motor control, dynamic balance and laterality.

Equipment

Low walking board and cross bar with mats.

Station 2: Mat Stunts

Performance objectives

By alligator crawling and creeping, learners demonstrate locomotor coordination, cross-laterality, and kinesthetic awareness.

Equipment

Mats

Challenges

1. Crawl on stomach using bent arms and legs to manoeuver body. This is called an alligator crawl.

2. Creep forward on hands and knees.

Stress: Cross-pattern movements, using opposite arm and leg in coordination. Speed is not important. Learners move down mats in one direction only!

Station 3: Bean Bag toss into tires

Performance objectives

By tossing a bean bag into tires with alternate hands, the learner demonstrates hand-eye coordination, laterality, and directionality.

Equipment

Bean bags and 6 bike tires or hoops.

Challenges:

1. *From behind a restraining line, the learner is given 3 underhand tosses on* each turn and attempts to get one bean bag into each tire. (The learner must get one bean bag into the first tire before trying for the 2^{nd} tire.

2. Learners successful with preferred hand may try opposite hand, or distance may be increased.

Stress: stepping forward with opposite foot from throwing hand to transfer weight into toss (cross-lateral movement), and following through toward target with tossing hand.

STATION 4 Jump Box

Performance Objectives

By jumping from jump box, onto mat or into tire target, the learner demonstrates dynamic balance, locomotor control, and space awareness.

Equipment

Jump box with incline board , tires/hoops and mats.

Challenges

1. Walk up incline board onto jump box, take correct jumping position, release with both feet at once and land on mat.

2. Run up incline board and jump from box onto mat.

3. Same ain 1 and 2 only add tire or hoop which the learner must land inside with good balance and control.

Stress:
Controlled landing (catch weight and freeze) with knees bent, Student lands "softly ' on front part of feet to cushion body. Arms are lowered to 'Break" movement as feet contact mat.

Lesson Two

Station 1: Low walking boards

Performance Objectives

By balancing bean bag on head on low bard and stepping into and over obstacles on walking board, the learner will demonstrate dynamic balance, laterality, and visual-motor coordination.

Equipment

Low walking board , bean bags , cross bar 2 tires and mats.

Challenges

1. Forward to centre of board, pick up bean bag, place on head, walk to the end of the board.

2. *Walk forward, step into tires, and over cross bar.*

Stress: The learner should bend knees and lower body down to pick up bean bag, not stooping from waist. Eyes focus on bean bag, not down at feet. The eyes shift from one visual target to another, but do not watch feet Movements are performed slowly.

Station 2: Obstacle course

Performance Objectives

By going over, under, and through obstacles, the learner demonstrates body and space awareness,

Equipment

Mats, 2 cross bars, and car tire with holder

Challenges

1. Jump over cross bar from a stationary position. (Adjust height of bar to ability level of participants.0

2. Crawl under low cross bar. (Student in prone position.)

3. Crawl through tire supported in tire holder.

4. After the learner has experienced success with the above challenges (2 or 3 repetitions), challenge the learner to find a different way of moving through the obstacles.

Stress: Learners attempts to go over, under, and through without touching any of the obstacles with his body.

Station 3: Coordination Ladder

Performance Objectives

By moving across the coordination ladder, the learner demonstrates foot-eye coordination, dynamic balance, and space awareness.

Equipment

Coordination ladder and mats.

Challenges

1. Balance walk forward on rungs of ladder

2. Run between the rungs of the ladder

3. Challenge the learner to create own pattern of movement.

Stress:

Eyes must guide movement. One student moves at a time on the ladder. Allow repetition of tasks. The learner moves only as fast as complete body control can be maintained.

Station 4 Ball bouncing with tires

Performance objectives

By bouncing and catching the ball while jumping and hopping across the tire pattern, the learner demonstrates hand-eye coordination, space awareness, and locomotor coordination.

Equipment

Ball and 5 hopes

Challenges

1. The learner bounces and catches ball once in each of 5 hoops followed by a jump into each of the hoops.

2. The learner hops through hoops on one foot and bounces ball into each hoop.(Bouncing of ball into hoop precedes the hop).

3. After the learner is successful on a few trails with challenges 1 and 2, challenge the learner to find a different way of moving through the hoops with the ball.

Stress: The learner bounces ball into the hoop followed by a jump into the same hoop. Both feet leave ground at the same time on each jump. Eyes focus on ball with hands and fingers forming a pocket to properly catch ball.

WEEK FIVE: Lesson One

Station 1: Walking boards

Performance Objectives

By kneeling on one knee on the walking board and stepping over the coiled rope wrapped around the board, the learner demonstrates dynamic balance, laterality and visual-motor coordination.

Equipment

Walking board, rope and mats.

Challenges

1. Walk forward to middle of board, kneel on one knee, rise and walk to end.

2. Walk forward using "snake" rope as visual target. (The learner, attempts to step into spaces provided by rope which is coiled around the board.)

Stress: The learner kneels on each side of body (alternates knees). The learner places feet in spaces provided by rope and is careful not to step on the sleeping "snake" rope.

Station 2: Jumping with ropes and hoops

Performance Objectives

By jumping forward, sideways, and twisting body in mid-air for alignment in the tire patter, the learner demonstrates locomotor coordination, balance, space awareness, directionality, and motor planning ability.

Equipment

Six hoops and five ropes

Challenges

1. First have the learner jump forward and sideways through the pattern as indicated by the placement of numbers. (Sideways jump from 1 to 2, 3 to 4, and 5 to 6).

2. Next have the learner jump through the pattern in the same direction as before, but body position must be changed (twist body) during each jump so that landing is made facing in the direction of the next jump as shown by the arrows.

Stress: Bending of knees on take off and landing of each jump. Both feet leave floor.

Station 3: Coordination Ladder

Performance Objectives

By moving along a coordination ladder, the learner demonstrates locomotor skill and coordination, balance and space awareness.

Equipment

Coordination ladder and mats

Challenges

1. Jump between rungs of ladder placed on mats or rug.

2. Jump into every other space between the rungs.

3. Four legged walk between or on rungs of ladder.

4. Balance walk forward on side rails of ladder (One foot on each side).

Stress: Both feet leave ground at same time on jump. The learner carefully guides feet so that they do not trip on rungs of ladder.

Station 4: Ball dribbling with obstacles

Performance Objectives

By dribbling a ball around a cone pattern, the learner demonstrates hand-eye coordination, visual memory ability, and directionality.

Equipment

Three traffic cones and a ball.

Challenges

1. Dribble ball (using one hand) around obstacles in pattern as shown. If unable to control ball with one-hand dribble, the learner may try dribbling with both hands.

Stress: The learner attempts to follow the directed pattern. Finger tips control the ball by using a push and not a slap.

Lesson Two

Station 1: Walking board

Performance Objectives

By walking backwards on a board while stepping over bean bags and turning, and by walking sideways, the learner demonstrates dynamic balance, and laterality.

Equipment

Walking boards, 2 bean bags, and mats.

Challenges

1. Walk backwards, step over first bean bag, make a complete turn at the centre of the board, continue to walk backwards and step over the 2^{nd} bean bag.

2. Walk sideways leading with the right foot to end of the board, and then return back to starting position leading with the left foot.

Stress: The learner "feels" for the board and bean bag with toes, and does not turn to look where going when moving backwards. Feet do not cross when moving sideways.

Station 2: Rebounder

Performance objectives

By jogging on a mini trampoline, the learner demonstrates locomotor control and laterality

Equipment

Mini trampoline and mats

Challenges

1. Knee slap jogging. The learner stands over the centre of the mini tramp with hands extended out in from of the body. The learner jogs (light running) with high knee action which results in slapping action against extended hands.

2. Cross lateral jogging. The learner jogs over the centre area if the tramp using cross lateral limb movements. That is, raising left arm with right leg and raising right arm with left leg.

Stress; Feet are placed approximately shoulder distance apart too begin all jogging challenges. Eyes focus on teacher, not down at the feet. Cross lateral jogging- Arms move in opposition to the leg movement. For safety: It is advisable to use "spotters" around the tramp. If mats are available, place on sides of tramp for added safety.

Station 3: Scooter board with obstacle

Performance Objectives

By moving a scooter board around an obstacle, the learner demonstrates bilateral coordination, balance, and kinesthetic awareness.

Equipment

Scooter board, traffic cone

Challenges

1. The learner takes prone position on a scooter board, and uses hands and arms to propel the scooter board around the traffic cone and back to starting position.

2. The learner takes a kneeling position on the scooter board and attempt the same challenge again.

Stress: Body is balanced on scooter board- feet do not touch the floor, and hands and arms work in rhythmic coordination

Station 4: Jump Box

Performance Objectives

By jumping from a jump box into a hoop, and moving through the hoops and cross bar pattern, the learner demonstrates locomotor skill, dynamic balance, foot-eye coordination, and space awareness.

Equipment

Jump box with incline board, 4 hoops (one of them red), cross bar and mats.

Challenges

1. Jump from the box, land in the red hoop, and then continue jumping into the hoops, over the cross bar, etc (use mats).

2. *Jump from the box, land in the red hoops, and then hop through the* pattern.

3. Jump sideways from box and land in tire, and then jump through the pattern moving sideways.

4. Hop from box, land on one foot in the red hoop and continue hopping through the pattern.

Stress: Controlled "Soft" landing in the red hoops. Use of arms to help left the body. Modify height of cross bar on hopping challenge for successful performance.

WEEK Six: Lesson One

Station 1: Walking board

Performance Objectives

By walking over a cross bar through the hoop on a board, and by walking forward and sideways, the learner demonstrates dynamic balance, directionality, laterality, and visual-motor coordination.

Equipment

Walking boards, cross bar, hoop and mats.

Challenges

1. Walk forward, step over the cross bar, make a full turn at the centre of the board, go through the hoop and walk to the end of the board. (Hoop must be held up by an aide),

2. Walk forward 1/3 of the way, walk sideways 1/3 of the way, and then walk backward to the end of the board.

Stress: Make turn slowly at the centre of the board, and then attempt to move through hoop without touching it.

Station 2: Jump Box

Performance Objectives

By jumping from the jump box and performing a mid-air quarter turn to land in the hoops, the learner demonstrates dynamic balance, body awareness, and space awareness.

Equipment

Jump box with incline board, for hoops, and mats.

Challenges

1. Walk up incline board onto the jump box, take a good jumping position, jump and perform quarter turn while airborne, and land facing in challenged direction either quarter turn left or quarter right.

2. Learner able to perform task in challenge 1 with good control, may be permitted to run up incline board and perform same task.

3. Place four hoops on mat and challenge learners to perform quarter turn to left or right with feet landing in correct hoops.

Stress: The learner jumps out away from the box and does not twist (turn0 body until after forward jump is made. For safety: Make sure mats are used to land on.

Station 3: Launch board

Performance Objectives

By catching, and launching bean bags with the use of a launching board, the learner demonstrates hand-eye coordination and foot-eye coordination.

Equipment

Launching board and set of bean bags.

Challenges

1. *Step on board with preferred foot, launch, eye track, and catch the bean bag.*

Stress; The learner should be given 5 to 10 trials on the launcher. The learner attempts to catch the bean bag 5 to 10 times in succession. The learner would successfully catches with 2 hands should be challenged to catch with one hand.

Station 4: Jumping and Hopping with Obstacles

Performance Objectives

By jumping through a hoop and cross bar pattern, and by hopping through a rope and hoop pattern, the learner demonstrates locomotor control, balance, space awareness, and eye-foot coordination.

Equipment

Two cross bas, 4 jump ropes and 7 hoops (2 red)

Challenges

1. Pattern 1: The learner jumps into a hoop, over first cross bar, stops in the red hoop, jumps into a hoop and over the 2nd cross bar and then stops in the second hoop.

2. Pattern 2: The learner hops over the rope and lands in first hoop and then continues hooping through the pattern. (Over, into, over, into, over).

Stress: Two patterns should be in operation at the same time. Pattern 1: Stopping in red hoop with complete body control. Bending knees and landing softly on front part of the feet. Use arms to help lift body on jump. Pattern 2: The learner takes off and lands on same foot. Arms are used to help maintain balance and left body.

Lesson Two:

Station 1: Walking boards

Performance Objectives

By dribbling a ball in hoops along a board, and balancing hoops on each wrist, the learner demonstrates dynamic balance, hand-eye coordination, and laterality.

Equipment

Walking board, rubber ball, 4 hoops and mats.

Challenges

1. Walk forward, carrying a rubber ball, dribble ball 5 times in hoop places on left side of the board, then dribble the ball 5 times in the hoop placed on the right side of the board.

2. Walk forward to centre of the board while balancing a hoop on each wrist, make a ½ turn at the centre of the board, and walk back ward to the end of the board.

Stress; When dribbling the ball, the left hand is used on the left side of the board and the right hand is used on the right side of the board. Finger tips push the ball down on the dribble , no slapping.

Station 2: Jump box obstacle course

Performance Objectives

By moving up a coordination ladder, jumping from a jump box, and moving through a hoop and cross bar pattern, the learner demonstrates locomotor coordination, dynamic balance, body and space awareness, directionality, and motor planning ability.

Equipment

Coordination ladder, jump box, red hoop, 2 cross bars and mats.

Challenges

1. The learner dog walks (on hands and feet0 up inclined ladder to top of jump box.

2. The learner jumps from the box into the red hoop target which is placed close to the cross bar on mats.

3. The learner hops over the low cross bar with touching it.

4. The learner crawls under the low cross bar with out touching it.

Stress: Landing on "soft" part of the feet. With low bending of knees for good body control and balance.

Station 3: Rebounder

Performance Objectives

By bouncing on a tramp and catching a thrown ball, the learner demonstrates dynamic balance, body awareness, and hand-eye coordination.

Equipment

Mini trampoline, ball and mats

Challenges

1. The learner performs coordinated sequence of hopping and jumping by rebounding twice on: right foot, left foot, and both feet. Repeat in a series.

2. The learner rebounds and catches a ball thrown underhand by teacher. Learner tosses ball back to teacher while maintaining rhythmic rebounding. The learner rebounds while catching and tossing a ball 3-5 times

Stress: Eyes watch ball into hands on catch. Hands must prepare to receive ball. The learner must stay over Rebounder centre. The learner makes a catch whilst *in the air. Proper timing on ball toss by teacher is important for successful* performance.

Station 4: Hoop and Rope Maze

Performance Objectives

By moving through hoop and rope pattern in various ways, the learner demonstrates locomotor coordination, balance, space awareness, directionality, and motor planning ability.

Equipment

Two long ropes, 4 short jump ropes and 5 hoops

Challenges

1. Challenge the learner to jump through the maze using a jump, straddle jump, jump, straddle sump etc. First jump is into hoop 1, followed by a straddle jump with feet landing outside of parallel side ropes. Next jump is into hoop 2 followed by a straddle jump etc.

2. Challenge the learner to jump through the hoops by moving sideways with right side leading, then through again with left side leading.

3. Challenge the learner to hop through the maze on one foot moving forward and through again moving sideways.

4. Challenge the learner to find a different way of moving through the maze.

Stress: Controlled movements, not speed! The learner attempts not to touch hoops or ropes while moving through the maze.

Sensory Motor Lesson Plans

WEEK ONE: Lesson One

Station One: Boxcar Push

Objective: Child will push or pull another child of similar weight across the gym hall.

Equipment: Large cardboard box

Procedure: Using a large box, one child sits inside while another child pushes it, trying to keep it on the railroad tracks. This provides resistance to arms. Take turns.

Station two : Hot Potato

Objective: Given a large cage ball, child will use both hands to throw it to another person.

Equipment: Large cage ball or medicine ball or LARGE heavy bean bag.

Procedure: Children play catch at close range with a large ball. If old enough they can play Hot Potato

Station three: Tug-of-War

Objective: Child will maintain hope on rope and pull child of similar weight.

Equipment: rope

Procedure: Using a strong rope children play tug-of-war, trying to pull the others over the line and into a pretend puddle.

Lesson two:

Station One: Raft

Objective: Child will propel self forward with both hands while sitting.

Equipment: Small mat or towel

Procedure: Imagine activities while sitting or kneeling on a small mat. Play "rafting" or "rowing" games, propelling body forward and backward with hands. Child's hands and arms are oars to be used to paddle around a circle. This may be strenuous for some children. Be sure to have a definite ending and have children stay on a path. A few times around a circle (or lake) is usually enough.

Station 2: Bean Bag push

Objective: Given a bean bag and path to follow, a child will push a bean bag with their head along a pathway.

Equipment: Bean bags, mats and ropes (for pathway)

Procedure: Have a child get down on all fours with a bean bag in front on them on the floor. The child pushes the bean bag with their head along a path.

WEEK TWO: Lesson One

Station One: Horse Cart Pull

Objective: Child will maintain hold on to rope for 20 seconds while being pulled.

Equipment: Thick rope, mat

Procedure: One child sits on floor. A thick rope is across child's lap. Two other children, each holding one end of the rope, pull the child across the floor.

Station two : Wheelbarrow

Objective: Child will keep arms extended and wheelbarrow walk for the length of two mats.

Equipment: mats

Procedure: One child "walks" on hands with feet being held by a partner. This activity works well incorporated into a game or relay. A variation may be following a rope path that turns, without hands touching the rope. Have a definite starting and stopping point.

Station three: Quicksand- Resisted Creeping

Objective: While on all-fours, child will creep for 20 seconds while being resisted.

Procedure: Child can pretend to be stuck on hands and knees in the mud. Position yourself behind the child, hanging onto the child's hips, knees, or ankles, and resist, but do not stop the child from creeping.

Lesson two:

Station One: Wind-up top

Objective: Child will stand and turn around ten times in 30 seconds without falling, on three occasions.

Equipment: rope, mats

Procedure: Tuck about four or five inches of a long rope into the child's pants pocket. Remind the child to keep arms on top of head while twirling around and around, winding the rope around the waist. Guide the rope to keep it taut, and don't let it slide sown around ankles. After the child is wound up, stop and wait as child may be dizzy. Then pull the rope gently and twirls, unwinding the rope.

Station two: Inner tube bounce

Objective: Child will bounce on an inner tube 25 times in two minutes on three occasions

Equipment: Large tractor inner tube

Procedure: Child sits on a large tractor inner tube with both feet on outside. Child tries to bounce ten times without falling off, then tries to bounce while moving sideways around the tube.

Station three: Ping-Pong Blow

Objective: Given a ping-pong bal, the child will blow it while in all-fours position following a path.

Equipment: Ping-pong ball, rope or hula hoop

Procedure: Child must get down on all fours and is given a ping-pong ball to blow. A path can follow·along a rope or a hula hoop.

WEEK THREE: Lesson one

Station One: Propeller

Objective: Child will use both hands while on scooter board and spin self around ten times while prone.

Equipment: Scooter board

Procedure: *Child pretends to be an helicopter propeller. Lying prone on scooter* board, child spins self around and around. Have child go in both directions.

Station two: Snake

Objective: Given a slow, "snaking" rope, the child will jump over the rope without touching it, four out of five times.

Equipment: rope

Procedure: While you are slowly "snaking" a rope by moving one end of it back and forth, child jumps over it.

Station three: Hit

Objective: Riding prone on scooter board, child will proceed in desired direction to hit a suspended ball two out of three times.

Equipment: Scooter board

Procedure: Child pushes off from wall, prone on scooter board , and hits a hanging ball with one hand. On next trip, child hits the ball with the other hand, then tries hitting it with both hands simultaneously.

Lesson two:

Station One: Motorboat

Objective: While lying supine on a towel, a child will propel self along a one metre path on the floor using feet only.

Equipment: towel

Procedure: Lying on back on a towel, the child propels self along the floor with feet only. The child holds the front corners of the towel so as not to slide off.

Station two: Many balls

Objective: Given two balls, the child will hold one in two hands ans use it to move another ball without dropping first ball.

Equipment: Two balls

Procedure: All children sit around in a circle. Each child is given a ball, which is held with two hands. Begin the game by rolling a second ball at one child. The child will then roll the ball back by hitting it with the ball held. Catching large balls on a bounce also encourages bilateral integration.

Station three: Back chalkboard

Objective: Child will identify shape when drawn on back two out of three times.

Equipment: none

Procedure: Child sits or lies on stomach on the floor in front of you. First, "ease" child's back with your hands, then draw a simple shape (circle or square) on the child's back with your finger. Child tells what you drew of draws it on the carpet with a finger.

WEEK FOUR: Lesson one

Station one: Tugboat Bump

Objective: While involved with games of tactile input, the child will show no adverse behaviour to stimulation or a strong craving for it.

Equipment: Towel, mats

Procedure: Lying down on a towel, the child is pulled off, on, and between mats spaced about one and a half feet apart. Going off one edge and onto another edge provides stimulation.

Station two: Prison

Objective: Child will demonstrate bilateral integration by using both sides in creeping for one metre.

Equipment: inner tube,·mats.

Procedure: Tie each child's feet together and have then sit in a circle on the floor. Explain that you are the guard, and the circle is jail. They must try to escape; you'll catch them and drag them back. They must be quiet and try to hide by keeping to the floor and creeping away.

Station three: Feeley-Meeley

Objective: With vision obstructed, the child will correctly identify common objects.

Equipment: Feeley Box , different types of objects.

Procedure: Everyone sits together on floor and you explain the Feeley-Meeley box. The Feeley-Meeley is a box with a hole on the side large enough to put a hand in and remove objects. Objects include everyday articles (such as toothbrush, pencil, pen, eraser, baseball, paper clip, sponge, comb, key etc)

Lesson two:

Station one: Tie Up

Objective: Child will hop ten times, keeping feet together on three occasions.

Equipment: inner tube, beacons, scooter board.

Procedure: Wrap child's ankles by using an inner tube band in a figure eight fashion. Have the child move self around on obstacle course by hopping, then try on a scooter board, using arms to push self.

Station two : Chariot

Objective: While sitting on a scooter board, the child will maintain balance for the length of the hall while being pulled with a rope.

Equipment: Scooter board, rope.

Procedure: The child will sit on a scooter board and hold a rope end in each hand. Another child will pull the child along a path or towards a goal.

Station three: Hand Ball

Objective: Child will use both sides of body simultaneously in situations as described below.

Equipment: Ball

Procedure: Sitting a circle, the children hand a large ball to one another, using both hands while facing in and out around the circle; sitting or standing in a single file circle, the children hand the ball over the head, under the legs, or any variation.

WEEK FIVE: Lesson One

Station one: Side Slide

Objective: Child will reciprocate hand usage while creeping up a ramp.

Equipment: Ramp

Procedure: Using reciprocal hand movements, the child crawls up front side of a ramp, holding onto both sides of the slide with hands, and pulls themself to the top.

Station two: Ice Skating

Objective: Given two sheets of paper with which to pretend to skate, child will move forward, backward, and sideways without losing "skates" .

Equipment: Newspaper

Procedure: Children should put on pretend roller skates - simply stand on two pieces of paper. Have everyone experiment with them. Skate following a path around a circle.

Station three: Wrestlers

Objective: Child will demonstrate co-contraction by pushing a person who is applying a slight resistance across a room.

Equipment: Mat

Procedure: Two children stand facing each other, palms touching. One child pushes the other backward; the other provides resistance but only to the degree that they are pushed slowly across the room. Reverse the roles.

Lesson two

Station One: Kickball

Objective: Child will assume position (sit down, lean back, feet up in the air) and maintain position for 30 seconds.

Equipment: Large ball

Procedure: Have a child sit on the floor and lean back, using hands for support, raising both feet in the air. Using a large ball, roll it to the child, then the child is to quickly push the ball back to you with both feet. This can be done with several children sitting in a circle rolling the ball to one another.

Station two: Bucking Bronco

Objective: While sitting on a large not on a hanging rope, a child will hang on for 20 seconds while you gently swing the rope.

Equipment: Hanging rope

Procedure: A child sits on a large knot that is tied on the end of a hanging rope. Gently shake the rope back and forth. The child presents to be riding a bucking bronco horse and hangs on tight. You can shake it harder. The child should fall off onto a soft mat surface.

Station three: Reach, Reach

Objective: While lying prone on elbows, children will keep head up without resting it on arm or floor for 30 seconds.

Equipment: Puzzle or building blocks.

Procedure: A child lies prone on elbows on floor. The goal is to complete task put in front of child, such as a puzzle or blocks. Child is to stay prone and reach for objects you hold out, such as puzzle pieces or blocks.

WEEK SIX: Lesson one

Station one: Rocking chair

Objective: Child will maintain a supine flexed position on floor for 20 seconds.

Equipment Mats

Procedure: Child sits on floor with legs bent, puts arms around legs as if to hug them tight. Child rolls backward, touching back of shoulders to floor; then comes up to sitting again. Rock again.

Station two: Tarzan- Over the River

Objective: Child to hang onto suspended rope and support own weight for five seconds.

Equipment: Hanging rope, mats

Procedure: The child hangs onto the rope and attempts to jump over a mat (riverO. Some children have a very difficult time getting the sustained flexion needed for this. Have the child start just going over the river one time, then over and back without a rest. Do not let the child sit on a knot in the rope.

Station three: Bean Bag toss

Objective: the child will maintain a pivot prone position for ten seconds while on a scooter board. While moving in a prone position on a scooter, the child will toss bean bag into a box at a distance of one metre.

Equipment: Scooter board, bean bag, box

Procedure: This game can be played individually or in a small group. Introduce by playing aeroplane (kicking off from wall while prone on scooter board). Set up one or more chairs with boxes on them. Child kicks off from the wall, picks up a bean bag from the floor, then tosses it into the box. Another child takes it out, then puts it back on the floor, and keeps track of how often their partner is successful.

Lesson two

Station One: Knee Puppets

Objective: Child will maintain a supine flexion position for 20 seconds.

Equipment: Chalk, mat

Procedure: Child lies on back on the floor, bends and lifts legs. Using soft chalk, the child draws a face on one knee at a time. The child must keep knees up and should draw slowly while watching what is being drawn.

Station two: River Rock top

Objective: A child will sustain hold on a rope for ten seconds using two hands.

Equipment: Hanging rope

Procedure: A child sits on a hanging rope. The child then swings across a mat a kicks a ball whilst still hanging onto the rope.

Station three: Foot Basketball

Objective: Lying supine, a child will left a large ball with feet and raise it to above head level without dropping the ball.

Equipment: Large ball, mat, bucket or box

Procedure: A child lies supine on the floor. Place a soft ball on the floor between the child's feet. The child slowly raises the ball and places it in a bucket or box that is just beyond the child's head. If a child makes a basket, it is a point! The child's arms should remain spread, resting on the floor. Move the bucket or box slightly to the child's right or left. The child should raise their head to watch feet get the ball and follow the moving ball to the bucket.