DOCTOR OF PHILOSOPHY

The identification of children with 'movement difficulties' in Gwynedd and an evaluation of an intervention programme

Dempsey Roberts, Veronica

Award date:
1998

Awarding institution:
University of Wales, Bangor

The Identification of Children with 'Movement Difficulties' in Gwynedd and an Evaluation of an Intervention Programme.

School of Sport, Health and Physical Education Sciences.
University of Wales - Bangor.

Written by : Veronica Dempsey Roberts.

Supervisors : Mrs. Sue Walsh.
Professor Lew Hardy.

ACKNOWLEDGEMENTS.

One of the main reasons for engaging in this study was to identify an area of need, to highlight a service deficiency in an area where I would like to practice my occupational therapy skills. As part of this process, I embarked upon a stimulating learning process which I had not anticipated. This process has enkindled an even keener interest in the subject and I owe a great deal of thanks to a number of people whose support, stimulation and encouragement were invaluable. I am most indebted to those mentioned below. I here express my sincere thanks to them.

Firstly, I would like to thank my supervisor Mrs Sue Walsh, without her continuous unfailing academic guidance, encouragement and support this study would not have been submitted. The timely arrival of my two children during this study seriously affected my motivation on occasions; however, her persistence in maintaining contact and ability to rekindle motivation resulted in completion. I would also like to express my gratitude to Professor Lew Hardy for his invaluable input.

Thanks also to the children who participated in the study and made it worth-while and fun, to their teachers and parents for their support. I am also indebted to Gwynedd Social Services Department who funded the first two years of the study and wish to express my gratitude.

I am grateful to Kate Jones, Angharad Pugh and Andrew Carpenter who helped to carry out some of the intervention activities, and to Andy Neal for his support and help with statistics.

At a personal level, I wish to express my sincere thanks to Nancy and Michael Dempsey, my parents, Erina and Trefor Roberts, my parents in law, for their continuous support and encouragement. To all who cared for my little ones while I engaged in this study. To my children, Daire and Niamh whose arrival may have delayed completion but gave it meaning and purpose and provided diversion from the subject.

Finally but by no means lastly, I would like to thank my husband who provided limitless support and encouragement, I dedicate this study to Bryn.

To Bryn.

ABSTRACT.

The purpose of this study was to identify the incidence of Developmental Co-ordination Disorder (DCD), (American Psychiatric Association, 1987) in the county of Gwynedd and design, carry out and evaluate an intervention programme with a sample of the children identified as having DCD.

Some children appear physically and intellectually normal yet lack the motor competence necessary to cope with the demands of everyday living (Gubbay, 1975; Henderson and Hall, 1982). This lack in motor competence or Developmental Co-ordination Disorder affects 6% of children in mainstream primary education (Peters, 1995). Recent longitudinal studies of such children have shown that the difficulties that these children face are not transitional and not devoid of personal, social and educational consequences (Henderson and Barnett, 1996).

A random sample of 7-8 year olds, (n=183), were assessed using the Movement Assessment Battery for Children (Henderson and Sugden, 1992). 5.8% (n=11) children were identified as being at 'risk' and a further 5.8% (n=11) children were in the 'borderline' category. Subsequently, from these two groups, 8 children were included in an intervention programme. The intervention programmes were based on a cognitive motor approach and were individually designed to meet the needs of each child. A single case study multiple baseline design was adopted to evaluate the intervention programme and the data was analysed using the SPSS 6.1 statistical package. The effects of the intervention programme was evaluated on an individual basis and on the group as a whole overall indicating the positive effect of the intervention programmes ($p<0.05$). The results of this study identify the efficacy of an intervention programme that may be incorporated within the day to day work of the primary school in addition to highlighting the need for a co-ordinated approach to assessment in the county of Gwynedd to ensure the special needs of this group of children are not being neglected.

TABLE OF CONTENTS.

CHAPTER 1 : Motor Function / Dysfunction - An Overview.

Introduction 2

Early Motor Development 3

The Child With Motor Difficulties 7

Clinical Presentation of the Child with DCD 10

The Current Situation in Gwynedd 12

Identifying an Assessment Tool 14

CHAPTER 2 : Intervention.

Introduction 27

Intervention Approaches 28

Conclusion 33

CHAPTER 3 : Methodology-Initial Screening.

Introduction 36

Social and Scientific Research 36

The Assessment Tool 37

The Subjects 42

Child Testing 44

CHAPTER 4 : Design and Methodology - Intervention.

Design 48

Data Evaluation 50

Method 55

CHAPTER 5 : Results.

Introduction 62

Part 1 - Initial Screening 63

Part 2 - Intervention Results 75

CHAPTER 6 : Discussion.

Introduction 99

Identification 100

Intervention Results 111

Implications For Gwynedd Health Authority 121

Limitations of the Present Study 124

Future Research Directions 126

Concluding Remarks 126

REFERENCES.

References 128

APPENDICES.

Appendix A 136
Appendix B 140
Appendix C 148
Appendix D 154
Appendix E 171

CHAPTER 1.

Motor Function / Dysfunction. An Overview.

INTRODUCTION.

Human motor control can take many forms, from the co-ordinating of our large muscle groups in activities such as rugby or trampolining to those in which the smallest muscle groups must be tuned precisely, as in typing or threading a needle.

Most humans are born with the ability to develop many skills. Schmidt (1991) notes that scientists define ability as being genetically determined. Therefore, abilities can be thought of as the basic 'equipment' individuals are born with and which they use to engage in various everyday tasks from which they develop skills. Skill, as defined by Schmidt (1991), being the ability to perform a particular task, and that ability may be modified by practice. Motor control or the production of movement by the neuromotor system, has developed into a major field of study. It is mainly concerned with developing techniques to advance performance and often, to achieve high level performance (Keogh & Sugden, 1985). However the majority of research in this field appears to have concentrated on individuals who have good motor ability, that is, those who do not demonstrate difficulties carrying out basic motor activities, such as dressing, feeding, catching a ball, or riding a bicycle.

Rosenbaum (1991) suggests that the motor system has two functions; firstly, movement and secondly, stabilisation-maintaining balance. When the motor system is impaired, behaviours that we take for granted such as, the ability to ride on a bus, walk through the woods, write, feed oneself, are all but impossible. Many factors may effect the development of these skills and it is appropriate to outline early motor development as a basis from which to consider motor difficulties in young children.

EARLY MOTOR DEVELOPMENT.

It has been widely accepted that motor development and maturation occurs from a head to feet direction (Clancy and Clark, 1990). The significance of this is that the child develops head control with shoulder and shoulder girdle control, upper trunk movements, then lower trunk and leg movements. Motor development and maturation was also thought to develop in a proximal-distal course and from the midline of the body to the periphery. However, some researchers have produced data questioning the proximal distal motor development model (Brinkman and Kuypers, 1973; Loria, 1980). They suggested that two different motor control systems exist, governing proximal and distal functioning. A model in which movements mature sequentially in relation to the planes and axes of the body appear to be widely accepted. For example flexion precedes extension patterns, adduction precedes abduction patterns, ulnar precedes radial patterns and gross movements precede fine movements. Muscle function follows a sequence starting with automatic reflex contraction present at birth developing into voluntary controlled contraction. The vestibular and reflex systems significantly influence the ability to move about in the environment. The important point is that all systems are interdependent.

New Born.

The new born baby shows responses to sensations of gravity and movement. If one suddenly lowers a baby, he will show alarm and his arms and legs will move outwards. This movement of the entire body is the first total body motor pattern. The new born baby appears to enjoy movement. Every mother quickly learns that carrying or rocking an infant brings comfort.

The second and third months.

The eyes and neck are the first body parts a baby learns to control. Keeping the eyes and head stable is a fundamental ability. He learns to hold his head up with his neck muscles and if lying face downwards the infant uses the muscles in his upper back and arms to lift his chest off the floor. The child also learns to sit upright with his head balanced if you support his lower back. At three months old the hands are open most of the time and the child will reach for objects and people but lacks the hand-eye co-ordination to make his reach accurate. Objects will be grabbed in the palm of the hand.

Four to six months.

Now the baby will make big movements with his arms and hands for example, banging a spoon against the table, being thrilled at having an impact on the physical world. He begins to look at and touch his hands and to develop an awareness of where his hands are in space. He begins to use his thumb and fore finger, but the grip continues to lack precision. An important development at this age is when the infant spontaneously brings his hands together in front of his body.

By six months the child has the ability to rotate the wrist and can now manipulate more objects. The child can sit for a few seconds without support. The six month old also appears to like to be rocked, swung in the air, turned over and moved about.

Six to eight months.

One of the most important aspects of development during this period is movement from one place to another. Rolling, crawling and creeping contribute many sensations giving the child a concept of himself as an independent being (Ayres, 1972). The child can now use his thumb and fore finger in a pincer action to pick up small objects or pull a string. He has control over his eye muscles and is able to direct his eyes to the place he needs to see.

Nine to Twelve months.

He creeps for longer distances explores more places in his environment. He will grasp and release objects, bang them together, bring objects across his midline. One of his major motor achievements is to pull himself into standing.

Twelve to Twenty Four months.

During the second year the child learns to walk, climb and plan more complex actions more effectively. He pick things up, throws them, pushes and pulls toys, pull pots and pans out of cupboards, and will scribble with pencils and crayons. The child learns to walk up and down stairs, explores the home and the world outside.

Three years.

The child can run fast indoors and out, can walk in any direction hauling large objects around and is able to climb on apparatus with agility. He can stand on one foot for approx. 5 seconds, rides a tricycle using peddles and can walk up stairs without holding onto the rail using one foot per step, and can descend using two feet per step.

The child can throw a ball overhead and can catch between extended arms. He can kick a ball forcibly. The child appreciates body size and shape in relation to surroundings when playing.

He uses a pencil with good control, can imitate a cross roughly and can cut paper with scissors. He can thread beads and can undo and do up buttons.

Four years.

The child can climb ladders and high playground equipment. He is able to walk up and down stairs easily alone, alternating feet and can jump off two steps. The child can run and kick a ball, ride a tricycle quickly and turns sharp corners.

He can hold a pencil with an adult grasp and can copy a ladder, cross, square and circle well. He can also draw a recognisable person. The child can take a train under a bridge of blocks, can thread small beads with a needle to make a necklace, and can build three steps with six bricks after demonstration.

Five years.

The child can run fast out of doors, can run upstairs and sometimes down, and can skip with alternating feet. He can hop on one foot 16 times, can walk heel to toe, and can climb trees skilfully.

The child can bounce and catch a ball. He plays a variety of ball games including those requiring appropriate placements of scoring.

At this age the child can write some letters from memory and can copy a square and a triangle. He can tie a single knot and thread a large needle, twelve beads to a colour pattern, and can fasten buckles.

The child can now draw a person or house with features and colours pictures neatly.

School Age.

It becomes apparent that by the time the child reaches school age. They possess a repertoire of motor skills that allows them to cope with the demands of both the home

and school environment. At the age of six the majority of children can put on their clothes, eat neatly with a spoon, wash their teeth and can walk, run, jump and skip. At school they will draw, write, handle bricks, beads, counters, rulers, scissors and join in ball games outside. After school they may ride a bicycle go roller-skating or help with domestic tasks such as cooking. These skills taken collectively serve as a foundation for the fully developed competent adult. However, the child continues to develop their motor skills and from six years on children experiment with, refine, extend and combine in new ways their existing skills.

THE CHILD WITH MOTOR DIFFICULTIES.

A child who fails to achieve the above developmental milestones, may be labelled as having motor delay. However, it is not as clear nor as easily defined as that. Disordered motor function is a major component of the clinical picture or presentation of many developmentally disabled children. Good co-ordination is not innate but develops in conjunction with maturation of the nervous system, aided by kinaesthesis, touch and sight senses, as well as by experience (Holle, 1976).

Movement problems in children manifest themselves in many different ways and probably have a variety of different causes (Henderson, 1986). The child with motor difficulties may be totally dependent on their carer to enable them to carry out all activities of daily living. The child may have more minor generalised difficulties or he may present as having difficulty in a particular age appropriate skill area. For example, difficulty with manual dexterity tasks, the child may continually drop their pencil, is unable to button their coat, thread a needle or tie their shoes. The child may have difficulty with ball skills, such as ball catching, appearing to attempt to catch before the ball reaches their hands. When throwing a ball, the child may release the ball too soon

resulting in the ball going in the wrong direction or not travelling as far as expected. The child may have difficulties in balance skills, continually falling over when engaging in hopping games or unable to take their place in an orderly queue without continually wriggling and moving from one foot to the other.

Because children with motor difficulties do not form a homogeneous group, classification within this group of children is almost impossible and consequently, classification or grouping together of individuals with common attributes has been the subject of much debate.

Alberman (1984) lists four different types of classification each one of which makes a vital contribution to our understanding of a particular impairment, or group of impairments, and therefore, to the provision that is made to those affected. She stresses that an *Aetiological* classification is required to help form hypotheses about the causes which may direct possible preventative action. A *Pathological* classification (e.g. cerebellar damage) is needed to help understand the nature of the defects in the condition. A *Clinical* classification is required to help with the prognosis and management of the individual case. Therefore, a classification of *Concomitants,* which considers the impairments, disabilities, difficulties and handicaps associated with the condition, is needed to plan service provision for the individuals affected. Both Rutter (1977) and Alberman (1984) note that the more broadly acceptable a classification scheme is the greater its potential usefulness and the more possibilities it offers for collaboration between researchers and practitioners. Motor difficulties are indeed difficult to classify. For example, motor problems may be considered a primary disability in cerebral palsy, a secondary disability accompanying blindness, a concomitant of intellectual retardation and as a specific deficit in a child who is 'clumsy' (Henderson, 1986). There are some differentiations that can be made medically such as, those

impairments resulting from damage to the Central Nervous System, and those which do not. The difficulty of accurately describing problems of motor development in children is highly correlated with the extent to which the central nervous system can be shown to be implicated (Henderson, 1986). It is widely accepted that there is some overlap between cerebral palsy and clumsiness and that a continuum of neurological damage underlies motor impairment. Cerebral palsy as defined by Bax (1964) is 'a nonprogressive disorder of movement and posture due to a defect or lesion of the immature brain'. The nature of this condition however can take many different forms effecting many or few parts of the body resulting in a range of disability from mild to profound. However, when problems have no clear organic base, it is even more difficult to assertain if the child's problems are due to lack of experience, shyness in new situations, or a genuine motor difficulty. Having no clear aetiology results in confusion in terminology and classification of difficulties. Much debate continues regarding classification and labelling in respect of children with movement difficulties. In the meanwhile, there are some children, who regardless of level of intellect, have no obvious physical handicap, have been exposed to a stimulating environment and appropriate teaching, but still exhibit what may be termed 'movement difficulties' (Gubbay, 1975). These children are commonly referred to as 'clumsy'. Within the clinical field, this group have been identified as: 'awkward' or 'dyspraxic' or having 'minimal brain dysfunction'; 'clumsy child syndrome'; 'perceptuo-motor difficulties'; 'sensory integrative dysfunction'; 'sensorimotor dysfunction'; 'motor impairment' and more recently 'Developmental Co-ordination Disorder' (DCD), a term proposed by the American Psychiatric Association (1987). For the purpose of this study Developmental Co-ordination Disorder (DCD) and the term movement difficulties will be used henceforth to refer to this group of children.

CLINICAL PRESENTATION OF THE CHILD WITH DCD.

Children with DCD are seen to be delayed in the functional skills which enable them to control their environment. Within this group the child's difficulties may range from those children mildly affected, that is, who may have difficulty writing in respect of speed, whilst others, more acutely affected have difficulty forming letters at all. Some children may lack motor competence while achieving competence in other areas, whereas, for others, their motor difficulties may be synonymous with an overall picture of developmental delay. A child may have good fine motor control and be considered dextrous but have great difficulty with gross motor skills being awkward when they try to kick a ball, hop, or jump.

A typical child with movement difficulties, (Sugden and Wright, 1995).

> 'Amy (not her real name) aged nine is in year 4 of primary school and her teacher has identified her as having motor difficulties that are adversely affecting her work. Amy finds it hard to grip writing and drawing tools use scissors accurately or trace objects and fumbles when using blocks, beads and puzzle pieces to complete tasks in class. She has a tendency to bump into furniture and looks unsteady when jumping and playing on playground or gym apparatus. She has little success in ball games. Once other children become involved in Amy's activities this forms another source of confusion especially if she is expected to adjust her responses to their presence such as joining in a game of 'tag' or moving to catch a thrown ball and pass it on again.
>
> Amy has a tendency to laugh or giggle a lot to cover up the extent of her difficulties. So far her inability to master her movements has not affected her determination and she readily approaches new tasks. In fact her enthusiasm often makes her impulsive and she has a tendency to begin tasks before the instructions are complete and she is impatient of detail, **(p 8)**.

In the past few years there has been increasing concern about the problems facing children who exhibit movement difficulties. Often, in addition to movement difficulties, these children may develop challenging behaviours or behavioural difficulties (Stevenson et al, 1986). It has been suggested that these behavioural difficulties may be as a direct result of the child's motor difficulties. For example;

* a child may feel threatened because tasks are too demanding or,
* they may have feelings of frustration because the intellectual ability of the child exceeds the achievement or,
* the child with poor self esteem and lacking in self confidence may develop behavioural problems to avoid tasks or avoid being ridiculed by peers.

Stevenson et al, (1986) also suggest that other emotional and psychomatic disorders such as, peer relationship problems and bed wetting may be as a result of pressures being put on the child by other children, parents, teachers and others who do not recognise and understand the problem. However it is important to point out that there are children with behavioural difficulties the causes of which are not related to motor difficulties.

Henderson and Sugden (1992) note that there are three reasons why clinicians should be concerned about children with motor difficulties;

* it can be very upsetting and stressful for the children and their families,
* it is associated with a high incidence of behavioural and social problems in addition to school failure
* and one cannot assume that the child will grow out of these difficulties.

We know that children with these difficulties exist (Henderson & Hall, 1982) (Keogh, Sugden, Reynard and Calkins, 1979). Henderson and Hall (1982) suggest an incidence of 5% of children with motor difficulties in the normal population. Although Keogh et al,

(1979) reported an incidence of 9% there is a distinct lack of empirical evidence to allow for a true estimation of the extent of this problem. Sugden and Sugden (1991) reported finding that boys generally showed more problems than girls.

Early screening or assessment and the identification of this disability is all important (Gordon and McKinlay, 1980) if the needs of these children are to be met appropriately. Although current practices in assessment do appear to vary greatly from area to area and between one profession and another. In addition to children in main stream schools who may have movement difficulties, many children with learning difficulties have been identified to have movement difficulties without any direct assessment of their movement skills (Keogh and Oliver, 1978). Researchers have applied themselves to addressing the need for appropriate assessment in this area. This need has been very difficult to meet for a variety of reasons, but primarily because this group of children are heterogeneous in respect of abilities and disabilities. There continues to be agreement that these children are not being identified and are therefore not having their special needs met. Henderson (1984) refers to this group as 'neglected'.

THE CURRENT SITUATION IN GWYNEDD.

At the present time there are no standardised tests used in Gwynedd to identify children who may have movement difficulties and normally, children may not be subject to any form of assessment at all unless they have more severe physical handicaps. If a child is suspected as having movement difficulties, there is no specific agency responsible for providing a service and therefore no agreed method of intervention within the county. In fact the child is unlikely to receive input at all.

In the past, Health Visitors relied on the Denver Developmental Test (Frankenburg and Dodds, 1967) as a screening tool. Since the Hall report (1991), which queried the value of administering developmental screening tests to all children, this test is no longer administered routinely in Gwynedd. However, it continues to be used by individuals who suspect a child has a problem and, because they are familiar with the test, use it to confirm their suspicions. Currently the early identification of the child's difficulties is based on the subjective assessment of Health Visitors who rely on their previous experience and knowledge of child development.

A child may, therefore, reach school age before these difficulties are noted. The school medical doctor will routinely see each child but no particular test of motor development will be carried out unless concern is expressed by the parents or the class teacher. A child with serious difficulties may then be referred to a Paediatrician to eliminate other conditions.

This situation does not appear to be exclusive to Gwynedd as there are no nationally agreed methods of identification of children with movement difficulties and there is evidence to suggest that if the child is performing at an acceptable level academically, he/she would not be referred for assessment (Henderson, Knight, Losse and Jongmans, 1991). In addition to this variation in assessment, intervention techniques also appear to vary from area to area with little empirical research available to guide intervention. Generally, children with movement difficulties may appear bright and physically normal but they do have considerable difficulty in acquiring basic skills for daily living and there is evidence to suggest that these children will not ' grow out of ' these difficulties (Losse et al, 1991; Henderson et al, 1991). As motor competence is necessary to cope with the demands of everyday living, it would seem appropriate that the needs of children with DCD should receive attention within this county. In Gwynedd there is a need for an

assessment tool to be introduced in order to identify these children and a further need to identify appropriate methods of intervention.

IDENTIFYING AN ASSESSMENT TOOL.

United States of America.

Lewko (1976) carried out a review of the different methodologies used in evaluating motor difficulties. He identified 256 different published and unpublished tests reported in use by a variety of disciplines. From his findings it became apparent that many of the tests were being misused. All of the tests were being used across the entire age range, from birth to sixteen, and most tests were used with all disability groups and not just those for whom the test was designed. The individuals carrying out the tests were from a variety of training backgrounds. It also became apparent that some institutions were not assessing the children in respect of motor ability, particularly in larger establishments.

Many of those administering these tests were dissatisfied with the tests they were using and gave the following examples of dissatisfaction:

* the Denver Developmental Screening Test (Frankenburg and Dobbs, 1967), which was widely used, was too subjective, open to errors when scoring, contained insufficient items per age level or category, and failed to test the quality of performance.

* the Gesell Developmental Schedules (Gesell, 1950) were criticised for the inadequate number of items presented and for the lack of normative data.

* the Purdue Test of Perceptual Motor Function (Kephart and Newell "n.d."), was severely criticised for the subjectivity of the scoring system.

* the Southern California Sensory Integration tests (Ayres, 1972) had limited value in diagnosing young children and, in addition, no consideration was given to neurological muscular impairment.

This type of criticism persists in regard to each of the tests. Lewko's (1976) study came about at a time when screening and assessment of the child were receiving attention both in the United States of America and Great Britain.

Great Britain.

In (1986) Henderson, reviewed the test instruments available to assess movement difficulties. She considered these under two headings *Traditional Approaches,* and *Alternative Approaches.*

Traditional Approaches.

* There are Descriptive tests which are used for assessing the performance of everyday activities with achievement measured against normative data for chronological age such as Denver Developmental Test (Frankenburg, and Dodds, 1967). No links with underlying processes are hypothesised

* Diagnostic tests such as, 'The Southern Californian Sensory Integration Tests' (Ayres, 1980) presume a relationship between educational performance and basic sensorimotor development and experience. Performance difficulties may be attributed to dysfunction of the central nervous system.

* Neurodevelopmental tests form part of a clinical examination, including items to detect subtle difficulties in neurological function relative to the child's age, that is, so called soft neurological signs. The assumption is that motor performance reflects intactness of the central nervous system function. Examples of this are found in tests carried out by Paediatric Neurologists (Touwen, 1979).

Alternative Approaches.

These tests do not tend to be norm referenced. Alternative approaches appear to be complimentary rather than exclusive alternatives.

* The assessment of how the child moves as opposed to what is achieved by a particular action. This is a documentation of how actions are performed. Performance appears to be judged on what is considered to be a mature efficient pattern of movement within the stages of a developmental sequence. The observer matches his observations against a verbal description of a prescribed pattern (McClenaghan & Gallahue, 1978; Williams & Breihan,1979).

* Another alternative approach is Biomechanical analysis, such as recording the measurement of joint angles, the electrical activity of muscles and the time relations between the movement in one joint and the movement in another. (see Neuhauser (1975) for a general review of this approach).

* Other Tests are those which allow analysis of component processes. These tests focus on the analysis of processes which underlie performance rather than measuring attainment in an empirical fashion; for example, the test battery of Stott et al. (1984) and Lazlo &Bairstow, (1985).

Considerable contention continues to surround the make-up, validity and reliability of structured and standardised testing procedures. There are many easily identifiable problems in administering tests; for example, the question of the ability and experience of the assessor, some tests cannot easily be used by inexperienced assessors, the notion that all children pass through all developmental stages is disputable, the pattern of movement may differ with the task e.g., a task demanding throwing distance rather than accuracy.

Keogh, Sugden, Reynard, and Calkins (1979) considered the question of whether motor difficulties could be identified with any consistency by different assessors and assessment methods. Their findings concluded that differences emerged when tests were administered by different professionals, suggesting that movement difficulties were in the eye of the beholder. They noted that it is important to avoid confusing a child who is disruptive with a child who has movement difficulties. Some children with genuine movement difficulties may not be identified because of their disruptive behaviour, whilst others may be identified as clumsy because of their presenting behavioural difficulties.

Later, Henderson and Hall (1982) conducted a study in which teacher assessments were compared to those of a psychologist and a paediatric Neurologist and these were shown to be very accurate. They argued that if teachers can be trained to assess movement difficulties in the classroom then paediatricians, psychologists and therapists might be able to concentrate on intervention rather than screening.

During the eighties there appears to have been an increase in the attention given to children with Developmental Co-ordination Disorder. Lam and Henderson (1987) attribute the increase in the concern for children with movement difficulties to the recommendations of the Warnock report (1978) and the subsequent Education Act (1981) which presented the task of developing a physical education programme for both able bodied and physically handicapped children.

To develop a single valid test, which could be administered with some consistency, would appear almost impossible. When developing a test it is possible to include aspects of other tests ad infinitum rendering a test complicated and difficult to administer. This may result in continued lack of identification of DCD and misuse of the tests (Lewko 1976).

Many tests appear very limited and in order to address the limitations of the available tests there have been two lines of enquiry. Firstly, looking for the best instrument to use, (Sugden and Wann, 1987), and secondly, identifying the most appropriate assessors in order to ensure identification of children with movement difficulties (Keogh, Sugden, Reynard and Calkins, 1979).

From the available literature a single test that has drawn on both these lines of enquiry is the Test of Motor impairment, (TOMI), (Stott et al, 1972). This test has emerged from work initiated in 1966. The Oseretsky Test of Motor Proficiency (OTMP), (Oseretsky 1943; 1948) became an important reference point for the development of the TOMI. The OTMP evaluated gross and fine motor skills and appeared to be the first systematic attempt to measure motor abilities in children. The TOMI was developed as part of a study conducted in Canada. The test has an age range of 5 to 13 years and assesses the following five motor functions:-

1. control and balance of the body while immobile,
2. control and co-ordination of the body while in motion,
3. control and co-ordination of the upper limbs,
4. manual dexterity with the emphasis on speed and
5. tasks which emphasise simultaneous movement and precision.

Henderson and Stott (1977) note that the standardised TOMI was not designed to measure motor ability as a quality but the authors suggest that it may have its place as follows;

1. as a screening instrument;
2. for individual assessment;
3. as a correlate to other types of handicap particularly behavioural disturbances;
4. as a technique which may contribute to our understanding of motor function and dysfunction.

The original version of TOMI was standardised on a Canadian population. Tew (1978) explored the differences between Welsh and Canadian Children on parts of the Test of Motor Impairment. Four subtests which measured hand function were taken from the test and given to 53, 10 year old Welsh children of 'normal' intelligence. The results showed a wide variation on achievement and girls were consistently faster than boys.

Hand speeds are known to increase with age during childhood (Annett, 1970) and therefore the 10 year old British children should have had a decided advantage over 8 year old Canadian Children. This did not appear to be the case in this study. Tew (1978) suggests that this may be due to differences in Child rearing practice and the cultural pursuits of North Americans. He also points out that the test manual claims that it has eliminated tasks favouring a particular sex for example, threading a needle for girls and overarm throwing for boys. However, Tew argues that girls must be at an advantage on the lacing test. From his results it would appear that restandardisation of the TOMI was necessary for this test to be clinically useful in the identification of children with motor difficulties.

In the 1972 edition of the TOMI there were 45 test items with 5 at each of 9 age levels. The test arrangements had many disadvantages particularly of a practical nature. Testers had to remember a large number of test items and carry around a large amount of equipment. Between 1977 and 1984 the TOMI was revised (Henderson, 1984) and restandardised on British and North American Populations. The two objectives of the revision were firstly, to reduce the number of items and make the procedure more manageable and secondly, to achieve greater consistency within the areas of function included in the test. This revision was standardised on approximately one thousand children between the ages of 5 and 12 years. A number of steps were taken in order to achieve the form of the test envisaged. The existing literature on the factor analysis of motor performance was reviewed, the structure of other tests was examined and pilot

studies were conducted to check on the reliability and validity of the new items. As a result of these steps, the TOMI was reorganised into three sections covering, Manual Dexterity, Ball Skills, and Static and Dynamic Balance. Each age-band now contained eight test items assessing performance along a continuum from gross to fine motor co-ordination.

Sugden and Wann (1987) applied the TOMI - Henderson Revision (Stott et al, 1984) to children with moderate learning difficulties. The presence of delayed motor control, in addition to mental handicap/learning disabilities, is well accepted in the clinical field and documented (Rarick and Widdop 1970; Bruininks,1974,). Sugden and Wann (1987) selected two tests of motor behaviour and examined the performance of 8-12 year olds with moderate learning difficulties. They selected the TOMI (Henderson Revision,) and the Test of Kinaesthetic Sensitivity (Laszlo and Bairstow, 1985). This investigation had three purposes; firstly, to determine the appropriateness of the two tests for use with this particular group of children; secondly, to determine the existence and nature of motor control difficulties in this group using standardised tests; and thirdly, to discover and examine the relationship between Kinaesthesis and Motor Impairment.

TOMI was chosen because it involved everyday motor skills and was widely used in the UK. The test of Kinaesthetic Sensitivity was chosen because it presented a suggestion as to why a child had motor dysfunction. It was not a test that claimed to identify children with motor control difficulties but infer a possible cause.

The Test of Kinaesthetic Sensitivity, (TKS) (Laszlo and Bairstow, 1985) was based on fifteen years work. Sugden and Wann (1987) stressed the importance of feedback, particularly kinaesthesis (the combined sensations by which position, weight and muscular position are perceived), to the control of skilled motor tasks. They also suggest

that poor motor performance/control could be as a result of a motor or sensory deficit, and argue that if the assessment indicated poor Kinaesthetic ability, then with specific remediation, there should be an improvement in motor control. This test (TKS) involved two separate tasks. Firstly, a test of Kinaesthetic acuity requiring the child to distinguish between the height of two inclined runways set at particular angles. The second part of the test is more complex. It involves Kinaesthetic Perception and Memory of movement patterns, involving intersensory integration. The child's task involved memorising a pattern presented in the kinaesthetic mode, the child's hand was guided about a stencil for two circuits without the child's vision of his hands. Then the orientation of the pattern is changed, the child is allowed to look and is requested to re-orientate the stencil back to where it was when he went around it, displaying the accuracy of that memory with visual information available. The actual test involved six patterns.

The children appeared to enjoy engaging in the tests and did not have difficulties understanding the demands of the tests. Sugden and Wann (1987) concluded from this study, that both the TOMI and TKS were acceptable tools to use with children with moderate learning difficulties. The second purpose of Sugden and Wann's (1987) study was to determine the existence of motor difficulties in this particular group of children with moderate learning difficulties. At the 8 year old test level there was ten times as many children with motor difficulties in this study group, when assessed on a criterion set by the TOMI which was standardised on normal school children, confirming the author's suspicions of a high incidence of motor learning difficulties in this particular group. The third purpose of this study was to explore the relationship between TOMI and TKS. Although the children who did poorly in the TOMI also did poorly in the TKS this was not significant enough to be considered predictive. There was a low correlation between the two parts of the TKS implying that different abilities were being assessed.

The TOMI tests a number of everyday movements that will make demands on a variety of proprioceptive and kinaesthetic abilities. The TKS tests a limited sample of these abilities. Perhaps it would therefore have been more appropriate to compare the TOMI with a more comprehensive test of kinaesthetic abilities.

Lam and Henderson, (1987) also applied the TOMI - Henderson Revision to children with Moderate Learning Difficulties. There were two aims to this study. Firstly to confirm that this revised test continued to be suitable to administer to the same population of children as the original version. Henderson was concerned that children with learning disabilities experienced failure in many aspects of their education and therefore would not perform well in formal testing settings. However, she concluded that using the TOMI made it possible to make the experience fun and enjoyable thereby minimising feelings of failure. She conducted a detailed comparison of the scores of the children with learning disabilities and children attending ordinary schools to present a more objective examination of its suitability. This comparison indicated that the TOMI could detect motor control difficulties in a group of children where the incidence is known to be high. The second aim was to add to the available data on the validity of the test. One of the issues the authors wanted to examine further was the extent to which the results were in agreement with the subjective observations of teachers and other professionals. A strong relationship was demonstrated between the children's performance on the TOMI and their scores on a dressing assessment and a teacher checklist. Those who did not perform well on the TOMI had been previously identified by their teachers as having poor motor control.

Fairgrieve, (1989) presented a study comparing the effectiveness of the TOMI - Henderson Revision and the Aston Index (AI), (Newton and Thompson, "n.d.") a standardised test for the screening and diagnosis of language difficulties (speech and

written) with the Southern California Sensory Integration tests (Ayres, 1972). Sensory Integration Theory amalgamates knowledge from the neuroscience's and developmental psychology into a hypothesised construct linking 'end products' of academic learning and functional living skills with the normal sequential development of sensorimotor processes. Aspects of the theoretical framework withstand scrutiny but the lack of scientific evidence to support hypothesised links has lead to criticism (Schaffer, 1984). These tests were compared on their ability to identify the type and severity of dysfunction, the level of expertise required to administer the tests and, time involved to administer and space requirements. The outcome of this study supported the use of TOMI and the AI as vehicles for pre-therapy and post therapy evaluation. However it was felt that an alternative means of assessing visual perception was necessary.

The main conclusion of a further study conducted by Henderson, Rose and Henderson (1992) was that reaction time and prolonged movement time occur alongside movement difficulties and that the TOMI is a powerful indicator of these difficulties. Not long after the revision of the Test of Motor Impairment was completed Henderson, (1984) standardised the test in America. Although they did not originally intend to change the test, as it was in its early stages of use, they did however take the opportunity to improve the test. Henderson noted that the 'development of a test is a continuous process and it is always possible to effect improvements'. This revision resulted in the Movement Assessment Battery For Children, (Movement ABC) which embodies all the developments of previous editions of the TOMI with the emphasis placed on practical applications and intervention. It includes a checklist which provides opportunities for classroom based assessment and screening, and outlines an approach to intervention. This test was the result of over thirty years of work.

The Movement ABC combines quantitative and qualitative assessment preserving all the advantages of a formal standardised test. It comprises of four sets of eight tasks, each set designed to be used within four different age bands ranging from 4 - 12 years. The test may be administered by a wide range of professionals without specific training in the test and is already being used in a range of settings by a variety of professionals. The user manual, which accompanies the test materials, includes constructive comments on the assessment package from a range of professionals. These include, a Consultant paediatrician, Occupational Therapists, a Physical Education Teacher, a Specialist Teacher, Research psychologists, Professor of Kinesiology, and a Physiotherapist. They note some strengths and weaknesses of the test as identified from their practical experience. The strengths noted include: the fact, that in addition to producing quantitative scores, one looks at outside factors affecting performance; the relatively short administration time; the portability of the equipment; and the ease of assembly; administration is not dependant on extensive clinical expertise; it is useful in monitoring progress; valued for the normative data it provides; it covers the complete age range of primary school children; useful to organise informal observations and is internationally recognised. Some of the shortfalls include: the fact that some users felt that the test required additional methods of assessment; its failure to measure one or two aspects of motor development, such as reaction time and the ability to perform simultaneous movements; and also a lack of perceptual motor ability testing.

However, overall the comments were very positive indeed, all expressing appreciation to the authors for developing such a test to address this vast area of need. The Movement Assessment Battery for Children appears to be a very useful simplified tool for the identification of areas of movement difficulties and monitoring progress when providing intervention. To administer the test does not require extensive training therefore allowing wider application. It allows freedom to investigate a number of channels when

considering service development, this being particularly important when funding and resources are limited. However as noted earlier, the use of an appropriate methodology for assessment should be balanced with an appropriate methodology for intervention.

CHAPTER 2.

Intervention.

INTRODUCTION.

The majority of empirical studies, within the field of motor control and skill development, have not generally included those individuals who have disabilities and who may not have the basic motor skills required to perform everyday tasks. When this group is included we are considering a continuum of motor abilities. At one end of the continuum are those individuals who are attempting to achieve basic motor skills; for example, feeding and dressing. At the opposite end are those individuals exhibiting a high level of skilled performance; for example, in the field of competitive sport. It is this group of highly skilled performers who are the subjects of the majority of research in motor skill acquisition and development (Schmidt, 1991). Achieving basic motor ability on an individual basis appears to move motor control into a more therapeutic setting rather than a coaching/training setting.

In a therapeutic setting, skill development programmes are referred to as 'intervention programmes', rather than 'training programmes'. Intervention programmes aim to elicit or modify existing motor output in the same way as training or coaching programmes. However, intervention techniques have varied from training/coaching techniques and there is much controversy about the efficacy of current intervention techniques being used with children who have DCD. Much of what is done to try to help these children is not proven (Gordon and McKinlay, 1980). There is little empirical evidence available to aid a therapist to select appropriate techniques or develop an appropriate intervention programme but this has not stopped individuals from attempting to address the problem. The methods of intervention that children with DCD receive appears to vary greatly from area to area within Britain and in some areas, the child's difficulties are not identified and therefore not addressed. Outlined below are some of the intervention approaches currently being applied.

INTERVENTION APPROACHES.

Perceptual motor training - When using this approach the child is encouraged and supported to engage in perceptual motor tasks. The child may work on body image. That is, drawing a man, completing puzzles of faces or figures and imitation of posture. Other skills used include those concerned with spatial awareness, grading, sequencing and sorting. This approach uses the task as a training tool, which is unlike Sensory Integration (outlined below) where it is suggested that these skills would improve automatically following a period of controlled sensory input concentrating on eliciting adaptive motor responses.

Perceptual motor training technique has been used and accepted widely as an effective form of intervention. This acceptance has been generally based on informal subjective evidence rather than formal empirical evidence Kavale and Mattson, (1983). Two Comprehensive reviews by Hallahan and Cruickshank, (1973), Myers and Hammill, (1976) have evaluated perceptual motor training in terms of their methodological soundness. Their conclusions did not favour perceptual motor training but suggested that the published evidence may be misleading because of faulty reporting and unsound methodological procedures. A meta-analysis by Kavale and Mattson, (1983) reviewed 180 studies assessing the effect of perceptual motor training. The main findings indicated that perceptual motor training is not an effective intervention technique for improving academic, cognitive, or perceptual-motor difficulties.

Doman-Delacato Method - This approach arises from the framework of perceptual motor training (Delacato 1959; 1963). Much of this work was done before the present knowledge of the central system (Huss, 1983). This approach assumes that an individuals neurological development parallels the evolution from fish to amphibian, to reptile to

anthropod. Treatment begins with simple patterns of movement utilising the child's existing reflexes and automatic responses. It is a multi-sensory approach and may include stimulation procedures such as brushing, pinching, heat, cold and a breathing exercise routine to increase the vital capacity. An intervention programme based on this approach is administered at least four times per day for 5-45 minute duration, 7 days each week. Each treatment requires at least 3 adults, because each extremity must be manipulated smoothly and rhythmically in the proper pattern (Hudson, Murphy, and Clunies-Ross, 1978).

Hebb's (1949) influence can be seen within the approach, as there is an emphasis on establishing 'memory traces', whilst Kephart's (1960) influence can be seen within the emphasis on motor behaviour and development as a pre-requisite and basis of all other learning. The original practice which focused on children with more severe motor and other handicaps, has more recently become more widely applied to individuals with lesser impairments. In recent years this approach has been widely criticised for its weak theoretical basis (Mc Keith, 1974), treatment methods (Tannock, 1976), restrictions on the child (Hudson et al 19,78) and the demands on the family (Cummins, 1988). Again there appears to be a lack of systematic empirical research to back the claims made for this approach.

Sensory Integration Therapy - This approach is based on the work of Dr. A. J. Ayres (1972) and is derived from the perceptual motor training framework. Ayres noted that the environment provides opportunities for many of our sensory experiences, such as smell, sight, sound, gravity and some touch sensations. The body provides movement/kinaesthetic sensations and touch sensations through movement within our environment. This provides intrinsic, proprioceptive feedback. All of these sensations and the responses to them cause the brain to develop (Ayres, 1979). Ayres hypothesised that

treatment which provided controlled sensory input in association with adaptive motor responses would result in improved processing at sub-cortical level, subsequently influencing cortical function. This treatment was outlined as a promising method for improving the academic scores of children with learning disabilities.

Sensory Integrative Therapy (S.I.) involves sensory stimulation and is completely natural. Ayres believed that interactions with a natural environment provide the sensory stimulation and adaptive responses that are sufficient to develop the brain in most young children, however the development of the brain may have been hindered inutero or in the early years of life. There is particular emphasis on the vestibular and tactile systems. The central idea of this therapy is to provide and control sensory input, especially the input from muscles, joints and skin, in such a way that the child responds spontaneously, forming the adaptive responses that integrate those sensations. This approach is different from other perceptual motor training, in that Ayres suggests that therapy is more effective when the child directs his own actions and the therapist unknowingly to the child, directs the environment, the child is not instructed in routines. Other perceptual motor training relies on the practices of ritual motor movement beginning with simple movements and graduating to more complex movements.

The use of S.I. techniques for children with DCD has proved to be controversial. Recent studies of S.I. effectiveness include a study in Ontario (Polatajko, Law, and Miller, 1991) in which no significant differences were found on measures of reading, writing, fine motor skills, gross motor skills or self esteem between a group receiving S.I. treatment and a group receiving traditional perceptual motor training. Ottenbacher (1982) carried out a meta analysis of eight studies and concluded that empirical support exists for S.I. as an intervention technique however there was no indication that it is superior to other approaches.

Motor learning principles - To date, the motor learning literature has been limited primarily to the consideration of problems in adulthood and studies of highly skilled performance (Schmidt, 1991).

Schmidt (1991) defined Motor Learning as,

> 'a set of processes associated with practice or experience leading to relatively permanent changes in the capability for skilled performance' (p153).

Only recently have theorists attempted to integrate information on studies of normal motor performance with those on apraxia and developmental dyspraxia (Goodgold and Cermak, 1989).

Motor Skill has been described as having three relatively distinct stages (Fitts and Posner, 1967). The first stage being, *the verbal-cognitive stage*, where the learner tries to understand the requirements of the task. The learner establishes a general understanding of the task and develops a cognitive map of the movements most likely to accomplish the goal. The second stage, *the associative stage*, is when the learner now organises more effective movement patterns to produce the action. Through practice and repetition movements become more consistent and there is an increase in efficiency and a decrease in variability. At this stage proprioceptive, intrinsic feedback is thought to become more important and there is a gradual decrease in reliance on visual cues (Goodgold and Cermak 1989). The third stage, *the autonomous stage*, is when the skill becomes automatic. After much practice the learner enters this stage. Here the movement is well developed and occurs with minimal conscious attention (Schmidt, 1991).

Feedback is essential to learning. However, some studies have shown that motor learning

can occur in the absence of intrinsic feedback (Rothwell et al, 1982). This study showed that new motor tasks can be learned while receiving extrinsic visual feedback, however when the visual feedback was removed the subjects performance deteriorated over time. The authors concluded that both extrinsic and intrinsic feedback was needed to inform the central nervous system of the success or failure of the movement.

The Cognitive - Motor Approach referred to in the Movement ABC (Henderson and Sugden, 1992) brings together motor learning theory and the cognitive approach. This model is based on recognition of the interaction of cognitive, motor and affective components of movement acquisition. The authors recognise the importance of conscious problem solving and the child's knowledge and understanding of the learning situation which influences their motor competence and vice versa. This approach recognises the child's emotional state and its interaction with skill development. A child's perception of their motor ability will affect how and if they participate and engage in movement learning. It may also affect their ability to realistically evaluate their own level of competence.

The clinical application of Learning Theory is appearing in the literature formulating physical and motor rehabilitation programmes. A dominant feature in these programmes is that learning is essential to all skill acquisition.

Croce (1989) stressed,

> 'that by understanding how motor skill acquisition is a function of information processing and several phases of learning, instructors can analyse an individuals present level of motor functioning and better facilitate the acquisition of new motor behaviours' (p10).

A predominant feature that runs throughout motor learning theory is that all movements are outcomes of information processing within the Central Nervous System including such processes as perception, cognition and motor planning. In Croce and DePapes' (1989)

critique of therapeutic intervention programming, it is suggested that activities should be purposeful. Only then will they assist the individual to build on their abilities and lead them to goal achievement. They stress that the child must be an active not passive participant in the learning process of rehabilitation. This is reiterated in an article by (Lee et al, 1991) which examines the effects of practice conditions on motor skill acquisition. They argue that the act of repeating a motor action is only a part of the process engaged in during the repetition of an action. The importance of cognitive processes are stressed. Cognitive processes are conscious goal directed thoughts and behaviours which may include decision making, evaluating, and the conscious development of strategies. Bernstein (1967) noted that practice and repetition of an action to achieve appropriate motor output or learned motor skill required the process of problem solving which includes the evaluation of feedback in addition to the development of a new plan in relation to the demands of the next movement task. There is evidence to suggest that considerable learning can occur in the absence of physical practice (Lee et al, 1991) providing further evidence on the importance of the cognitive process in motor learning.

CONCLUSION.

Form the evidence, it would appear logical to apply the principles of motor learning theory within the area of Developmental Co-ordination Disorder (Poole, J. L., 1991). Its application to individuals at this end of the motor ability continuum does require further research. To recognise and highlight the importance of cognition and affective components of learning would appear vital with this group of children. Motor difficulties rarely occur in isolation, in addition children often present low levels of confidence, poor self esteem, and may appear lonely and underachieve in school. It would therefore appear essential to identify a child's abilities which would ensure success in some tasks, and therefore develop self confidence which is so essential to successful learning (Gordon and

McKinlay, 1980; Russell, 1988).

It has been suggested that children with DCD respond better to a stage by stage progression of a prescriptive type of approach until skill and self confidence are gained and they can engage with their peers without fear of being ridiculed (Russell, 1988) and this is in keeping with the cognitive motor approach. There does appear to be a move towards basing intervention programmes on Motor Learning Theory. However, many intervention programmes continue to be based on perceptual motor training alone and as noted earlier there is increasing evidence contradicting the effectiveness of this approach (Kavale and Mattson, 1983), (Ottenbacher, 1982).

Croce and DePape (1989) believe that the keys to successful motor training programmes are repetition, correctly performed practice of functional skills, and sufficient learning time to facilitate skill retention and transfer. Based on existing knowledge, the Cognitive Motor approach would appear to be a most valuable intervention technique. However, further extensive research is required in this field. As noted earlier in this chapter motor learning theory has been developed around elite, highly skilled performers. The true value of this approach when working with individuals at the opposite end of a motor ability continuum needs to be ascertained.

As noted earlier, within the County of Gwynedd there is a need both to investigate the incidence of DCD and to introduce an intervention approach. Assessment using the Movement ABC in addition to the Cognitive Motor approach to intervention are used in a study of children with DCD in this county. The identification and intervention procedures are described in Chapter 3, Methodology: Initial screening, and Chapter 4, Design and Methodology: Intervention. The results of the intervention programme are outlined in Chapter 5, and discussed in Chapter 6.

CHAPTER 3.

Methodology : Initial screening.

INTRODUCTION.

The purpose of this study is to investigate the incidence of Development Co-ordination Disorder in Gwynedd in mainstream schools and to design and evaluate an intervention programme. This chapter presents the initial screening process which was adopted to identify children with movement difficulties.

SOCIAL AND SCIENTIFIC RESEARCH.

There are 4 main groupings of social scientific research as outlined by Kerlinger (1982); laboratory experiments, field experiments, field studies, and survey research. These categories may be derived from two sources, the differences between experimental and non experimental research and those between laboratory and field research. The main difference between experimental/non-experimental, laboratory/field research is "control". To control a research situation is to eliminate the numerous external influences that may influence the study or have an effect on the dependent and independent variables (Kerlinger, 1982).

The present research study is to be carried out in a realistic situation in which subjects will be observed in their natural environment. Where an experiment is carried out in a realistic situation and where one or more variables are manipulated by the researcher the study may be considered a field experiment. Therefore, for the purpose of this study the strengths and weaknesses of field studies must be taken into consideration. Kerlinger (1982) recognises the following three main strengths of field experiments;

1. In a field experiment the variables usually have a greater effect than those of experiments carried out in the laboratory,
2. The effects of distractions in the laboratory are often greater than those in the field situation. The principle being, the more realistic the environment in which the study is carried out the stronger the variables.

3. Field experiments are more appropriate for studying intricate social and psychological influences, processes and changes in realistic, lifelike situations.

As indicated earlier, the weakness in a research study carried out in a realistic situation is lack of "control". Kerlinger (1982) suggests that an important obstacle to be aware of when considering a good design is the attitude of the researcher. The following are examples of negative attitudes: "the administrators or teachers will not allow such an experiment to be carried out in their school", "You will not receive teacher co-operation for that aspect of the study", or "experiments cannot be done on that problem in that situation". Thus it is possible to compromise a good research design before the study even begins. These factors were considered throughout this chapter and subsequent chapters in order to realistically address the issues of the data collection, analysis and review in an objective manner.

THE ASSESSMENT TOOL

Movement Assessment Battery For Children (Henderson and Sugden, 1992).

The 'Movement ABC' (Henderson and Sugden, 1992) is an assessment battery specifically designed to identify and evaluate movement problems that may influence a child's integration in school. It provides screening, assessment and management of movement problems in an integrated package. The Movement ABC has two formats: a teacher checklist and a comprehensive assessment battery.

The Movement ABC Checklist.

The checklist may be completed by an adult familiar with the child's day-to-day motor functioning. There are five parts to the checklist. The first four, look at the child

interacting with his/her physical environment. The fifth part addresses behaviours associated with movement difficulties and this score is taken into consideration when looking at the checklist as a whole. The focus of assessment in each section is as follows;

Section 1. The child is stationary and the environment is stable.

Section 2. The child is moving and the environment is stable.

Section 3. The Child is stationary and the environment is changing.

Section 4. The child is moving and the environment is changing.

Section 5. Behaviours related to physical activity.

There are 12 questions in each section. For each of the 48 questions in sections1-4 there is a choice of four scores which describes how well the child deals with the activity;

0 = Very Well, 1 = Just OK, 2 = Almost, 3 = Not Close.

An initial assessment as to whether the child can or cannot do the task, is followed by consideration of whether they perform it very well or just OK. Scores for each section are then totalled. These four separate scores are then entered in a summary box on the front of the checklist and totalled to present an overall score. In Section five the list of behaviours associated with movement difficulties include: distractible (looks around responds to noises/movement outside the room); lacks persistence (gives up quickly, is easily frustrated, daydreams); overactive (squirms and fidgets, moves constantly when listening to instructions, fiddles with clothes); and implusive (starts before instructions/demonstrations are complete, impatient of detail). There is a choice of three scores which refers to the frequency which the child displays the outlined behaviour:

0 = Rarely, 1 = Occasionally, 2 = Often.

The checklist is progressive in that, the tasks become increasingly difficult. The Checklist is primarily designed as a guide, it is not a standardised test. Henderson and Sugden (1992) suggest that total checklist scores may require very careful and cautious interpretation if the total in section 5 is very high. For example, a very impulsive child may score poorly because of temperament rather than movement difficulties (Henderson and Sugden, 1992).

The checklist may be used as a screening tool to identify 'at risk' children and may also be used to monitor a treatment programme.

Checklist interpretation.

Section 1-4.

> "Table 1 shows two useful cut-off scores for each age group. Higher checklist scores indicate greater difficulties.
>
> The middle column shows the score that marks the boundary for the 5% of the population with the most severe movement problems. This score is equal to, or greater than, that obtained by 95% of the children in the standardisation samples and is therefore quite extreme. The children achieving a checklist score at or above this level can confidently be assumed to require more detailed assessment and some form of special consideration in terms of a management or remediation programme."(Henderson and Sugden, 1992 p26).

The 5th and 15th percentile points for the total scores on the motor component of the checklist are presented in **Table 1.**

Table 1.

Age(years)	5th %ile	15th %ile
6	90	60
7	75	50
8	55	35
9+	50	35

> "The Right-hand column in the table shows the score for each age group that marks the boundary for the highest-scoring 15% of the population. This Score is equal to, or greater than, that obtained by 85% of the standardisation samples. Although it includes children with less severe problems than those identified by the first cut off score, it represents quite a marked degree of movement difficulty. Such children should be considered "at risk" as a result of this assessment." (Henderson and Sugden, 1992 p27).

For the children in the at risk category, the scores should be considered alongside additional information from parents and carers in other situations. A decision should then be made to act immediately or closely monitor the situation.

Section 5.

This section highlights those behaviours which may influence a child's score in sections 1-4. These behaviours may be significant to both the assessment and the intervention plan. Henderson and Sugden (1992) suggest that there are two main questions to consider when looking at section 5:

1. Would this behaviour have prevented the child from demonstrating his/her true capacity?

2.Will this behaviour need to be taken into account in future management or remedial programmes?

The scores in section 5 are not summed. The assessor must apply questions 1 and 2 and consider by comparison with other children whether these behavioural factors have a high, medium or low significance. The checklist may be used for initial screening purposes but the Movement ABC Test provides more objective data on the child's performance.

The Movement ABC Test.

For the purpose of this study, the Movement ABC test was used as the screening tool to provide more objective data on a child's performance. The test comprises of four sets of eight tasks, each set designed to be used with four different agebands ranging from 4-12 years. The test provides a comprehensive practical assessment to identify those 'at risk', yielding both quantitative and qualitative measures of movement competence in the areas of Manual Dexterity, Ball Skills, Static Balance and Dynamic Balance. The test scores indicate the extent to which a child falls below the normative levels of his or her age peers. No attempt is made to differentiate between children who perform above this level. Age norms are provided for children aged 4-12 years and are based on a representative sample of over 1200 children. Administration of the test takes from 20 to 40 minutes per child. The testing procedure for ageband 2 is outlined in Appendix B. The recorded scores for each of the eight tasks are transformed to a score of 1-5 on the record sheet provided with the assessment battery and then totalled giving an overall score. This score is then interpreted against the percentile norm tables as outlined on page 109 of the movement ABC manual (Henderson and Sugden, 1992).

The Movement ABC may be administered by various professionals with a wide range of expertise and experience. In its standard format, no special training or knowledge is required, except a basic knowledge of the general procedures of standardised testing and some experience of working with children, especially pre-school children and children with special educational needs. To use the Movement ABC Test with qualitative observations requires skill and experience in observing children. It requires the ability to note subtle behavioural characteristics of emotional stress and poor motivation, as well as an awareness of the children's ability to adapt and cope with their difficulties. These skills, for some professionals, in both the educational and medical fields, may be developed during their training, but for others additional training may be required.

The Subjects.

The subjects for this investigation were 7 and 8 year old boys and girls in mainstream primary schools in the county of Gwynedd, North Wales. A list of all the primary schools in Gwynedd (n = 200) was obtained from the Local Education Department, from which a random sample of 5 schools was selected. Initial contact was made with all the primary schools by a letter circulated through the Education Department's mailing system.

All correspondence was in both Welsh and English, adhering to the Local Authority's bilingual policy and translation was carried out by the translating department within Gwynedd County Council. There were some minor difficulties with the translation of some of the terminology from within the field of motor control, as direct translation did not always reflect the meaning. The assistance of bilingual professionals working in the field was required to proof read all translated material and note discrepancies. Clarification and correction of these discrepancies proved to be a time consuming process.

Initial correspondence was addressed to the Head Teachers. It explained the researcher's role, the purpose of the assessment and requested permission to assess 7 and 8 year olds in his/her school. The letter included a brief description of the assessment and a return slip which allowed the Head Teacher to agree, disagree or request further information (see Appendix A). A stamped and addressed envelope was enclosed, for further correspondence. A specific date by which the reply slip should be returned was included to ensure a maximum return rate. **Table 2** outlines a breakdown of the replies and the response rate.

Table 2..

Response Rate.

Total Number of Letters sent	n = 200
Schools requiring additional information	n = 6
Schools who replied NO.	n = 19
Schools who replied YES.	n = 89
Total number of replies-	114
Response Rate-	**57%**

A list of schools who had agreed to be included in the testing was drawn up and numbered and 5 schools were randomly selected from which eleven classes of 7 and 8 year old boys and girls were assessed.

Total number of boys = 95

Total number of girls = 88

Total Number of children assessed = 183.

The head teacher of each school was contacted to arrange a meeting to discuss the assessment procedure in more detail and make the necessary arrangements to proceed with the practical assessment. Three out of the five schools were happy for the assessment to begin immediately and the other two schools requested written parental permission for each child being assessed. The assessment was initiated in those schools not requiring written parental permission. Bilingual letters requesting parental permission were forwarded to the parents within the remaining schools prior to the intended period of assessment (see Appendix A). No parent objected to their child being a subject for the test.

Child Testing.

Each school made available a suitable area for the practical assessment to be carried out. All children in each school aged 7 or 8 during the period of testing, were tested. This proved to be a lengthy process, each child taking approximately 30 minutes to assess. Time was often lost accommodating the school timetabled programme and by the limitations of having shared access to the allocated testing area. Each child was tested and assessed in the areas of *Manual Dexterity, Ball Skills, and Static and Dynamic Balance,* in the relevant age band. The three skill areas tested (Age band 2; 7 and 8 years) are outlined below:

Manual Dexterity:

(a)Placing pegs - The child was timed placing 12 pegs in a peg board with 16 holes. Both hands were tested.

(b)Threading Lace - The child was timed threading a lace back and forth through a lacing board.

(c)Flower Trail - The child was expected to draw one continuous line following a pre-defined trail without crossing the boundaries.

Ball Skills:

(a) One hand Bounce and Catch - The child was asked to bounce the ball on the floor and catch it with the same hand. Both hands were tested.

(b) Throwing Bean Bag into Box - The child was requested to throw a bean bag into the target box with one hand. Only one hand is tested.

Balance:

(1)Static Balance.

(a)Stork Balance - The child was requested to stand on one leg with the sole of the other

foot against the side of his/her knee. The hands are on the hips with the fingers to the front. Both legs are tested.

(2)Dynamic Balance.

(a)Jumping in Squares (6 adjacent squares each measuring 18x18 inches) - The child was requested to make five continuous jumps forward from square to square with feet together, stopping inside the last square. The child starts this test standing in the first square.

(b) Heel to Toe Walking - The child was requested to walk along a taped line of 15 feet, placing one foot in front of the other placing the heel of one foot against the toe of the other foot.

The Jumping in squares task was taped on a length of carpet, six adjacent squares each with an inside measurement of 18/18 inches. The carpet could then be transported from venue to venue, saving time and allowing greater flexibility in the use of space.

The test was administered in accordance with the standardised testing procedures as specified in the Movement ABC manual. The specific instructions for administration of the tests are outlined in Appendix 2 and taken directly from the assessment battery manual (Henderson and Sugden, 1992). See Movement ABC Instruction Manual for scoring details. A summary of quantitative initial screening data is presented in Appendix C.

For the purpose of this study the main focus is on the quantitative data rather than qualitative observations due to the limitations of the researchers previous experience in observing children. The most important score from the test is the total impairment score which reflects performance on the test as a whole. This score is then interpreted against the percentile norm tables. A complete table of the norms are outlined on page 109 of the Movement ABC manual (Henderson and Sugden,1992). **Table 3**, below notes the cut off

points which are considered to be the most useful.

Table 3.

The 5th and 15th percentile for age band 2, (7 and 8 year olds).

	5th %ile	15th%ile
Age 6 and above	13.5	10.0

Total impairment scores below the 5th percentile (i.e. children with scores > or = 13.5) is indicative of a definite motor problem. Scores between the 5th and 15th percentile (i.e. > or = 10 and <13.5) is indicative of a level of difficulty that may be considered borderline. Further information on the effect of these difficulties on the child's development would be required in order to make a decision as to whether immediate additional help or ongoing monitoring is required for the child.

A total of 183 children were assessed, 11 children were identified as having a definite motor problem and 11 as being in the borderline category. It was not practical to include all these children in the intervention programme due to the size of the county. From this group, nine children were selected with higher scores (indicating poorer ability), two children from school No.5., three children from school No.3, and four Children from school No.4.This group of nine were further divided into two groups:

Group 1. Children who would receive intervention from the researcher and

Group 2. Children who would receive intervention from their class teacher.

Intervention plans for all children were compiled by the researcher.

CHAPTER 4.

Design and Methodology: Intervention

DESIGN

Much of the research within fields such as clinical psychology, education, psychiatry, and counselling has been carried out using between group research design. There are many requirements of between group designs that are not always possible to meet in the above applied clinical fields, such as homogeneous groups of subjects, standardisation of treatments, and random assignment of subjects to groups (Kazdin, 1982). In many settings, the focus of intervention may be directed to only one or a few individuals.

Single case research design enables the researcher to carry out experimental investigations with one subject. The term single case however does not necessarily mean only one subject is included in the design. Many 'single case' designs have included thousands of subjects (Kazdin, 1982). These designs can be used to evaluate the outcomes of interventions applied to large groups or questions posed in between group research. However, their distinguishing attribute is that the design provides a strict framework from which one can evaluate intervention effects with the individual.

For the purpose of this study, the researcher was concerned with the effect of applying an intervention to the subjects identified from the ABC screening as having difficulties in the area of motor control. The researcher selected a 'multiple base line single case design' for use with these subjects. Multiple baseline designs demonstrate the effects of an intervention by presenting an intervention to each of several different baselines at different points in time (Kazdin, 1982). If there is a change in the baseline when the intervention is introduced, this change can be ascribed to the intervention rather than other incidental events.

Multiple Base-line Designs may be used to look at different baselines, for example, different behaviours within the one individual (*Multiple Base-line Design Across*

Behaviours), or an identified behaviour across a number of individuals (*Multiple Base-line Design across Individuals).*

Multiple Base-line Design Across Individuals was selected for the purpose of this study. Baseline data was gathered, that is, weekly Movement ABC scores for the eight subjects identified above (two groups of four subjects). A minimum of six ABC scores were collected prior to applying the intervention within both groups. The intervention was applied to only one subject at a time while the others continued in base-line conditions. A further individual was exposed to intervention each week thereafter until each child was receiving intervention.

The effect of the intervention is shown when a change occurs in performance at the point where intervention is initiated and not before. Kazdin (1982) suggests that ambiguity can occur from several sources when drawing conclusions about intervention effects using this design. These uncertainties can result from the interdependence of individuals or situations and inconsistent effects of intervention on different individuals.

Practical and methodological difficulties may occur when intervention is withheld from individuals for a period of time, ethical issues may also arise. Where there is great variation in behaviour it may be difficult to determine an appropriate time to initiate intervention. This design meets the demands of many applied settings, however it is important to be aware of the above ambiguities. Some steps can be taken to reduce these ambiguities. There is no need to reduce or temporarily withdraw treatment for the purpose of this design as prolonged baselines can be avoided by utilising short baseline phases or short time lags before introducing intervention to the next subject.

DATA EVALUATION.

Investigations carried out in the applied field use experimental and therapeutic criteria to evaluate data (Risley, 1970). *Experimental Criteria* include methods of evaluating the data to assertain whether or not the intervention has had an effect. Visual inspection of graphic presentation of the data and statistical tests to appraise the reliability of the findings are applied. Visual inspection is the primary method of data evaluation for single case research (Kazdin, 1982). *Therapeutic Criteria* evaluate whether or not the findings, that is, the effect of intervention, is indeed significant within the applied setting. The findings may indicate change following a period of intervention however the change may not have made an important difference in the client's lives. Therefore clinical or applied research has two requirements for evaluating data calling upon both experimental and therapeutic criteria.

Visual inspection.

Judgements are made by examining the effects of intervention at different points over time, examining the overall pattern of a graphical presentation of the data to judge whether or not the pattern infers a relationship. This examination is clearly open to subjectivity and researcher bias. Kazdin (1982) suggests that this method of evaluation can be used because of the nature or type of effects that are looked for in applied research. The researcher within the applied setting searches for intervention that causes an effect that is obvious and therefore can be seen clearly from visual inspection of the data (Baer, 1977; Michael, 1974; Sidman, 1960). This may suggest that only powerful interventions that produce reliable effects can be identified using visual examination. This technique may put at risk the identification of interventions that cause smaller effects and this may be a disadvantage, as a weak intervention may be developed to the point that major effects are produced (Parsonson and Baer, 1978).

There are many characteristics of data upon which visual inspection depends. Of particular importance are those that relate to *magnitude* of change across phases and the *rate* of these changes. Mean and level relate to magnitude of change and trend and latency refer to rate of change. *Changes in means,* refers to a change in the average performance across phases. *Changes in level,* refers to a change from the end of one phase to the beginning of the next phase. Changes in mean and level are independent of each other. *Changes in trend* refers to a change in the systematic slope or trend of the data over time. *Latency of change* refers to the time lag between initiation or cessation of one condition and changes in performance, for example, baseline phase to intervention phase. Kazdin (1982) suggests that the sooner that change occurs after altering the conditions, the stronger the argument for intervention effect.

There are other characteristics that must be taken into consideration when carrying out visual inspection; the reliability of the assessment data as well as other factors, such as variability in performance within a particular phase, the length of a phase and the consistancy of effect. The use of visual inspection alone may raise major concerns, particularly when intervention effects are not clearly identifiable from graphic displays. This method of evaluation is clearly open to inconsistency of interpretation and problems of subjectivity. In addition, to overlook weak yet consistent effects may have adverse outcomes. In situations where visual inspection is difficult to apply statistical analysis may be of use.

Statistical Investigation.

For single case experiments, visual inspection continues to be the most frequently used criterion. However as this approach has extended to human behaviour and the applied fields, a variety of population settings and complex situations arise. As noted earlier, one of the main weaknesses of field research is that of lack of 'control'. In many situations the demanded criteria for visual inspection cannot be met and a further means of analyses is required. Statistical analysis may be used to compliment or replace visual inspection. Many researchers have objected to using statistical tests, which are likely to detect minor changes that in the main would be rejected by visual inspection. These researchers appear to indicate that the main goal of applied research is to identify potent variables for which only visual inspection is required (Kazdin, 1982). Another area of objection to the use of statistical analysis is that the development of statistical tests for single case research has fallen behind the development of appropriate tests for between group research.

Occasionally, the assumptions upon which the various between group tests depend have been abused in order to apply them to single case research data. It therefore has been suggested that in these cases statistical analysis may compliment visual inspection.

Reasons for using statistical tests.

Unstable baselines,

Stable baselines may not always occur and visual inspection depends upon having them. For example, should the baseline systematically improve, statistical analysis may evaluate the effect of intervention by examining the intervention phase taking into account the initial trend of the baseline.

Small Changes may be important;

For selected problems small changes may be particularly important. For example, interventions applied to reduce crime may not need to be of large effect to be of vital importance (Schnelle, Kirchner, McNees, and Lawler, 1975). In many new areas of applied research it may be important to discover relatively weak intervention effects in order to initiate the exploration and further development of the intervention technique.

Large intrasubject variability.

Where control over the environment and other influences on the behaviour is reduced larger variability in subject performance may occur and statistical investigation may be necessary.

Tests available for the 'single case' researcher.

Statistical tests are numerous and quite diverse in their assumptions however their application to single case research continues to remain infrequent. Their computations, assumptions and appropriateness to single case designs places demands on the researcher. The researcher must be aware of the issues that may arise in their application to single case studies.

Selected statistics for single case experimental designs (Kazdin, 1982).

> *Conventional t and F tests* may be applied to the data, they are especially suited for detecting change from one phase to another in which data for a single subject do not show serial dependency; They are suited to ABAB, multiple baseline and other designs in which separate phases can be identified. This test evaluates whether there is a significant change in mean from one phase to the next. There must be observation phases, equal numbers of observations are required if data is to be matched in some way across phases to make comparisons. Evidence should be included that serial dependency does not exist before proceeding with the analysis,

(Jones, Weinrott, and Vaught,1978; and Kratochwill and Wetzel, 1977).

Ra, test of rank is especially suited to multiple baseline designs in which the influence of the intervention on different behaviours, persons, or situations is examined. The test evaluates whether performance changes at each point that the intervention is introduced relative to base lines that have yet to receive the intervention. Each baseline serves as an AB experiment. All baselines are ranked in terms of the magnitude of the behaviour at each point that the intervention is introduced to a new baseline. The ranks refer to the position of the behaviour that has received the intervention relative to the others that have not. If implementation of the intervention is associated with behaviour change, the sum of ranks of the different baselines should reflect this change. The underlying rationale of the test depends on applying the intervention to the different baselines in a random order. Also a minimum requirement to detect a significant difference at $p<.05$ level is four baselines, (Kazdin, 1976; and Revusky, 1967).

The Split Middle technique examines trends in two or more phases as in ABAB, multiple baseline or other designs. The rate of change in behaviour over the course of different phases is examined by plotting linear trend lines that best fit the data. A line is plotted that divided or splits the data at the median level in each phase. This line expresses the rate of change over the course of the phase. The technique is usually advocated as a method to describe data across phases Stastical evaluation has been recommended by projecting the linear trend line of baseline into the intervention phase. A binomial test is applied to see whether the number of data points in the intervention phase fall above (or below) the projected line of the baseline. Several observations are needed in two or more separate phases to compute trends. Observations should be equally spaced intervals in each phase, **(p246).**

METHOD.

Subjects.

From the 183 children assessed 22 children were identified with ABC test scores of 10 or above. Of this group of 22, 11 children had scores of 13.5 or above.

Table 4, presents those children who scored >= 10 and the school attended.

Table 4.

Children with scores >= 10.

School No.	Child No.	Score.
1	1	19.5
2	12	13
3	20	13
3	24	10.5
3	36	14.5
3	43	11
3	50	10.5
4	72	26
4	84	11.5
4	85	19.5
4	107	13.5
4	117	10
4	119	14.5
4	126	16.5
4	127	16
4	128	13
4	130	15
5	139	11.5
5	142	14
5	148	10
5	158	16.5
5	171	10

Prior to final selection, and further communication with the school authorities, child No. 107 had left the area. Children No's 119 and 126 were also eliminated from the final sample, although they did not score well on their first attempt at the ABC, the author from experience noted that the presentation was clearly not a motor problem. During the

assessment child No. 119 was very giggly on the first attempt, child No.126 appeared very underconfident and shy on first attempt however, given a second attempt, both children performed very well. The class teachers had not identified any difficulties in the area of motor ability and in fact had noted that both girls performed very well in this area. Of the other children identified the class teachers had not previously identified particular motor difficulties but recognised problems when particular areas of difficulty were highlighted by the test. A further two children from the borderline category were included in the intervention, both in School No. 3 (children No's 20 & 43) as these children had been identified by the class teachers as having some difficulties.

Of the remaining eight children in the 'definite problem' category, Child No.1 from School No. 1 lived too far from the researcher to be included in a regular intervention programme or to receive regular monitoring. The researcher met with the class teacher and one of the child's parents as both had recognised motor problems prior to ABC testing. A copy of the test was given to the headteacher and an intervention programme for school and home was provided. Both school and parents were to monitor progress and take further action through the existing channels if no improvement was observed.

A single case study multiple base line research design was adopted for the remaining nine children. Unfortunately prior to its initiation child No.127 had been expelled from the school and would not be returning. The remaining eight children were divided into two groups. Three children would receive intervention from the researcher and a support worker as a small group, weekly for forty/forty five minutes per week. Five children would receive intervention prescribed by the researcher but carried out by the class teacher. The teachers agreed to carry out the perscribe activities twice weekly. The scores of all other children in the borderline category were brought to the attention of the relevant headteachers who agreed to monitor the situation and take further action through

the existing channels should the need arise. Copies of the assessments were offered to the headteachers. The researcher spoke with each teacher individually outlining the difficulties as indicated by the movement ABC test. The approach that was to be adopted in the intervention was verbally outlined and discussed. Each teacher commented on the type and frequency of the activities they could realistically include as part of the curriculum. Each headteacher accepted the responsibility of discussing the details of the assessment and intervention with the relevant parents.

Each child's strengths and weaknesses were noted from the test scores looking at the three skill areas of Manual dexterity, Ball skills, and Static and Dynamic Balance. The programmes were designed to give the child a varied range of experiences. Activities concentrating on particular areas of weakness for each individual child were included alongside ongoing continuous task analysis to ensure that the activities were adapted for the child and thereby ensuring success.

The intervention activity charts carried out by the researcher and the assistant can be seen in Appendix D. The following is an example of an activity programme for child No. 72 who presented as having difficulties across all three movement areas.

Child No. 72, School No. 4, Week No. 1.

Intervention was initiated following 7 baseline assessment scores.

Activities.

Manual Dexterity

*Threading - Bobbins on Laces. Thread bobbins on lace matching colour, alternating colour etc.

*Dot-to-Dot pictures. Ask the child to complete the first 5 dot-dot pictures in the book provided.

Ball skills.

*Bouncing and catching - ask the child to bounce and catch the ball on his own.

*Throwing and catching - ask child to throw to the other person and bounce to the other person.

Static and Dynamic Balance

*Wobble board. - Ask child to remove shoes and socks and attempt to stay on the wobble board, encourage the child to shift his/her weight from one foot to the other.

*Stepping crossing mid line. - TIP_TOE PATH, Walk on tip-toes, matching feet to the toe prints on the rug. If the child places a wrong foot on the print, do not correct him. Simply ask, 'Does your big toe match the big toe on the rug?'

-SIDEWAYS CROSS-OVER, stand on the first two black feet. Do this slowly and accurately as precise landing on the target foot prints greatly increases the difficulty. Now lift the left foot over the right and place it on the adjacent redfoot print. Next take the right foot off the black print and move it to the right red foot print. Continue crossing one foot over the other to the end of the line.

NOTE (ignore little and big cross over section of the mat for this session)

EQUIPMENT.

Bobbins and laces.

Dot-to-dot book

Yellow therapy Ball.(a)

Wobble Board.(a)

Crossing Mid-line rug.(a)

(a) equipment available from Nottingham Rehab.

Teacher intervention programmes.

The activities for each child were identified as above, however the programme was restricted depending on what the teacher felt could be included during a normal week. All teachers requested the researcher to minimise the amount of paper work expected of them. The following is an example of a teacher intervention programme for child No.43. The subsequent record sheet was provided with the activity programme each week. (The remaining teacher intervention programmes are presented in Appendix D)

Manual dexterity.
Bolts on nuts.-removing and placing against time.

Activities for the writing hand.
*Stand at arm distance away from the wall. Lean on the wall, with the hands flat on it. Keeping the arms straight, use fingers to push away from the wall to get to an upright position. As the child becomes more proficient, move the feet backwards so that there is a greater angle of lean against the wall.
(minimum 20 times.) Record degree of difficulty for the child, observations on fluency of movement.
*A bandage is laid out across the table the child sits at the table trapping the end of the bandage between the wrist of the writing hand and the edge of the table. Using fingers only, try to gather the bandage under the hand.

As the child progresses she can be timed, this time can be recorded and the child attempts to beat these times during subsequent attempts.
Ball Skills.
Throwing and catching balls / bean bags of different sizes through a suspended hoop. 5/10 mins.

Throwing balls / bean bags items of different weights into a box or other suitable target placed at a distance from the child that will ensure success. 5/10mins.
Balance.
*Bunny jumps.--- Crouch down, place hands a shoulder width apart, and kick feet in the air. Ask the child to keep their feet in the air as long as possible.
(minimum-20 jumps)

*From a crouch position, with hands flat on the ground, try to touch a ball with the forehead without moving it . The ball is placed slightly in front of the hands. Start with a large ball progressing to a tennis ball. (5 mins)

Record-size of ball being used and degree of success.

Notes.

Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out, when, for how long and any other comments you may have.

Thank you for your continued support.

Diolch yn fawr iawn.

Example of Teacher record sheet.

RECORDING.

(Please record, the activities the child has engaged in from the programme each week. Please note time taken where indicated and any other observations you may have. For the purpose of this study it is important to note if there has not been an opportunity to carry out these activities, should this be the case.)

CHAPTER 5.

RESULTS.

INTRODUCTION.

This Chapter will be presented in two parts; **PART 1: INITIAL SCREENING** and **PART *2:* INTERVENTION RESULTS.** Part 1 is based on the data collected from the initial screening process of 183 children using the Movement Assessment Battery for Children (Henderson and Sugden, 1992) see Appendix C. The analysis applied will identify if, like other areas in Britain there are children in Gwynedd who have movement difficulties and investigate some associations within this sample. Part 2 is based on the data collected from eight children who were identified as having motor difficulties and who subsequently were subjects of the intervention programme, see Appendix E. The effects of the intervention programme will be evaluated on an individual basis and across the group as a whole.

PART 1: INITIAL SCREENING.

The data was addressed as follows:-

* Firstly an initial descriptive analysis was carried out to establish an overview of the population and enable the identification of those subjects with motor difficulties.

* Secondly, Chi Square Analysis was applied to measure associations between incidence of motor difficulty and school attended, incidence and gender, and incidence and handedness. As outlined previously, the literature suggests that incidence is not related to variations in stimulating environments. The research literature also suggests that there is a higher incidence of motor difficulties in boys than girls. However there appear to be no studies exploring the incidence of motor difficulties in relation to handedness.

INITIAL ANALYSIS.

As an initial step in organising the data, a descriptive analysis provided information as outlined in **Tables 5-10.**

Gender, School Attended and Hand Dominance.

Of the one hundred and eighty three children assessed (within the 7-8 age band), eighty eight of the children were boys and ninety five were girls, see **Table 5**.

Table 5.

Frequency and percentage of children in relation to gender;

gender	Frequency	Percent
male	88	48.10
female	95	51.90
	183	**100.00**

The size of the schools varied greatly, the smallest school having seven children in this age band and the largest school having sixty four children in this age band, see **Table 6.**

Table 6.

Frequency and percentage of children in relation to School;

Schools	Frequency	Percent
1	9	4.90
2	7	3.80
3	55	30.10
4	64	35.00
5	48	26.20
	183	**100.00**

Of the children assessed 85.2% were right handed and 14.8 % were left handed, see **Table 7**.

Table 7.

Frequency and percentage of children in relation to hand dominance;

Hand	Frequency	Percent
right	156	85.20
left	27	14.80
	183	**100.00**

Of the twenty seven children who were left handed, ten were boys and seventeen were girls.

Sub Total Scores.

Tables 8, 9 & 10, (p 66) pertain to the 'sub total' scores of the Movement ABC. As detailed previously, the Total ABC score is made up of three sub-total scores; Manual Dexterity, Ball Skills, and Balance. The Manual Dexterity sub total is made up of three tests, the Ball Skills sub-total is made up of two tests and the Balance sub-total is made up of three tests. The higher the score the poorer the ability. The total ABC score is the sum of all three sub-totals.

Table 8, presents the number, percentage and cumulative percentage of children in relation to their sub total scores in 'Manual Dexterity', (sub total 1). The highest score possible in this sub total is 15.

Table 9, presents the number, percentage and cumulative percentage of children in relation to their sub total scores in 'Ball Skills', (sub total 2). The highest score possible in this sub total is 10.

Table 10, presents the number, percentage and cumulative percentage of children in relation to sub total scores in 'Balance', (sub total 3). The highest score possible in this sub total is 15.

Table 8. Sub total 1- Manual Dexterity.

Frequency and percentage of children in relation to sub total scores;

Sub-total 1	Frequency	Percent
0.00	15	8.20
0.50	3	1.60
1.00	17	9.30
1.50	5	2.70
2.00	23	12.60
2.50	8	4.40
3.00	24	13.10
3.50	8	4.40
4.00	21	11.50
4.50	14	7.70
5.00	9	4.90
5.50	6	3.30
6.00	9	4.90
6.50	5	2.70
7.00	4	2.20
7.50	4	2.20
8.00	2	1.10
8.50	1	0.50
9.00	1	0.50
9.50	2	1.10
11.00	2	1.10

Table 9. Sub total 2 - Ball skills.

Frequency and percentage in relation to sub total scores;

Sub-total 2	Frequency	Percentage
0	58	31.70
0.5	36	19.70
1	31	16.90
1.5	11	6.00
2	10	5.50
2.5	5	2.70
3	6	3.30
3.5	8	4.40
4	2	1.10
4.5	6	3.30
5	2	1.10
5.5	3	1.60
6.5	1	0.50
7	1	0.50
8	2	1.10
10	1	0.50

Table 10. Sub total 3 - Balance.

Frequency and percentage in relation to sub total scores;

Sub total 3	Frequency	percentage
0.00	79	43.20
0.50	27	14.80
1.00	21	11.50
1.50	14	7.70
2.00	12	6.60
2.50	7	3.80
3.00	6	3.30
3.50	2	1.10
4.00	4	2.20
4.50	4	2.20
5.00	1	0.50
5.50	1	0.50
6.00	2	1.10
6.50	1	0.50
7.00	1	0.50
9.00	1	0.50

FREQUENCY AND PERCENTAGE IN RELATION TO ABC SUB-TOTAL SCORES.

It is interesting to look at the frequency distribution of children in relation to sub total scores. If, for example, we take the median in each sub total as a cut off point then in sub total 1, approximately 80% of the children have a score < or = the median (5); in sub total 2, 94% of the children have a score < or = the median (3.75), in sub total 3, 93% of the children have a score < or = the median (3.75), (see **Table 11.**) This spread of scores will be commented upon in the discussion chapter.

Table 11.

Cumulative percentage of children who scored < or = the mean of each sub total;

Sub total	Median	Cum' percentage
Manual Dexterity	5	80
Ball Skills	3.75	94
Balance	3.75	93

ABC Total Scores.

Table 12. Total ABC scores.

Frequency and percentage in relation to, total scores below the 15th%;

Totals	Frequency	Percent	Cum/percent
Borderline			
10.00	3	1.6	
10.50	2	1.1	
11.00	1	0.5	
11.50	2	1.1	
13.00	3	1.6	
	11	**5.9**	
At risk			
13.50	1	0.5	
14.00	1	0.5	
14.50	2	1.1	
15.00	1	0.5	
16.00	1	0.5	
16.50	2	1.1	
19.50	2	1.1	
26.00	1	0.5	
	11	**5.8**	**11.7**

Table 12 presents the number, percentage and cumulative percentage of children in relation to their overall total ABC scores; 11 of the children fall within the borderline category and 11 children are in the at risk category. These 22 children account for 11.7% of the sample group. The 11 children identified in the at risk category, who are considered as having a definite motor problem, account for 5.8% of the sample group, this is consistant with literature reporting 5% incidence in the normal population (Sugden and Wann, 1985). **Figure 1,** (page 69) presents a histogram of the distribution of the total ABC scores.

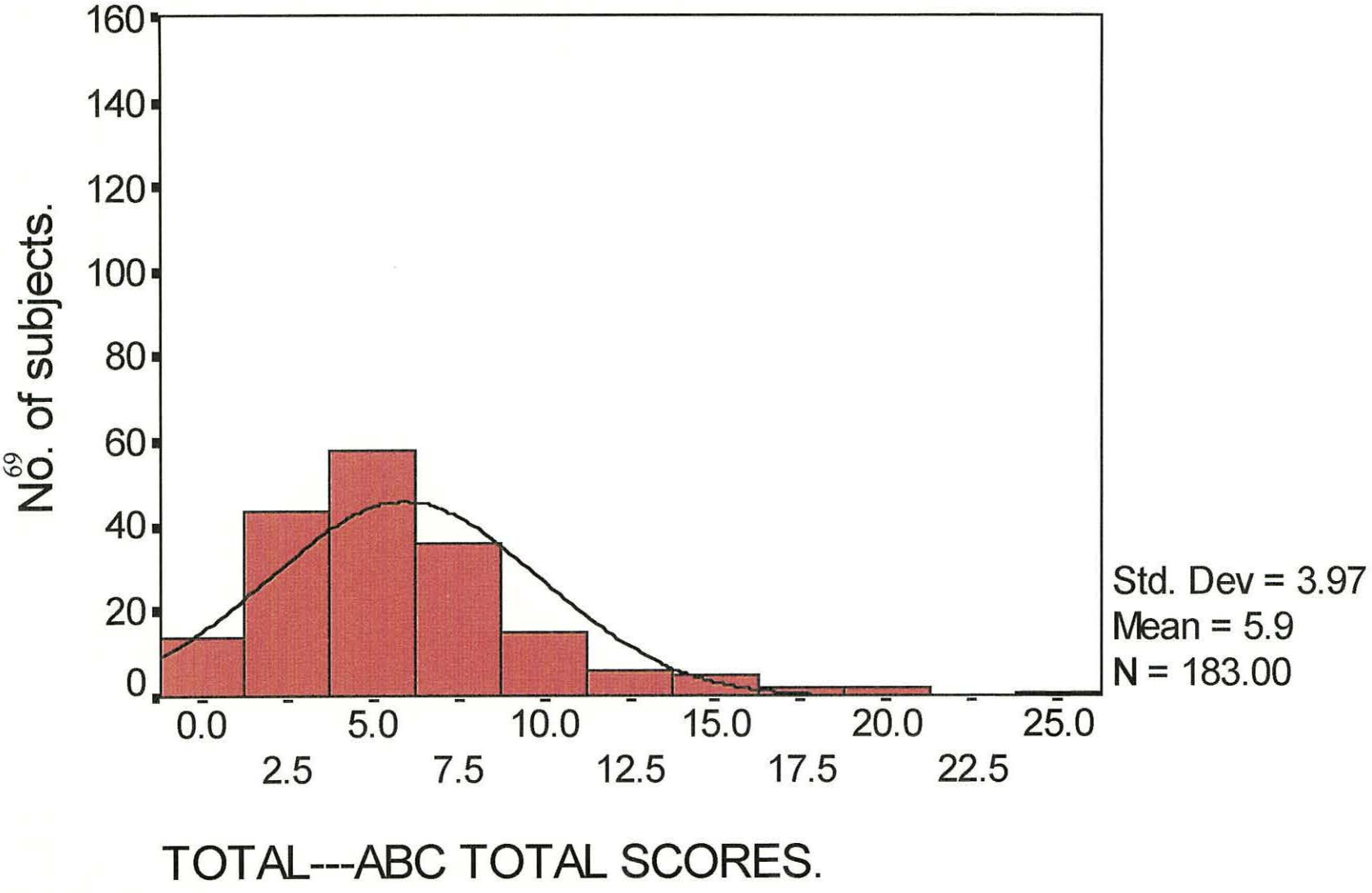

No. of subjects.
160
140
120
100
80
60
40
20
0
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
Std. Dev = 3.97
Mean = 5.9
N = 183.00
TOTAL---ABC TOTAL SCORES.

Figure 1.

Having identified the children in the borderline and at risk categories, further questions can now be addressed;

- is there a significantly higher number of children with difficulties in a particular school?
- is there a significant difference between the incidence in boys and the incidence in girls?
- is there a significant difference between the incidence in left handed children and right handed children?.

CHI SQUARE ANALYSIS.

The data was further analysed using Chi square as a measure of associations. As no assumptions were made about the distribution of the variables within this population, Chi square was selected as a non-parametric statistic to compare the actual frequency in each group with the expected frequency. The data meets the assumptions underlying Chi Square. The data is a count of the number of subjects in each condition and no subject is in more than one cell.

The number of subjects available for this study was 183 which may be considered quite a large sample. However, the incidence of children who are identified as being in the 'at risk' category (that is, having a definite motor problem) is quite low. These limitations are highlighted in the interpretation of results. When applying Chi Square to a relatively small sample group resulting in the expected frequency being < 5 in any one cell, the sampling distribution for chi square may deviate substantially from normal. Although nominal data are used to calculate a chi-square, chi square values have a continuous distribution. To overcome this difficulty the *Yates Correction* was applied. The subjects were regrouped into smaller categories to reduce the number of cells in the analysis, (Munro and Page, 1993). The total ABC scores were categorised into two groups; that is, Group 1, children with total ABC scores 0 through 9.5 (no problems identified); and Group 2, children with

total ABC scores 10 through highest (those considered borderline and at risk).

Table 13 presents the results of the subsequent Chi square analysis of School by the Total ABC scores.

Table 13.

Chi square analyses of Schools by ABC total scores, groups 1 and 2.

ABC groups;

		1	2	
Schools;	1	8	1	
	2	6	1	
	3	50	5	
	4	54	10	
	5	43	5	
Column total.		161	22	**183**

Chi- square.	value	DF	Significance
Pearson	1.390	4	.846

Minimum Expected frequency- .842

Cells with expected frequency <5 - 2 of 10 (20%)

Statistic	Value	Significance.
Phi	.087	.846
Cramer's V	.087	.846

There is no significant relationship between total ABC scores and individual schools, (see **Table 13**) however there continues to be 20% of the cells with an expected frequency less

than 5.

The schools were regrouped as far as possible demographically into Rural Schools, group A, and Large town schools, group B. The Chi square result is outlined below in **Table 14.**

Table 14.

Chi square analysis of school groups A and B by ABC total scores, groups 1 and 2

		ABC groups		
		1	2	
schools	A	64	7	
	B	97	15	
Column Total		161	22	**183**

Chi- square.	Value	DF	Significance
Pearson	0.513	1	.474

Minimum Expected Frequency - 8.536

Statistic	Value	Significance.
Phi	.053	.474
Cramer's V	.053	.474

Again there was no significant relationship between the type of school and ABC total score. It should be noted that within the County of Gwynedd the catchment area for all five schools may include a rural aspect. It is therefore appropriate to have a further look at **Table 13** and acknowledge that 20% of the cells have an expected frequency of less than 5. The non significant result in this case may not be strong, however it is in keeping

with literature to date which does not suggest that there is an association between the incidence of motor difficulties and school attended. A larger sample group may have overcome this difficulty and given greater strength to this result.

Table 15 presents a chi square analysis of gender by ABC total scores. There was no significtant relationships between ABC total scores and gender.

Table 15.

Chi square analysis of Gender by ABC total scores groups 1 and 2;

		ABC groups, 1	2	
Gender	Female	83	12	
	Male	78	10	
Column Total		161	22	**183**

Chi- square.	Value	DF	Significance
Pearson	.069	1	.792

Minimum Expected frequency- 10.579

Statistic	Value	Significance.
Phi	.019	.792
Cramer's V	.019	.792

Table 16 presents a Chi square analysis of handedness by total scores. There was no association between handedness and total score. However 25% of the cells have an

expected frequency < 5. This could be affected by sample size and this needs to be noted when drawing firm conclusions from these results.

Table 16.

Chi square analyais of Handedness by ABC total scores, groups 1 and 2;

		ABC groups		
		1	2	
Hand	right	138	18	
	left	23	4	
Column Total		161	22	**183**

Chi- square.	Value	DF	Significance
Pearson	0.234	1	.629

Minimum Expected frequency- 3.246

Cells with expected frequency <5 - 1 of 4 (25%)

Statistic	Value	Significance.
Phi	.036	.629
Cramer's V	.036	.629

PART 2: INTERVENTION RESULTS.

Following the initial analysis, the subjects to be included in the intervention phase of the study were selected from the 'borderline', (total ABC score > = 10, < = 13) and 'at risk' (total ABC score > = 13.5) categories. A total of eight children were included in the intervention phase, six children were selected from the 'at risk' category and two children from the 'borderline' category. The children included were Nos 42, 158, 85, 130, 72, 36, 20, and 43 from the initial screening group (see Appendix C) This new intervention group were numbered 1-8 for the purpose of further data evaluation. The eight subjects were further divided into two groups, one group of five children (this group included the children from the borderline category) having intervention delivered by the class teacher but designed by the researcher, and the other group of three children having intervention delivered by the researcher.

A single case study multiple base line design was adopted for these two groups of children. The baseline data was gathered from weekly Movement ABC scores for the eight subjects identified. A minimum of six ABC total scores were obtained for each individual prior to intervention. The intervention was applied to only one subject while the others continued in base-line conditions. A further individual was exposed to intervention each week thereafter until each child was receiving intervention.

In order to introduce an appropriate intervention programme it is important to identify if children find greater difficulty in a particular motor skill area that is, manual dexterity, ball skills or balance. The overall framework for the intervention programmes was the Cognitive Motor Approach (see chapter 3). The design of the individual programmes was guided by the information gleaned from each child's individual assessments.
As noted previously, weekly ABC scores, pre-and post-intervention were obtained (see

Appendix E). It should be noted at this point that, although all eight children were started on the intervention programme some of the data has been withdrawn from the final analysis. Child No. 7 has been included for visual inspection only as the teacher was unable to carry out the intervention programme. Children Nos 2 and 4 crossed into another assessment ageband during the intervention phase. For the purpose of this evaluation only the scores obtained in ageband 2 have been included. Those scores obtained in the subsequent ageband will be commented on in the discussion. In order to interpret the data a series of evaluation techniques was carried out, firstly;

Visual Inspection.

A graphical presentation of the data was examined to determine whether or not the pattern infered a relationship. Other characteristics of visual inspection noted were: *Changes in means,* that is, the average performance across phases; *Changes in level,* that is a change from the score at the end of one phase to the beginning of the next phase and *Changes in trend,* that is changes in the slope or trend of the data over time (see chapter 3).

Statistical Analysis.

The presence of variability in the scores and the lack of stable baselines required further statistical analysis to compliment the visual inspection of this data. The techniques applied were a t-*test,* to detect whether the change in mean from one phase to the next was significant for each individual and Rn, test of ranks, to examine the effects of the intervention across the group as a whole. The Split Middle Technique was not applied due to an insufficient number of observations. A special requirement of the t-test is evidence that serial dependency does not exist. This was assessed by investigating if the data are correlated over time using an autocorrelation technique see **Table 17**. Child No. 2 is not

included in this table as there is an insufficient number of observations in the intervention phase in the relevant ageband. Child No. 7 is not included in this table as the teacher was unable to carry out the intervention programme. The results of both these children will be outlined later in this chapter.

Table 17. *Autocorrelation of Total ABC scores pre and post intervention.*

Child	*Pre-intervention*		*Post intervention*	
	r	p	r	p
No. 1	-0.891	0.017	-0.362	0.638
No. 3	-0.659	0.108	0.516	0.655
No. 4	0.453	0.443	0.280	0.648
No. 5	-0.183	0.728	0.609	0.082
No. 6	-0.416	0.354	0.601	0.207
No. 8	0.296	0.477	0.094	0.88

The author accepts that there are some variations within the autocorrelations in the pre- and post- intervention phases **Table 17,** and has accepted the level of variation and applied the conventional t- test except in relation to child No.1 as p = 0.017 was in the pre-intervention phase.

Table 18 presents the results of the t-tests, compairing the group means of the pre-intervention scores and the post-intervention scores.

Table 18. *A comparison between pre intervention scores and post intervention scores;* **(T = Teacher intervention, R = Researcher intervention).**

	Child	Pre-intervention	Post-intervention			one tailed
		Mean	Mean	t	df	p
R	No. 3	17.31	12.87	2.03	10	0.035*
R	No. 4	15.75	14.40	-0.42	13	0.221
R	No. 5	25.14	19.95	2.53	15	0.012*
T	No. 6	14.31	13.00	1.15	13	0.136
T	No. 8	15.72	12.67	1.88	13	0.041*

* significant at p<= 0.05.

CHILD 1.

Table 19 presents a summary of the data obtained for child No.1, with sub 1; (manual dexterity), sub 2; (ball skills), sub 3; (balance) and total ABC scores;

Table 19. Child 1.

Total ABC scores Pre intervention-

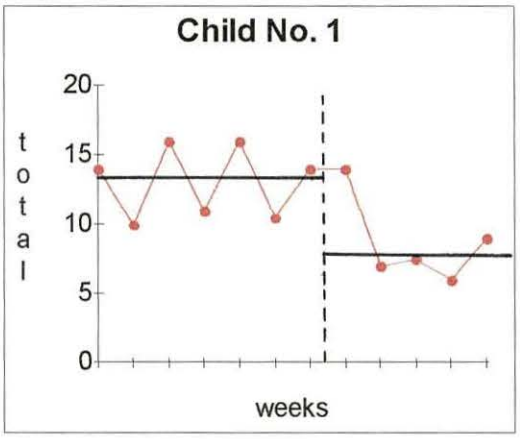
week	sub 1	sub 2	sub 3	Total ABC scores.
1	7.5	4.5	2	**14.00**
2	3	5	2	**10.00**
3	7	7	2	**16.00**
4	5	5.5	0.5	**11.00**
5	4.5	9	2.5	**16.00**
6	4.5	4	2	**10.50**
7	7.5	3	3.5	**14.00**

Total ABC scores Post intervention-

week	sub 1	sub 2	sub 3	Total ABC scores
8	4	7	3	**14.00**
9	3	0.5	3.5	**7.00**
10	2.5	2	3	**7.50**
11	5	0	1	**6.00**
12	4	2.5	2.5	**9.00**

Chart 1. outlines all 12 total ABC score points for child 1(pre- and post-intervention), week eight being the first total ABC score point post intervention. The intervention with this child was carried out by the class teacher.

Chart 1. *Total ABC scores pre and post intervention;*



- - - - - - indicates the beginning of the intervention phase.
——— indicates the mean score.

Visual Inspection:

* The initial observation was the variability in performance.

* The *mean* of the pre-intervention phase was 13.07 and the mean post-intervention was 8.7, suggesting an improvement in performance in the intervention phase.

* There was *no change in level* across phases. At the end of phase 1 the child scored 14 and at the beginning of phase 2, the intervention phase, the child also scored a total of 14.

* On visual inspection the *trend* of the data appears to be horizontal in the pre intervention phase and lower with one week lag in the intervention phase suggesting improvement in the intervention phase.

Statistical analysis:

* The t-test was not applied.

CHILD 2.

Table 20, presents a summary of the data obtained for child No. 2, with sub 1; (manual dexterity, sub 2; (ball skills), sub 3; (balance) and total ABC scores.

Table 20. Child 2.

ABC scores Pre intervention-

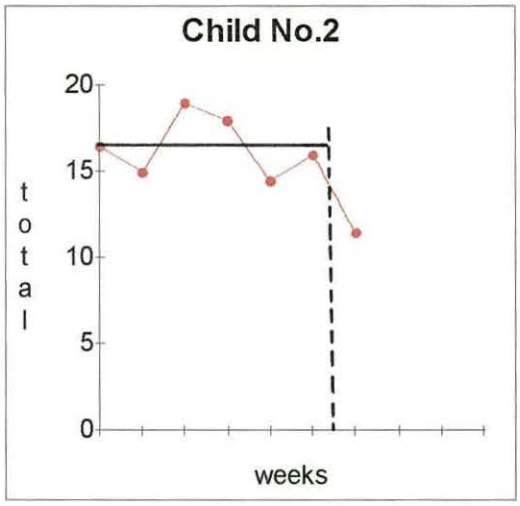
week	sub 1	sub 2	sub 3	**Total ABC scores.**
1	7	8	1.5	**16.50**
2	4	6.5	4.5	**15.00**
3	10	3.5	5.5	**19.00**
4	9	2	7	**18.00**
5	7.5	1	6	**14.50**
6	7.5	1	7.5	**16.00**

ABC scores Post intervention-

week	sub 1	sub 2	sub 3	**Total ABC scores.**
7	7	1.5	3	11.5

Chart 2 (page 82) presents 7 total score points for child 2 (pre and post intervention), week 7 being the first score post intervention, this child crossed into age band 3 at week 8 this will be discussed further in the following chapter. However, some observations can be derived from the graphical representation of this childs data points. The intervention with this child was carried out by the class teacher.

Chart 2, *Total ABC scores pre and post intervention;*



- - - - - - indicates the beginning of the intervention phase.

——— indicates the mean scores.

Visual inspection:

* The initial observation was variability in performance.

* There was a change in level from the pre-intervention phase to the post-intervention. The final score in the first phase was 16 and the first score in the second phase is 11.5. This single data point obtained at week 7 following intervention does appear from visual inspection only to be significantly lower than the points in the pre- intervention phase. All 6 points in the baseline phase were in the 'at risk ' category. The single point in the intervention phase was in the borderline category.

*On visual inspection the trend of the data in the pre-intervention phase appears to be horizontal.

* No firm conclusions can be drawn from this graph with so few data points post-intervention in age band 2.

Statistical Analysis:

This Child was not included in the t-test due to insuficient data points in the relevant ageband in the intervention phase.

A record form was provided to the teacher. No written observations were recorded by the teacher other than that the prescribed programme was carried out twice weekly as agreed with the researcher.

CHILD 3.

Table 21 presents the Summary data for child No.3, with sub 1; (manual dexterity), sub 2; (ball skills), sub 3; (balance) and total ABC score;

Table 21. Child 3.

Total ABC scores Pre- intervention;

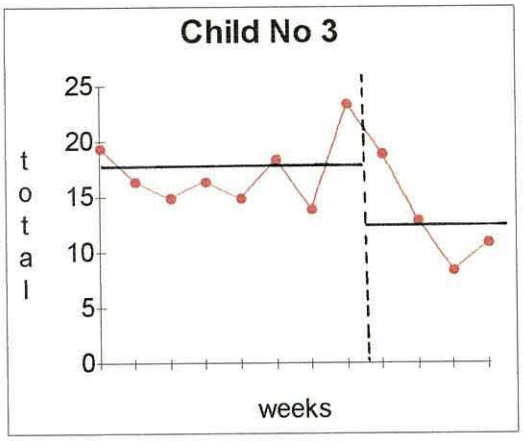
week	sub 1	sub 2	sub 3	Total ABC scores
1	11	4.5	4	**19.5**
2	9	5.5	2	**16.5**
3	10	1	4	**15**
4	11.5	2.5	2.5	**16.5**
5	11	1	3	**15**
6	11.5	2	5	**18.5**
7	9	2	3	**14**
8	10.5	4.5	8.5	**23.5**

ABC scores Post - intervention;

week	sub 1	sub 2	sub 3	Total ABC scores
9	9	2.5	6.5	**19**
10	8.5	2	2.5	**13**
11	2.5	0.5	5.5	**8.5**
12	8.5	0	2.5	**11**

Chart 3 outlines all 12 total score points for Child No.3 (pre- and post-intervention), week 9 being the first score point post-intervention. The intervention with this child was carried out by the researcher.

Chart 3. *Total ABC scores pre and post intervention;*



- - - - - - indicates the beginning of the intervention phase.

——— indicates the mean score

Visual Inspection:

* The initial observation was variability in performance.

* The *mean* pre-intervention was 17.31 and the mean post-intervention was 12.87 indicating an improvement in performance in the intervention phase.

* A change in *level* can be observed in the direction of improvement. At the end of phase 1 the score was 23.5 and at the beginning of phase 2 the child scored 19.

* On visual inspection the trend of the data appears to be horizontal in the pre-intervention phase and downward in the intervention phase.

Statistical analysis:

* A t-test was applied to evaluate the change in mean which resulted in a value of $t(10) = 2.03$, $p=0.035$. This change in mean was significant at the traditional 5% level, therefore suggesting improvement occurred in the intervention phase.

CHILD 4.

Table 22 presents a summary of the data obtained for Child no 4; with sub1-manual dexterity, sub 2- ball skills, sub 3- balance and total ABC scores.

Table 22. Child 4.

ABC scores Pre-intervention

week	Sub1	sub 2	sub 3	Total ABC scores
1	9.5	0.5	5	**15**
2	6	1.5	6.5	**14**
3	8.5	0	6.5	**15**
4	8.5	3.5	5.5	**17.5**
5	10	1.5	5.5	**17**
6	12	1.5	5.5	**16**

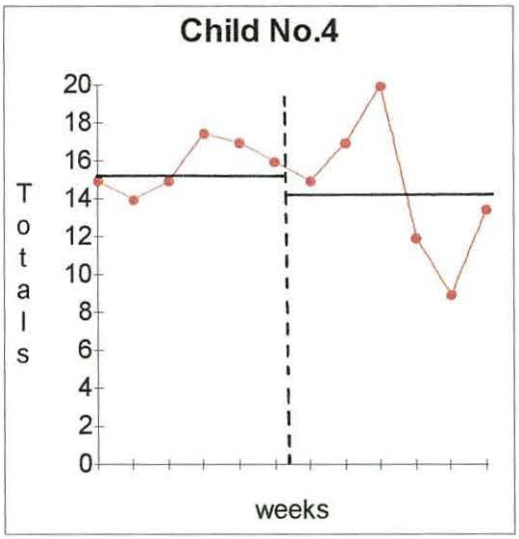
ABC scores Post-intervention

week	sub 1	sub 2	sub 3	Total ABC scores
7	10	1.5	3.5	**15**
8	7.5	3	6.5	**17**
9	10.5	2	7.5	**20**
10	9.5	0.5	2	**12**
11	7.5	0.5	1	**9**
12	5.5	0.5	7.5	**13.5**

Chart 4 presents 12 total score points for child 4 pre- and post-intervention, week 7 being the first score post-intervention. The intervention with this child was carried out by the researcher.

Chart 4,

Total ABC scores pre- and post-intervention;



- - - - - - indicates beginning of the intervention phase.

——— indicates the mean scores.

Visual inspection:

* The initial observation was the variability in performance.

* The *mean* pre-intervention was 15.75 the *mean* post-intervention was 14.4 which suggests little improvement in performance.

* There is a small change in *level* from a score of 16 at the end of the baseline phase to a score of 15 at the beginning of the intervention phase.

* There appears to be an upward *trend* in performance in the baseline phase and a downward or no trend in the intervention phase suggesting improvement in performance.

Statistical analysis:

* When the t test was applied this resulted in a value of t(10) = 0.42, p=0.221 indicating no improvement in the intervention phase.

CHILD 5.

Table 23 presents a summary of the data obtained for Child No. 5, with sub1; (manual dexterity), sub 2; (ball skills), sub 3; (balance) and total ABC scores.

Table 23. Child 5.

ABC scores Pre - intervention;

week	sub 1	sub 2	sub 3	Total ABC scores
1	11	8	7	**26**
2	9	8	9	**26**
3	12.5	6	8	**26.5**
4	12	8	9.5	**29.5**
5	6.5	4.5	5	**16**
6	11.5	5	6.5	**23**
7	10	7.5	11.5	**29**

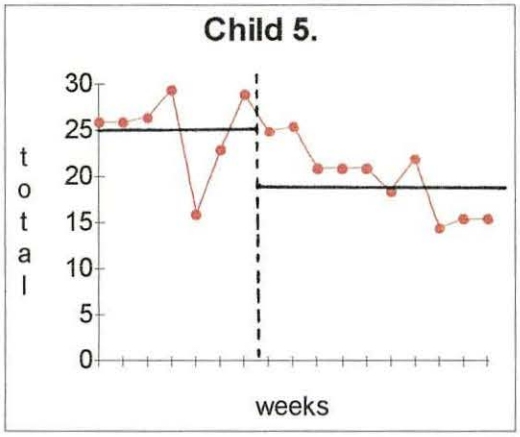
Post - intervention;

week	sub 1	sub 2	sub 3	Total ABC scores
8	11	6.5	7.5	**25**
9	11.5	8.5	5.5	**25.5**
10	10	5	6	**21**
11	11	1.5	8.5	**21**
12	11	1	9	**21**
13	8	4.5	6	**18.5**
14	9.5	2	10.5	**22**
15	7	3	4.5	**14.5**
16	7.5	4	4	**15.5**
17	11	2	2.5	**15.5**

Chart 5 presents the total ABC scores (pre- and post-intervention), week 8 being the first score point post-intervention. The intervention with this child was carried out by the researcher.

Chart 5.

Total ABC scores, (pre- and post- intervention).



- - - - - - indicating improvement in the intervention phase.

——— indicates mean score.

Visual inspection:

* The initial observation was variability in performance especially in the pre-intervention phase.

* The *mean* in the first phase was 25.14 and in the second phase the mean was 19.95 indicating an improvement in performance.

* There is a change in *level* across phases. The final score pre-intervention was 29 and the first score in the post-intervention phase was 25, indicating a change in level in the direction of improvement.

* On visual inspection the *trend* of the data appears to be horizontal in the pre-intervention phase and downward in the post-intervention phase.

Statistical Analysis:

* The applied t-test resulted in a value of $t(15) = 2.53$, $p = 0.012$ indicating that the difference in mean was significant.

CHILD 6.

Table 24 presents a summary of the data obtained for Child 6, with sub1; (manual dexterity) sub 2; (ball skills), sub 3; (balance) and total ABC scores.

Table 24. Child 6.

ABC scores pre intervention;

week	sub 1	sub 2	sub 3	Total ABC scores
1	4.5	10	0	**14.5**
2	2	8	2.5	**12.5**
3	4	7	2	**13**
4	5	7.5	3	**15.5**
5	5	6	3	**14**
6	5	8	2	**15**
7	6.5	3	3.5	**13**
8	7.5	7	2.5	**17**

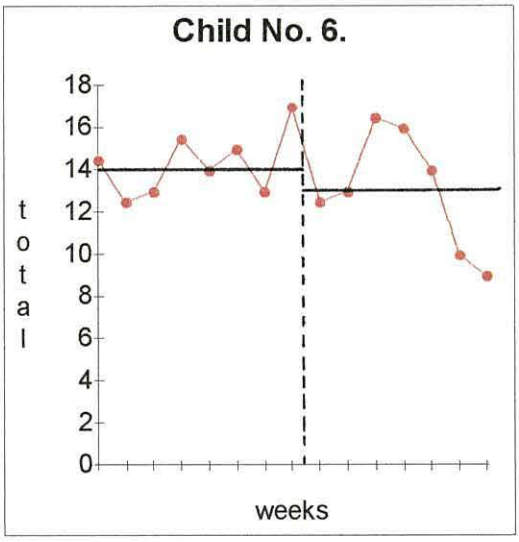
ABC scores Post - intervention;

week	sub 1	sub 2	sub 3	Total ABC scores
9	3.5	9	0	**12.5**
10	7.5	5.5	0	**13**
11	8	5.5	3	**16.5**
12	6.5	5	4.5	**16**
13	5.5	4.5	4	**14**
14	5	5	0	**10**
15	7	2	0	**9**

Chart 6 outlines all 15 total ABC score points for child 5 (pre- and post-intervention), week 9 being the first score point post-intervention. The intervention activities for this child were carried out by the class teacher.

Chart 6.

Total ABC scores (pre and post intervention);



- - - - - - indicating beginning of the intervention phase.

——— indicates the mean score.

Visual inspection:

* The initial observation was variability in performance.

* The *mean* pre-intervention was 14.31 and post-intervention was 13 this change in mean was small, however it is in the direction of improvement.

*A change in *level* can be seen at the point where the child crosses from phase 1 to phase 2. A total score of 17 in the last test pre-intervention and a score of 12.5 first test post-intervention, suggesting an improvement in performance.

* There appears to be a slight upward trend in the pre-intervention phase and a downward trend after a three week lag in the intervention phase suggesting improvement in the intervention phase.

Statistical Analysis:

* When the t-test was applied to this data the change in mean is not significant,

$t(13) = 1.15$, $p = 0.136$.

CHILD 7.

Table 25 presents a summary of the data obtained for child Child No. 7, with sub1; (manual dexterity), sub2; (ball skills), sub 3; (balance) and total ABC scores. As noted previously, the teacher was unable to carry out the intervention programme with this child. The scores have been included for visual inspection only.

Table 25. Child 7.

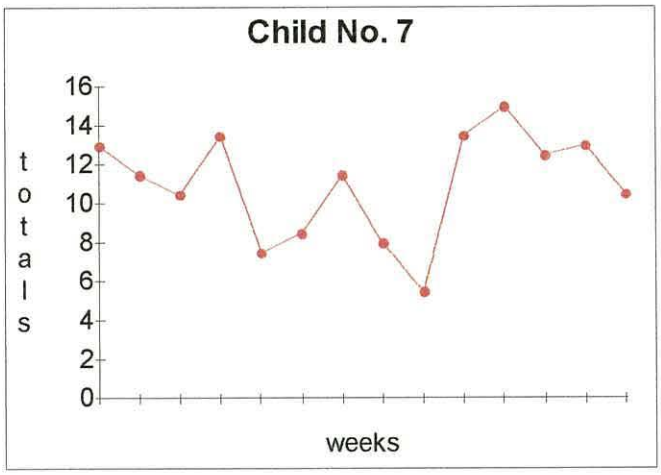
Total ABC scores;

week	sub 1	sub 2	sub 3	Total ABC scores
1	7.5	0	5.5	**13**
2	8.5	0.5	2.5	**11.5**
3	6	0	4.5	**10.5**
4	6.5	0.5	6.5	**13.5**
5	4	0.5	3	**7.5**
6	4	1	3.5	**8.5**
7	7.5	2	2	**11.5**
8	4.5	1	2.5	**8**
9	3	0	2.5	**5.5**
10	5.5	0	8	**13.5**
11	7	1.5	6.5	**15**
12	5.5	2	5	**12.5**
13	8.5	0.5	4	**13**
14	4.5	1	5	**10.5**

Chart 7 outlines all 14 total ABC score points for child 7.

Chart 7.

Total ABC scores;



Visual inspection;

* Initial observation was variability in performance.

*On visual inspection the *trend* of the data appears to be horizontal, suggesting no improvement with time.

CHILD 8.

Table 26 presents a summary of the data obtained for child Child No. 8 with sub 1; (manual dexterity), sub 2; (ball skills), sub 3; (balance) and total ABC scores. The intervention with this child was carried out by the class teacher.

Table 26. Child 8.

ABC scores Pre - intervention;

week	sub 1	sub 2	sub 3	Total ABC scores
1	5.5	1	4.5	**11**
2	10.5	1.5	5	**17**
3	9	3	4.5	**16.5**
4	10	5	2	**17**
5	8	8	4	**20**
6	11	5.5	4	**20.5**
7	5	3.5	5.5	**13**
8	6.5	3.5	3	**13**
9	5.5	0.5	7.5	**13.5**

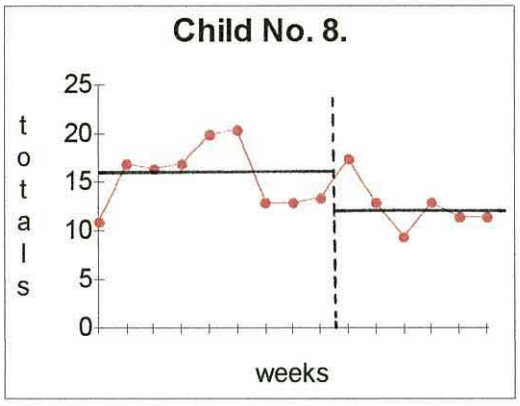
ABC scores Post - intervention;

week	sub 1	sub 2	sub 3	Total ABC scores
10	8	3	6.5	**17.5**
11	7.5	0	5.5	**13**
12	9	0.5	0	**9.5**
13	7	1	5	**13**
14	4	0	7.5	**11.5**
15	7.5	0.5	3.5	**11.5**

Chart 8 outlines all 15 total score points for child 8 (pre- and post-intervention) week 10 being the first score point post-intervention.

Chart 8.

Total ABC scores (pre and post intervention);



- - - - - - indicating beginning of intervention phase.

——— indicates the mean scores.

Visual Inspection:

* Initial observation was variability in performance.

* The *mean* pre-intervention was 15.72 and post-intervention was 12.67. indicating an improvement in performance in the intervention phase.

* There is a change in *level,* the last score in the first phase was 13.5 and the first score in the second phase was 17.5. This change in level was not in the direction of improvement.

* The *trend* in the pre-intervention phase appears horizontal and the trend in the intervention phase appears horizontal but lower, suggesting improvement in the intervention phase.

Statistical Analysis:

* The t test resulted in a value $t(13) = 1.88$, $p = 0.041$ this change in mean is significant and therefore suggests improvement in the intervention phase.

TEST OF RANKS.

Finally *Rn, Test of ranks* was applied to evaluate the effect of the intervention across the group as a whole. The performance of each of the baselines was evaluated at the time that intervention was introduced. The performance of all subjects was ranked when intervention was introduced to any one subject. When the intervention was introduced to subsequent subjects all children except those who had received intervention were ranked. The sum of the ranks (Rn) makes known the extent to which the ranks are unlikely to be due to random factors.

As is evident in each childs' individual results, there was great variability within this data. The total scores vary markedly across the different baselines. In addition to variability in individual scores there is variability between the scores across subjects. This means that although the intervention may lead to a change this would not be reflected in the rankings because of the discrepancies in the magnitude of the scores between subjects.

Applying Rn in a straight forward manner may not give a true reflection of the effect of intervention and therefore, when applying the test of ranks to such varied data, Kazdin (1982) suggests two steps; firstly, that the intervention may be evaluated on mean performance and secondly, to apply a data transformation formula to alleviate the problem of response magnitude.

Table 27 presents the total ABC scores for seven subjects and the first scores in the intervention phase are highlighted in **bold (b).**

Table 27. *Total ABC scores.* (***b*** *= point of intervention for a each child.*)

Child No	weekly scores																
1	14	10	16	11	16	10.5	14	***14b***	7	7.5	6	9					
2	16.5	15	19	18	14.5	16	***11.5b***										
3	19.5	16.5	15	16.5	15	18.5	14	23.5	***19b***	13	8.5	11					
4	15	14	15	17.5	17	16	***15b***	17	20	12	9	13.5					
5	26	26	26.5	29.5	16	23	29	***25b***	25.5	21	21	21	18.5	22	14.5	15.5	15.5
6	14.5	12.5	13	15.5	14	15	13	17	***12.5b***	13	16.5	16	14	10	9		
8	11	17	16.5	17	20	20.5	13	13	13.5	***17.5b***	13	9.5	13	11.5	11.5		

The Transformation formula is as follows:

$$(Bi - Ai)/_{Ai}$$

Where Bi = performance level for subject i when the experimental intervention is introduced and

Ai = mean performance across all baseline days for the same subject.

(Kazdin 1982 p333)

Table 28 presents the transformed scores for all eight children, the transformed score highlighted in red is based on the mean intervention score.

Table 28. Transformed scores.

Child							
4	-0.0857						
2	-0.0018	-0.2825					
5	-0.0851	0.1535	-0.2064				
1	-0.2241	-0.1966	0.07115	-0.3343			
3	-0.1334	0.0687	-0.1912	0.3575	-0.2564		
6	0.0831	-0.0216	0.0482	-0.0915	0.1879	-0.0915	
8	0.0814	0.2722	0.302	-0.173	-0.173	-0.1412	-0.194

When the transformation formula is applied to the above data using the mean baseline and the mean intervention scores the ranking is as follows in **Table 29.**

$\sum R = 10$ which is significant at 0.025 level of significance. This provides further evidence to suggest that improvement occurs in the intervention phase of this group of children.

Table 29 Ranked transformation scores for children (transformed using mean baseline and mean intervention scores.)

CHILD	4	2	5	1	3	6	8	$\sum R$
RANK	3	1	1	1	1	2	1	**10**

CHAPTER 6

DISCUSSION

INTRODUCTION.

The first purpose of this study was to identify those children in Gwynedd who, when assessed with the Movement ABC, are identified as having impairment in the development and performance of motor skills or have what may be called 'Developmental Co-ordination disorder', (DCD) (American Psychiatric Association, 1987). These children may more commonly be described as 'clumsy'. The second purpose of this study, was to apply an intervention programme with a sample of children identified with DCD, and evaluate its effect.

The findings from the study are of particular interest to the author who, as an Occupational Therapist working in the field of learning disabilities, was aware that there are services developed for this group of children in other parts of Britain. However, in Gwynedd, there is no co-ordinated approach to the identification of children with these difficulties and no structured intervention service available should a problem be suspected or identified.

The results of this study will be discussed under six sub headings: **IDENTIFICATION; INTERVENTION; INTERVENTION RESULTS; IMPLICATIONS FOR GWYNEDD HEALTH AUTHORITY; LIMITATIONS OF THE PRESENT STUDY; FUTURE RESEARCH DIRECTIONS;** and **CONCLUDING REMARKS.** Under these sub headings the author will discuss the presence of DCD in Gwynedd and whether or not the extent of the difficulties is similar to other areas in the UK. The intervention programme will be evaluated, and the implications the findings may have for the development of a strategic policy in Gwynedd will be discussed. The study raised further questions which will be highlighted under future research directions; and lastly, a brief overview of the study will be presented.

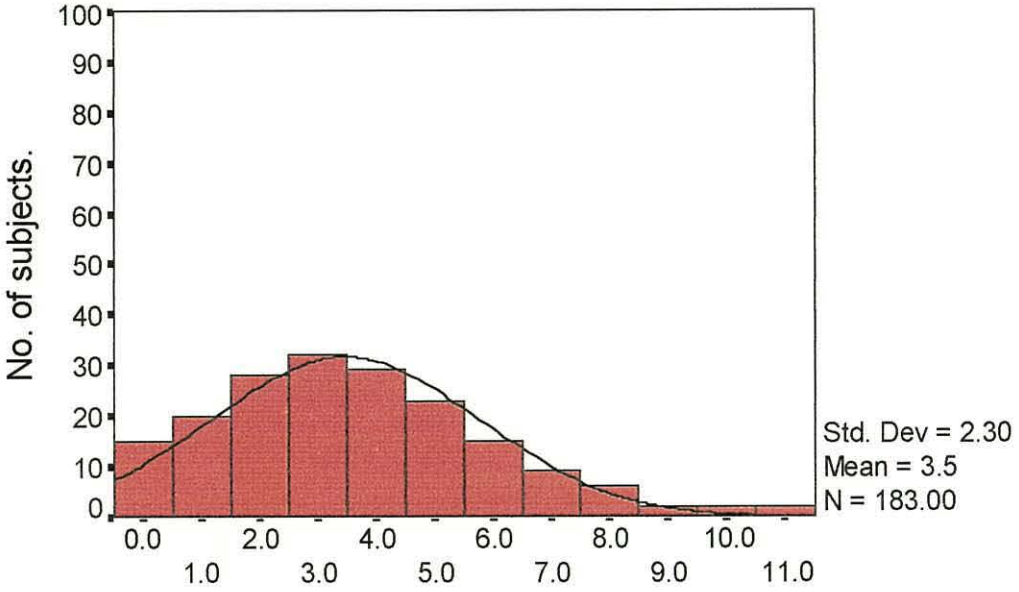
IDENTIFICATION

Five schools were selected at random and the total number of children assessed with the Movement ABC was 183. From this initial screening process, eleven children were identified in the at risk category; that is 5.8% of the sample group. This is consistent with other literature which reports 5% incidence in the normal population (Sugden and Wann, 1987; Henderson and Hall, 1992); whilst Gubbay (1975) identified 6% of his Australian group, Peters (1995) reported a 6% incidence in her study which was carried out in Britain and evaluated the effect of a specific group exercise programme, on motor function and self esteem. Other literature reports a slightly higher incidence; for example, Keogh (1968) reported an incidence of 7% in his study of 9 year old British boys. A further 11 children were identified in the borderline category. The remaining 161 children were considered as being competent in respect of movement skills.

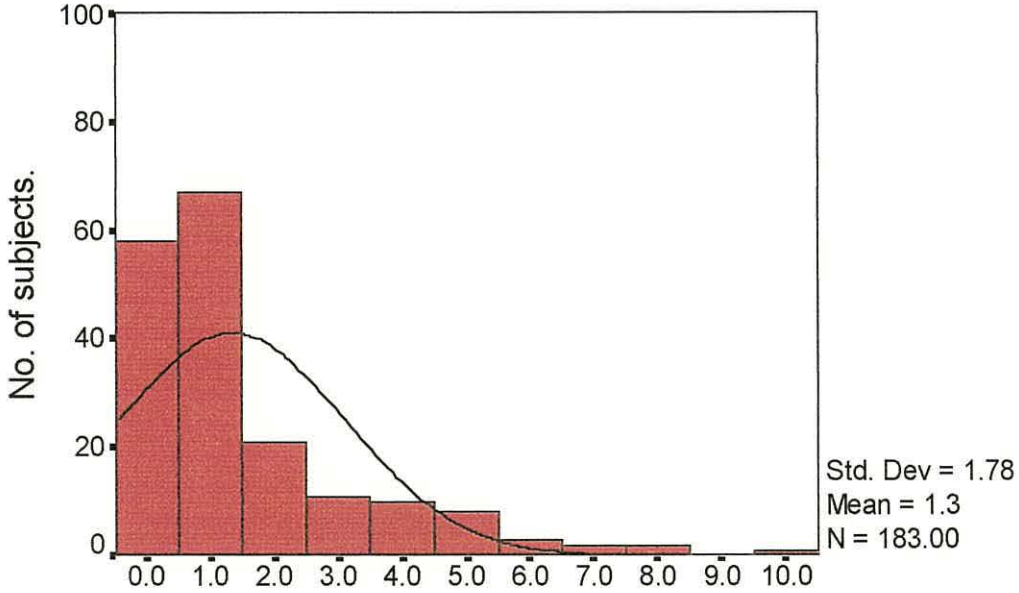
Having identified that there are children in Gwynedd who have difficulties in the motor domain when assessed using the Movement ABC, it is appropriate to have a closer look at the overall scores of the children in the screening process.

From **Tables 8, 9, & 10** (page 66) it is interesting to look at the sub total scores. In sub total 1, manual dexterity, 45 children score above the median; in sub total 2, ball skills, 26 children score above the median and in sub total 3, balance, 17 children score above the median. From this, it can be seen that sub total 1, manual dexterity has a higher median and a greater number of children scoring above the median. **Figure 2a,b,** (pages101 & 102) presents a visual presentation of the three sub total scores.

Figure 2a.

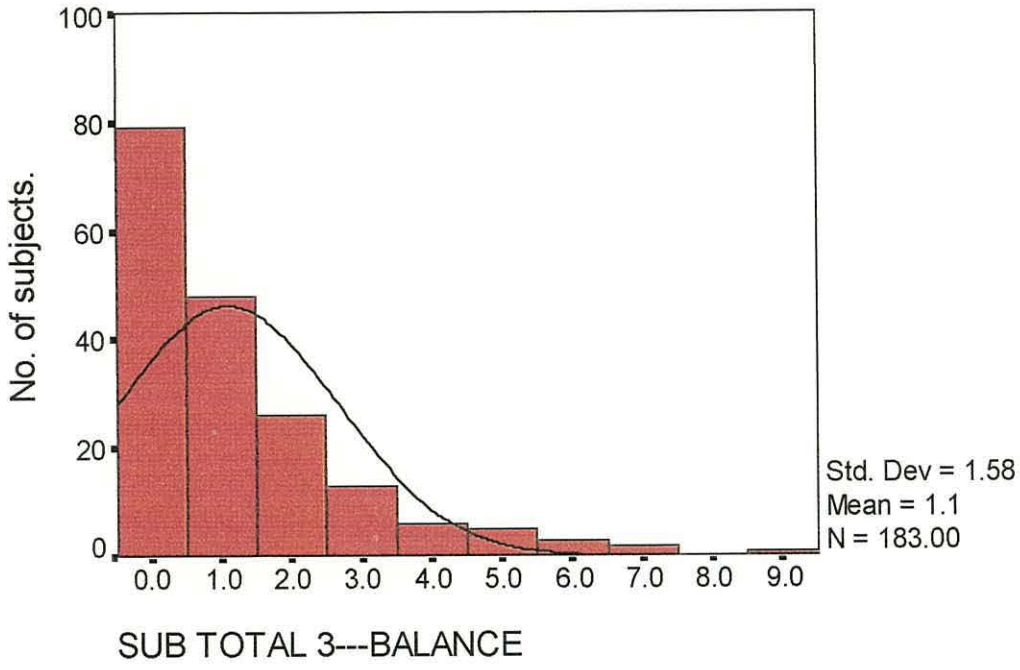


SUB TOTAL 1---MANUAL DEXTERITY.



SUB TOTAL 2 --- BALL SKILLS.

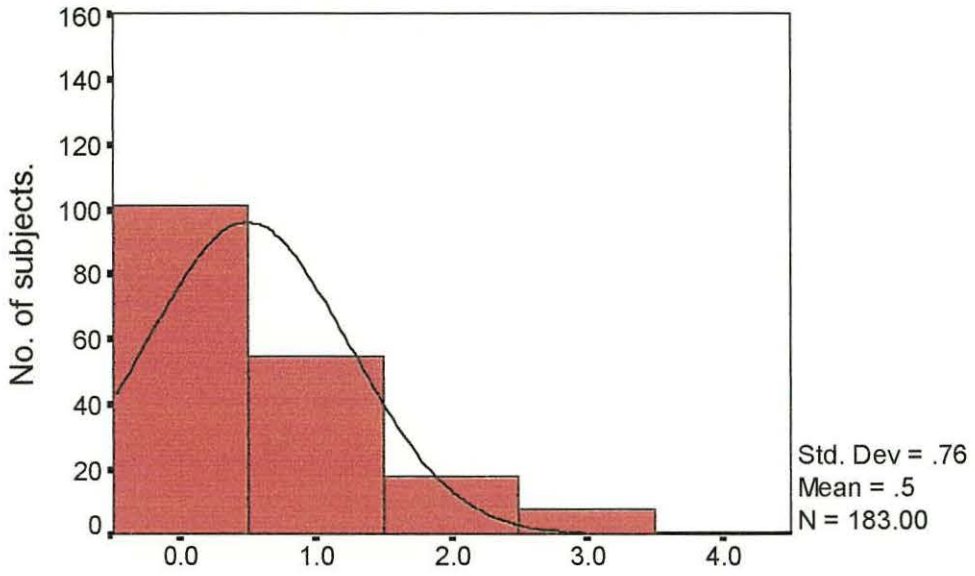
Figure 2b.


100
80
60
40
20
0
No. of subjects.
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
Std. Dev = 1.58
Mean = 1.1
N = 183.00
SUB TOTAL 3---BALANCE

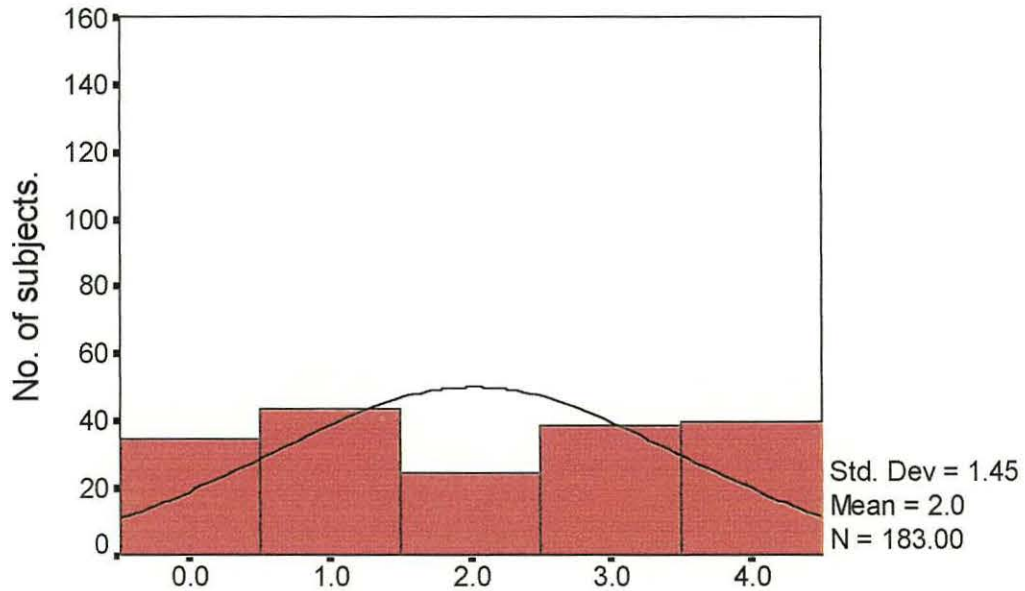
It is important to keep in mind that each of these sub total scores are contributing to the total ABC score. This may suggests that children generally score lower, that is, have fewer problems in the areas of ball skills and balance than in manual dexterity in this Age Band, or that the manual dexterity tasks are more difficult for children in this Age Band. This may also suggest that each sub group is not equally informative when identifying children with difficulties and, therefore, it may not be necessary to assess in all three areas. However, the visual presentations of the distribution of the scores for each of the eight sub tests, see **Figure 3a,b,c, &d,** (pages 104-107) suggests that it is individual sub tests that are contributing to this picture of unequal distribution in the skill groups. The individual test with the lowest mean score is the hopping test from the balance category and the individual test with the highest mean score is the threading test, from the manual dexterity category. Although these two tests may be contributing to the appearance of increased difficulties in the area of manual dexterity and decreased difficulties in the area of balance; it could be argued that hopping games may be popular or in fashion and therefore children get increased practice in this skill. Additionally, perhaps the current fashion of Velcro fastenings on children's' footwear has removed one of the main daily living opportunities to practice the skill of threading. Therefore, it is not appropriate to conclude from this study that some of the tests are less informative than others and could be omitted as suggested earlier. However it would be interesting to consider the spread of the scores with children from different areas.

Figure 3a.

HISTOGRAM PRESENTATION OF INDIVIDUAL TESTS SCORES,

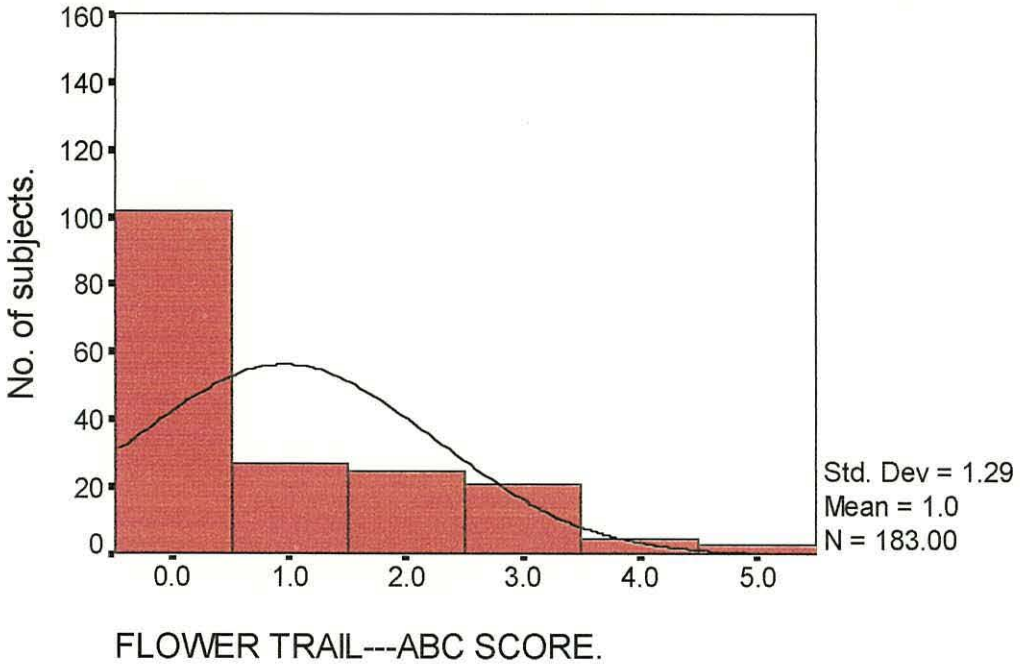


PEG PLACING---ABC SCORES.



THREAD---ABC SCORE.

Figure 3b.


160
140
120
100
80
60
40
20
0
No. of subjects.
0.0
1.0
2.0
3.0
4.0
5.0
Std. Dev = 1.29
Mean = 1.0
N = 183.00
FLOWER TRAIL---ABC SCORE.

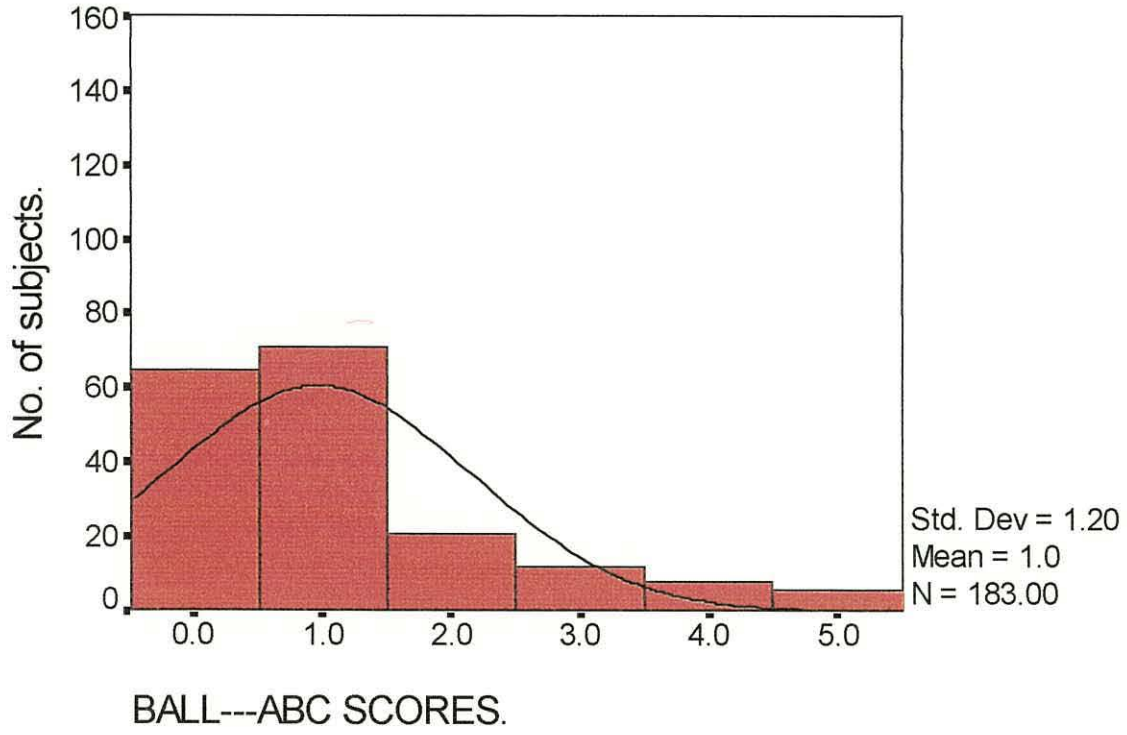
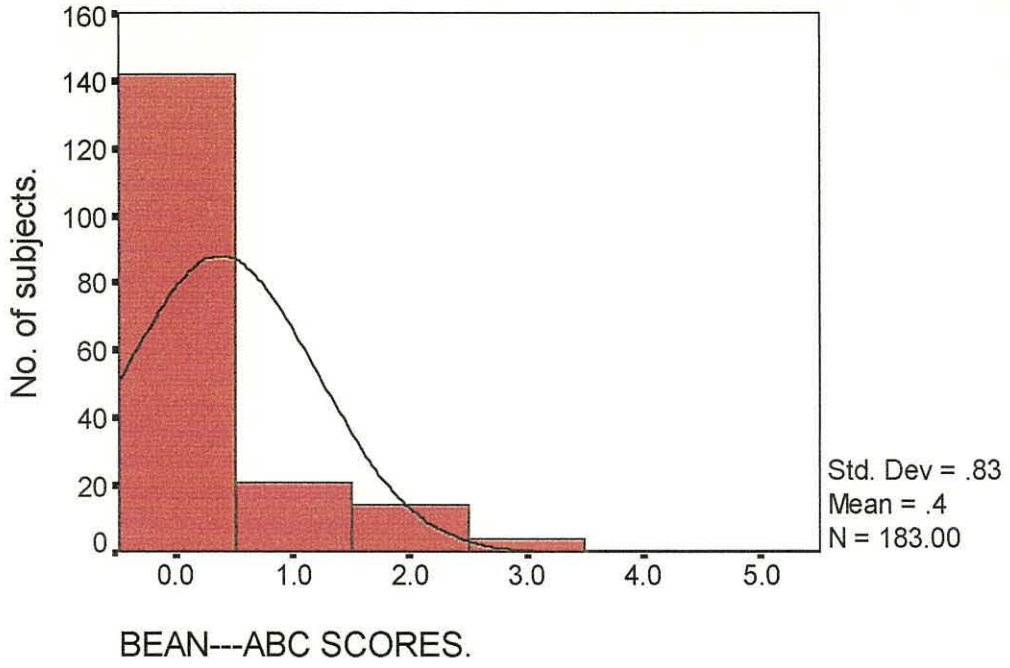

160
140
120
100
80
60
40
20
0
No. of subjects.
0.0
1.0
2.0
3.0
4.0
5.0
Std. Dev = 1.20
Mean = 1.0
N = 183.00
BALL---ABC SCORES.

Figure 3c.


No. of subjects.
160
140
120
100
80
60
40
20
0
0.0
1.0
2.0
3.0
4.0
5.0
Std. Dev = .83
Mean = .4
N = 183.00
BEAN---ABC SCORES.

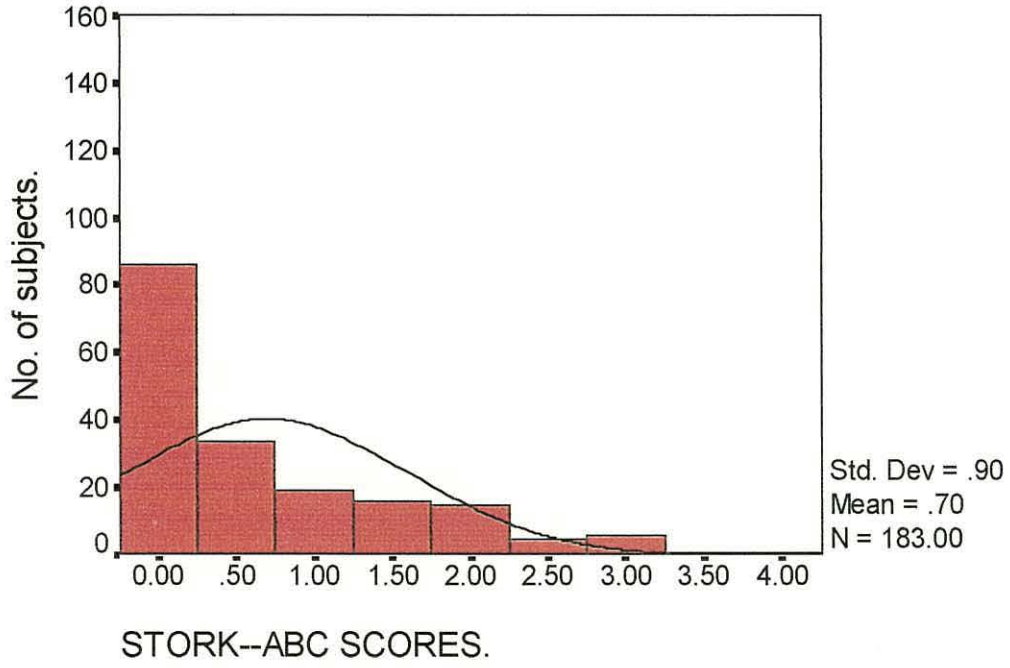
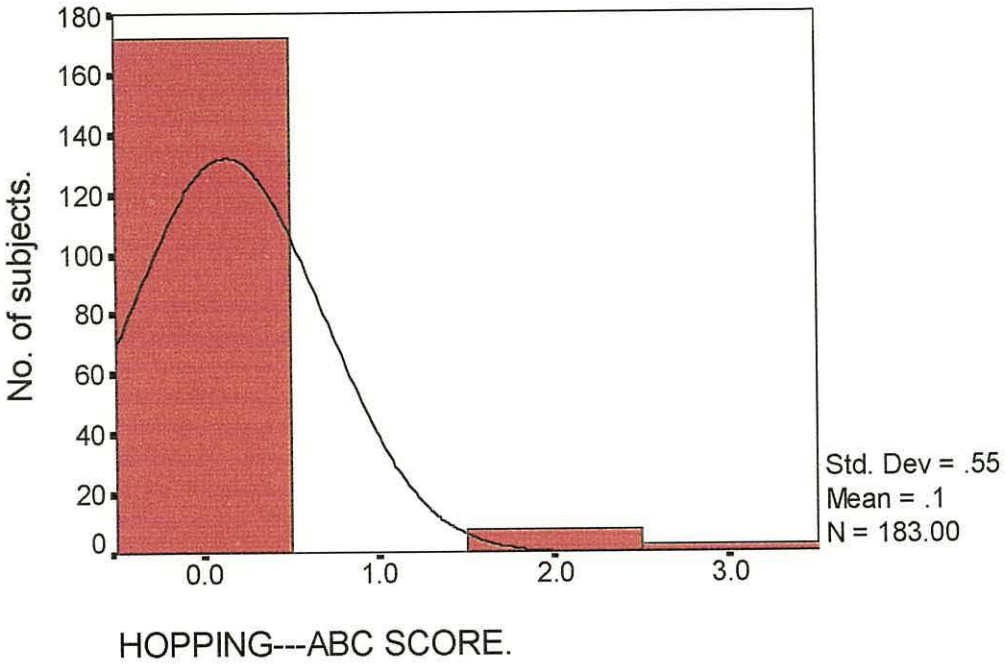
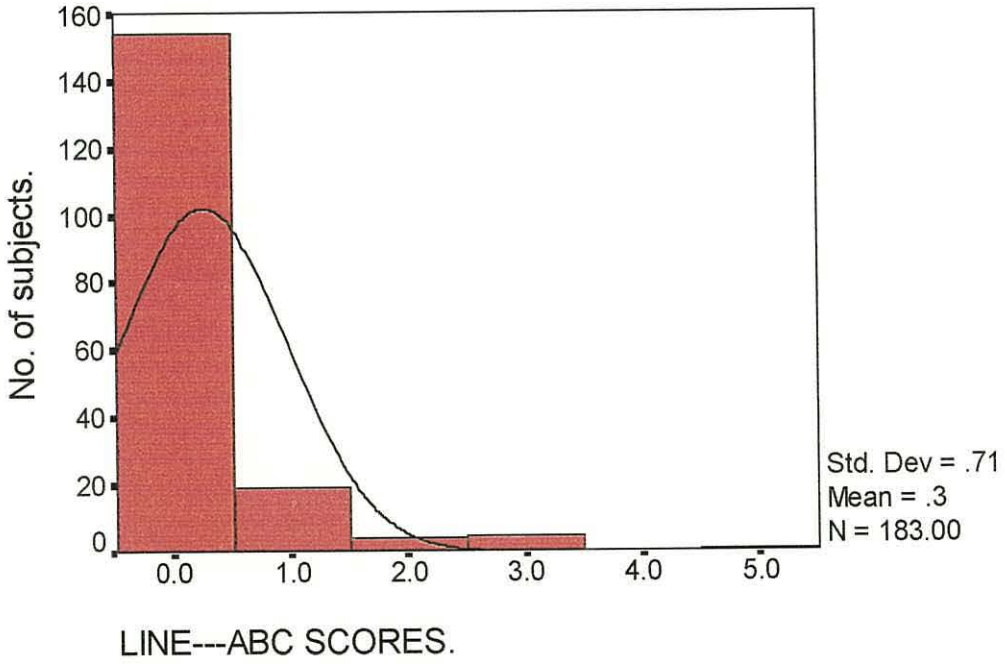

No. of subjects.
160
140
120
100
80
60
40
20
0
0.00
.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
Std. Dev = .90
Mean = .70
N = 183.00
STORK--ABC SCORES.

Figure 3d.


No. of subjects.
180
160
140
120
100
80
60
40
20
0
0.0
1.0
2.0
3.0
Std. Dev = .55
Mean = .1
N = 183.00
HOPPING---ABC SCORE.


No. of subjects.
160
140
120
100
80
60
40
20
0
0.0
1.0
2.0
3.0
4.0
5.0
Std. Dev = .71
Mean = .3
N = 183.00
LINE---ABC SCORES.

Chi Square analysis was used to further evaluate the initial screening scores and the results identified no significant association between the incidence of DCD and school attended, gender or handedness. However, there are some difficulties inherent in using Chi Square Analysis with this subject group. In **Table 13** page 71, 20% of the cells have an expected frequency of less than 5. As noted previously, when more than 20% of the cells have less than 5 or if one cell has no frequency, the sampling distribution for Chi Square may deviate from normal (Munro and Page, 1993). To overcome this difficulty, the schools were recategorised into rural and urban, but the results continued to indicate no significant relationship. It should be noted, however, that within the County of Gwynedd the catchment area for all five schools may include a rural aspect. It is therefore appropriate to have a further look at **Table 13,** and acknowledging that 20% of the cells have an expected frequency of less than 5, the non significant result in this case may not be strong. However, it is in keeping with literature to date which does not present evidence to indicate that there is an association between the incidence of motor difficulties and school attended. Stephenson, McKay and McKay (1986) note that despite variation in stimulating environments, that is variation in opportunities within the school, home and local settings, there are some children who have motor difficulties. A larger sample group might have eleviated this difficulty and given greater strength to this result.

From the analysis, there was no significant association between the incidence of motor difficulties and gender. This is in keeping with a study by Gubbay (1975) who also found no association. However, many other authors have identified more boys than girls with motor difficulties and this is consistent with other types of learning disabilities (Keogh, Sugden, Reynard and Calkins, 1979). Rarick et al, (1976) did not directly measure clumsiness but found 17% of boys and 7% of girls performing below the mean in the motor aspect of their study. Keogh et al (1979) report from Sugden's (1972) unpublished thesis that three times as many boys as girls have difficulties in the motor domain.

There appears to be little or no literature that comments on the incidence of DCD in relation to handedness and no significant associations were identified in this study. However, it could be argued that the total number of left handed children in this study is too small to draw any firm conclusions. Current literature suggests that the incidence of left handed people in the normal population is 10% (Youngson, 1995). In this study 27 children were left handed which accounted for 14 % of the sample group. No firm conclusions can be drawn from this slightly higher incidence given the sample size. The group of at risk children form a very small sample from which to make inferences and this needs to be kept in mind when interpreting the results.

INTERVENTION.

When we consider intervention with these children, who are the experts? There is little empirical evidence available to aid a therapist to select a clear method of intervention once the child has been assessed and identified as having difficulties. As outlined in the chapter on intervention, the input that such children receive varies greatly. Many diagnostic tools that confirm ones suspicions of problems do not empower the therapist to attempt to address the difficulties. One of the unique advantages of the Movement ABC is that it presents a structure from which to build an intervention programme.

There is a distinct lack of research in the area of intervention with children who have movement difficulties. Currently in Gwynedd, a child who does have movement difficulties is not likely to receive intervention. In other areas, therapists and other individuals appear to be designing intervention programmes based on skills acquired from various backgrounds and training such as Occupational Therapy, Physiotherapy and other Remedial Therapies. The approaches being applied include Bobath (a Neurodevelopmental Approach), Sensory Integration (a therapy system derived within the perceptual-motor training framework) and others. Success has been claimed as discussed in the literature

review chapter of this study. However, it is vital that therapists investigate their approaches and present evidence about the specific aspect of the intervention that is making any difference. Intervention should be carefully monitored to establish whether or not there is actual improvement, what exactly is leading to this improvement, and whether or not this improvement is lasting and permanent.

The Movement ABC advocates a cognitive motor approach to intervention drawing on information from motor learning theory (Schmidt, 1991) (Poole, 1991) and cognitive psychology (Guilfoyle et al, 1981). This is a problem solving approach to which the solution comprises of three parts; motor planning, motor execution, and task evaluation. As discussed in Chapter 2, this approach is based on the idea that a dynamic interaction between cognition, emotion and motor skill is required for the development of motor competence. The intervention programmes designed for the present study were based on this approach.

The following discussion outlines the progress of the eight children included in the intervention programme. The intervention programmes were designed to be carried out twice weekly as part of children's physical education activities, by the respective class teachers with five of the children (Children 1,2,6,7, & 8) and carried out once each week for forty minutes by the author with the remaining three children. The results will be discussed within the following groupings; teacher intervention, researcher intervention, and those children who crossed assessment Age Bands. Each child's intervention results will be discussed separately and more general issues will be discussed at the end of this section. Where appropriate, the qualitative comments made by the classroom teacher about a child will be included in the discussion, although it is recognised that these comments are subjective in nature.

INTERVENTION RESULTS.

Teacher Intervention.

Child No 1.

When we consider child 1, the results of the visual inspection of this child's results suggest improvement occurring in the intervention phase. There was a change in mean in the direction of improvement in the intervention phase however a t - test could not be carried out to confirm the significance of the change in mean as serial dependency occurred in the pre-intervention phase. This child's teacher noted that the programme was carried out once only each week which immediately poses the question, would the intervention have caused greater effect if it had been carried out twice weekly as prescribed. The initial observation with child 1, as with each of the other subjects, was the variability in the scoring.

Another point that is important is one of timing and the frequency of using the Movement ABC for assessment. It is evident, from the baseline phase, that this child crosses from the at risk category to the borderline category and may not have been identified for intervention if the screening assessment had been conducted on a different day. This variability in performance presents difficulties and raises questions about single assessment methodologies. The class teacher had observed occasional 'clumsiness' but she had not considered that the child may have particular motor problems. The teacher had felt that any clumsiness that she had observed was as a result of the child's size. This child was taller and of larger frame than her class peers. However, when some of the other children engaged in some of the prescribed activities they appeared to find the tasks easier and on occasions were faster in carrying out the activities, particularly the manual dexterity tasks.

Child No 2.

This child presents an interesting case in terms of the timing of assessment. As noted previously, this child has only one score point in the intervention phase assessed in Age Band 2. The subject had a birthday in the intervention phase and subsequently was assessed in Age Band 3. Age Band 3 is for the assessment of 9 and 10 year old children. Again the children are assessed in the areas of Manual Dexterity, Ball Skills Static and Dynamic Balance. The tasks are different from the previous Age Band. The issue of crossing Age Bands will be discussed later in this chapter. However, visual inspection of the data is of value when taken into consideration with the data of the other children. In the base line phase there is some variability in the scores. This child's baseline scores are consistently in the at risk category, the final score in the baseline phase was 16. The single score in the intervention phase was 11.5, a score in the borderline category This change in level, from the baseline phase to the intervention phase, suggests that there may have been improvement associated with the intervention which would have been identified if the child had continued to be assessed in Age Band 2, particularly as the single intervention score moved the child from the at risk category for the first time. The three subsequent scores in the intervention phase are presented in **Table 30,** page 119. The scores obtained in Age Band 3 are again in the 'at risk' category.

This child was regularly absent from school and therefore received the intervention twice in the week prior to assessment 7, was absent for week 8, and once only in each week 9, 10, & 11 thereafter. With only one score point in the intervention phase in age band two, no firm conclusions can be drawn in respect of the effect of intervention.

It would be interesting to consider whether there is any relationship between this persistent absenteeism and the co-ordination difficulties of the child. Although her movement experiences and opportunities obviously extend beyond school.

The intervention was carried out by the class teacher who had not considered the child to have motor difficulties. Although the teacher did note while carrying out the programme, that other children appeared to find the prescribed balance activities easier than the subject did. No other observations about this child's progress in relation to motor skill were noted by the class teacher.

Child No 6.

When we consider child 6, again there is some variation in the total scores. There is a change in mean from 14.31 in the baseline phase to 13 in the intervention phase. This change was not significant ($p= 0.136$). However, from visual inspection of the change in level and the change in trend suggest that there may have been some improvement in the intervention phase. The trend of the data in the baseline phase appears horizontal, perhaps slightly upwards, suggesting no change and perhaps some deterioration. In the intervention phase, the baseline trend appears initially to continue up to week 11 but then there is a definite downward trend over the remaining 4 weeks suggesting improvement.

The intervention with this child was carried out by the class teacher twice weekly. Of the eight baseline scores three of the scores fall into the borderline category. This again raises the issue of timing and the frequency of using the Movement ABC. As in the case of child No.1, this child may not have been identified for intervention if they had not happened to score in the at risk category on their first assessment. This child was one of twins and the class teacher had observed differences in the presentation of their work and in ball skills in the playground. This child's Ball skills sub total score reflects these difficulties. The teacher observed of this child that;

" her work is untidy and she cannot catch a ball in the playground."

No further observations were noted by the class teacher.

Child No 7.

This child's results are not included in the group analysis however, the results are briefly discussed here. The intervention programme was not carried out with this child. Each week the teacher reported that she had not been able to carry out the intervention plan due to the child's involvement in other activities and musical events occurring in the school at that time. The child's teacher had noticed that the child had some difficulties in the playground catching a ball and in the class room knocking into chairs and desks. She suggested that these difficulties were connected to the child being of larger frame and much taller than her peers, similar to the observations by the teacher in respect of child 2.

From visual inspection I feel that it is of value to note that yet again there is variability in the subject's scores which swing from the borderline to the at risk category again with implications for the timing and frequency of assessment using the Movement ABC. It is also of note that, taking the data as a whole, there appears to be a horizontal trend in the data suggesting no change over time which again supports the need for intervention.

Child No 8.

When we consider child 8, again from visual inspection the initial observation is of variability in performance. Three total scores of nine, in the baseline phase were in the borderline category. In the intervention phase, five of the six total scores were in the borderline category. The trend in the baseline phase appears horizontal whilst the trend in the intervention phase appears to be horizontal but lower. There was a change in mean indicating improvement in the intervention phase which proved to be significant ($p=0.041$).

The teacher had not observed that the child had particular motor difficulties except to note that she had concerns about the child's untidy writing. This child's sub total scores

reflected greater difficulty in the area of manual dexterity which, on visual inspection, did appear to improve in the intervention phase. Whilst carrying out some of the activities the teacher noticed that other children could perform the manual dexterity tasks faster than this child. The teacher commented that the child's hand writing had improved greatly by the end of the intervention phase and that she appeared to be more confident in relation to writing and taking part in physical education classes.

Researcher Intervention.

The intervention with the following three children was carried out by the researcher and an assistant. The prescribed activities demanded various combinations of relationships within this group. That is the activities were carried out on a 1:1, 1:2 or 2:3 basis. As noted above, the sessions were carried out once only each week for a 40 minute period.

Child No 3.

Once again, on visual inspection, this child's total ABC scores, indicate variability in performance in both phases. In the baseline phase all the scores are in the at risk category. Three of the four scores in the intervention phase are in the borderline category. This, taken into consideration with the change in mean, the upward trend of the data in the baseline phase and the downward trend in the intervention phase, indicates improvement occurring in the intervention phase. The mean in the pre-intervention phase was 17.31 and 12.87 in the intervention phase. This change in mean proved to be significant ($p=0.035$).

Child No 4

Child 4 is the second of the two children who cross to another assessment Age Band. In Age Band 3 all scores obtained were in the at 'risk' category. For the purpose of this evaluation only those scores that were in Age Band 2 are presented in the results. Again great variability in the scores can be seen In the baseline data all scores are in the at risk

category. Two of the six scores in the intervention phase are in the borderline category. There is a change in mean however, this change did not prove to be significant at the .05 level of significance (p=0.442). Although the change in mean did not prove to be significant, it is important to note from visual inspection that the trend of the data in the baseline phase is upwards, suggesting deterioration in the baseline phase and the trend in the intervention phase is downward, suggesting improvement occurring in this phase. Here, as with child 2, there was a distinct rise in the scores when the child crosses Age Bands. Further research is required to investigate this issue.

Child No 5.

The results from the Movement ABC again shows great variability in total scores. The visual presentation of this data shows a horizontal trend in the baseline phase. There is a definite downward trend in the data in the intervention phase. All of the scores in the baseline phase are in the at risk category, 86% of the scores are above a score of 20, whereas in the intervention phase, 60% of the scores are below 20 suggesting improvement. The change in mean , change in level, change in direction of trend and the significance of the change in mean (p=0.012) all contribute to a total picture of change in the second phase, and suggest improvement in the intervention phase.

It may be worth noting week 5 in the baseline phase when this child scored 16. This score appears to be quite different from the general pattern of the scores, even when we allow for the range in scores found in other subjects. Without this single score the evidence supporting the argument of improvement in the intervention phase would be even greater.

This child was initially extremely timid and shy. However, as the weeks progressed his confidence appeared to improve immensely. He increasingly participated with great enthusiasm and he showed considerable improvement in his motor skill ability. This child

appeared to respond to the one to one and small group situation very positively. The class teacher commented that she had not observed an improvement in his motor skill ability, however, she had observed an increase in confidence in his interaction with his peers.

All Children.

From the visual inspection of the graphs of the 8 children, excluding child No.2 (as there is only one point in the intervention phase) and Child No. 7 (as no intervention took place), it can be seen that the lower scores in the intervention phases come towards the end of the graphs. This poses questions in relation to the length of the intervention phase. The intervention may be having an effect but the time scale within which this study was conducted did not adequately allow for the delay in intervention effect. This would support the argument for extended periods of intervention before expecting highly significant improvements in motor ability as measured by the ABC.

Finally, the intervention effect was evaluated across the group as a whole using the Rn test of ranks. The effect of the intervention proved to be significant at 0.025 level of significance.

From the information presented above there is evidence that suggests improvement occurs following intervention. Whether this improvement is as a result of the attention the children are receiving or the fact that they have time to practice their skills, is difficult to ascertain particularly when there is such variation in the baseline phase and when the study is conducted within limited base line periods. Improvement occurred both with children who received intervention from the class teacher and those who received intervention from the researcher. Wright, Sugden, Richard Ng, and Tan John, (1994) provided evidence which strongly supports the idea that children do not need to be withdrawn from the classroom, but note that specific planning for each individual child is essential for success.

However, there is evidence to suggest that intervention should not be the responsibility of one individual. For example, Child No. 7 did not receive intervention because various other school activities demanded the focus of the teacher. These demands are typical in any school and may determine how regularly the prescribed activities are carried out, as with Child 2. To ensure intervention occurs must be the first priority when carrying out an intervention study. For this reason alone, in retrospect, a shared approach would have been of great value where the intervention is not the sole responsibility of one individual.

The 'best' person to carry out the programme or be responsible for the programme may vary for each individual child. When a child is assessed, each individual involved with the child must also be assessed as to the realistic level of commitment that they can give to the programme. In respect of this study, class size, the structure of the physical education programmes, teachers other responsibilities, facilities, and equipment available all varied from school to school and teacher to teacher and therefore may have affected the level of commitment each teacher could give. In this study parents, were not involved in the intervention programme. However, it could be argued that they too may be key figures. Peters (1995) carried out a study to evaluate the effect of a specific group exercise programme co-designed by a physiotherapist and a teacher on motor function. ABC scores decreased significantly ($p<0.005$). Her study provided evidence in support of an interdisciplinary approach to intervention programmes for children with movement difficulties.

Those Who Crossed Assessment Age Bands.

Of the group of eight children, two children (Child No's 2 & 4) had birthdays in their intervention phase which brought them into another Age Band for assessment. This resulted in higher scores and, in both cases, placed the child in the at risk category.

Table 30 below and **Table 31** (page 120), include the scores obtained when children No's. 2 & 4 were assessed in Age Band 3 during the intervention phase.

Table 30.

Child No.2 *ABC scores Post intervention (Age band 3),*

week	sub 1	sub 2	sub 3	**Total ABC scores.**
8	14	0	7.5	21.5
9	13	3	5.5	21.5
10	14.5	2	2	18.5

Total ABC scores (pre and post intervention) including the final 3 scores that were obtained in Age Band 3. (---------- Indicates the beginning of the intervention phase)

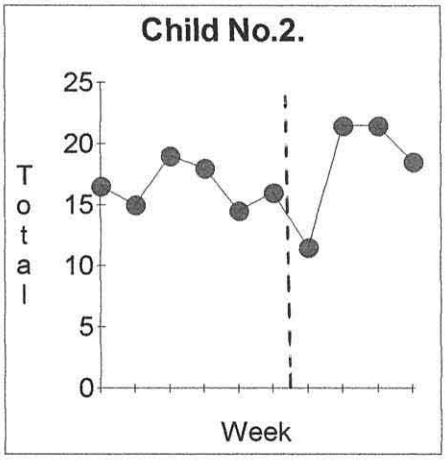


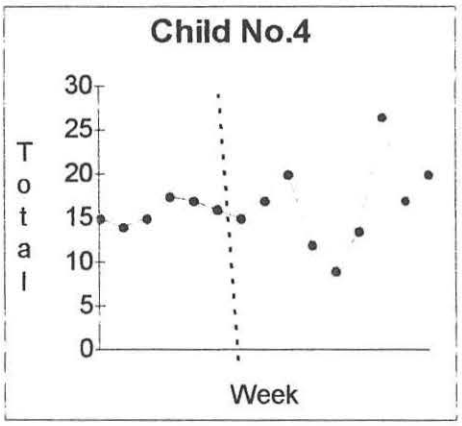
Table 31.

Child No. 4.

ABC scores post intervention (Age band 3),

Week	sub 1	sub 2	sub 3	Total
13	13.5	3	10	26.5
14	7.5	0	9.5	17
15	10	1	9	20

Total ABC scores (pre and post intervention) including the final 3 scores that were obtained in Age Band 3. (-------- indicates the beginning of the intervention phase)



At the point in time when a child transfers to another Age Band for assessment there is a concomitant increase in total scores, and this gives rise to many questions. For example, is this increase in total scores temporary and does it occur with all children at the point of Age Band change? or is it because the children in this study were a little more anxious, as they were told that they were being assessed within an older Age Band and therefore may have assumed the activities were more difficult. A child may be assessed in the next

appropriate Age Band immediately following a birthday and provide total ABC scores which are high. The issue is then one of whether this increase in score reflects a deterioration in performance or is it a result due to test procedures. As there are only three scores in the third Age Band for each child, it is difficult to make any firm conclusions about this issue. However, this would support the need to obtain information from other individuals involved with the child to gain a total picture of the motor ability of a child and not depend on one assessment alone. This may be obtained from parents, teachers or both.

As is evident from this study, the evaluation of intervention is a difficult area to research as there are so many uncontrollable variables. There are books and articles which suggest methods of treatment or intervention for these children, however, very few of these articles evaluate the treatments either in the long or short term. Many therapists verbally report improvement following periods of intervention but do not present empirical evaluations of the intervention. Miyahara (1996) reviewed recent intervention studied on children with DCD. A meta-analysis of the findings from previous studies found no support for the efficacy of any specific intervention approach. This is in agreement with Wilson, Kaplan, Fellowes, Grunchy, & Faris, (1992) who compared the effects of an intervention programme based on sensory integration and one based on tutoring and also found no support in favour of a particular approach. Miyahara (1996) also critically examined the methodological problems of the intervention studies and raised several issues particularly the need for more specific empirical evidence if therapists, parents or teachers are to treat and recognise the problems inherent in children with DCD.

IMPLICATIONS FOR GWYNEDD HEALTH AUTHORITY.

In brief, the results from this study suggest that approximately 5% of children in Gwynedd experience motor difficulties and there is evidence to suggest that they would benefit from

a period of intervention. This being the case, there are two main issues facing Gwynedd; one of screening, to ensure the identification of all children with DCD, and the second, to provide a co-ordinated intervention response to these difficulties. These two issues raise some interesting questions. Firstly, in relation to screening, should specific individuals be employed to screen for DCD only and screen all children or should individuals already involved in screening, such as Health Visitors, G.P.s Teachers and others, be educated to be more aware of DCD? It would appear to be worth exploring the possibility of heightening the awareness of health visitors and teachers to DCD, as these individuals are more likely to have more contact with children at an early stage and be able to see them participating in normal activities at home and school. They are also in a position to work closely with parents and pick up on any of their concerns.

Secondly, in relation to intervention, the question arises about who should be responsible for the intervention: Occupational Therapists, Physiotherapists, Other Remedial Therapists, Teachers or others? Is it appropriate to place further demands on existing children services? Support to fund the provision of an intervention service could be difficult to obtain in the light of the limited empirical evidence confirming the success of intervention techniques.

I feel it is essential to provide a service for these children and, in the long term, it would be very short sighted not to. Failure to address the problem at an early stage may lead to further difficulties in schools, and at home which, in turn, may make further demands on other services (Henderson, Knight, Losse, and Jongmans, 1991). In this situation, the real needs of the child may be overlooked. It is not sufficient to assume that the existing services can accommodate children with movement difficulties and pay appropriate attention to their special needs. In other parts of the UK. Occupational Therapists have been identified to have the appropriate skills to develop and address the difficulties of this

group of children (Fairgrieve, 1989). However, as this study has highlighted, intervention must be closely monitored and evaluated. In order to do this it may be necessary to allocate full time Therapists or others to develop this service from a screening and intervention aspect. These individuals could be involved in: awareness training for the individuals involved in early screening; maintaining up to date information on screening tools; collating information on intervention from other areas; identifying other areas of good practice; carrying out and co-ordinating intervention; and conducting ongoing research in the area of intervention. Therapy training has recognised the importance of research skills for therapists and recent trends in professional training include an increased element of research skill development. Therapists have recognised the importance of formally evaluating their work and recently, within the Health Service, there are increased demands on therapists to provide quantitative quality assurance measures. Jointly funded positions, by Health and Education Authorities, may enable a Therapist to develop an intervention service and conduct more formal research to ensure quality of service.

The two issues outlined above have funding implications which pose a further challenge, specifically that of the identification of responsibility. This service deficiency should be responsibility of the Health Authority, or the Local Education Authority, or some voluntary agency, or joint responsibility. The problems that arise when the needs of such children are not addressed may have an effect on a number of the above agencies. Therefore, I would argue that the provision of this service should not necessarily be the responsibility of one agency but that partnerships should be developed to provide a more holistic response to the needs of children with DCD.

LIMITATIONS OF THE PRESENT STUDY.

As this study proceeded various limitations became apparent. The following points are outlined in order to summarise the concerns of the researcher in the interpretation of the results of this study and to point out issues which may be taken into consideration when planning future research.

The researcher has expressed concerns in the previous chapter regarding sample size and suggests that the reader is aware of this when considering the results. When evaluating the results of the intervention phase the absence of stable baselines also presents limitations. This study was carried out in a specified time limited period. Consequently, there were limitations on the time that could be allowed for the baselines to stabilise. Kerlinger (1982) notes that;

> 'Visual inspection depends on having stable baseline phases in which no trend in the direction of expected change is evident' **(p242)**.

The evidence from this study did not suggest a therapeutic trend in the baseline phase. However, the number of baseline data points is limited, one further test score in this phase may have resulted in a visual trend in the direction of expected change. Because of the limitations and restrictions on time each child was assessed on a weekly basis. The child could become very familiar with the test and practice those tasks included in the test. Therefore the improvement, indicated in the intervention phase, may be a delayed learning effect and not as a direct result of the intervention.

Literature suggests that the expected frequency of DCD is 6%. As this study was carried out in a rural area, there were a number of practical problems involved in identifying a

sample group. These included the size of the county for screening, transport costs, travel time required, and the amount of time necessary to carry out the screening assessments.

Many difficulties arise when carrying out research. As noted previously, one of the great difficulties of carrying out research in the field is lack of control. When carrying out the intervention programmes further practical issues arose. These included: lack of access to children when arriving at a school; one child identified as having difficulties was based too far away to see on a regular basis; another child, who was identified for intervention was expelled from the school for behavioural difficulties; children not present for assessment due to illness, or the teacher forgetting the appointment, or on arrival at the school the child was engaged in other school activities such as outings or concerts; shared facilities in which to carry out the assessments and the intervention; and additional demands on teacher time. The researcher did not always have control over the manner in which the intervention activities were taught or whether or not the programme was carried out. In this study, the intervention programmes were not always carried out as often as prescribed due to other demands on teacher time. If all the intervention programmes had been carried out by the researcher the results may have been more convincing. Evaluating teacher versus external input would perhaps have been more appropriately left to another time. Perhaps that is a study that should only be addressed when the framework for intervention with these children is further researched and is more reliable. Lack of control results in statements of relations being weaker for field studies as opposed to laboratory experiments (Kerlinger 1986). The limitations and lack of control in the field study make it all the more important to focus the research and not try to answer too many questions.

A further limitation of this study was that a follow up study to evaluate if the changes were permanent could not be carried out in the light of the instability of each subjects total scores. The assessment would need to be repeated over a period of time which went

beyond the time restraints operating upon the researcher. These points should be considered when planning further research in this area.

FUTURE RESEARCH DIRECTIONS.

Although the difficulties of carrying out research in the field have been highlighted above, this should not discourage therapists or others from carrying out research in relation to intervention. If therapists or others are working with children who have movement difficulties, the techniques should be documented and evaluated, and published to share with other therapists and not just kept in the individual's case notes.

This study has highlighted the need for further research in the field of intervention. In addition to this, the issue of assessing at the point where a child has a birthday and crosses from one assessment Age Band to the next requires further investigation. Does the high score that occurs with the two children in this study at the point of Age Band change occur only with the children who have difficulties or does this rise in score occur with all children? Is it temporary, or is it more appropriate to assess a child when they are one month or two months into a new assessment Age Band?

CONCLUDING REMARKS.

As noted at the beginning of this chapter, this study had two main aims, firstly to establish the percentage of children in Gwynedd with Developmental Co-ordination Disorder (DCD) and secondly, to apply an intervention programme with a sample of children with DCD, and evaluate its effect.

This study confirms that there are children in Gwynedd who have movement difficulties and this raises issues about acknowledging these difficulties and the concomitant provision of adequate services to meet the identified need. In addition, the Movement ABC

(Henderson and Sugden, 1992) has been identified as an appropriate assessment tool to initiate the identification of this group of children.

The study outlines the activity programmes carried out with eight of the children who were identified to have movement difficulties and, following evaluation, each child appears to have benefited from the intervention. The fact that children appear to benefit from intervention makes the need for the recognition of these difficulties within the county of Gwynedd all the more urgent. I hope the findings of this study are of benefit to the children who continue to contend with movement difficulties.

REFERENCES

Alberman, E. (1984). Describing the Cerebral Palsies: Methods of Classifying and Counting. In F.Stanley & E. Alberman (Eds.), *The Epidemiology of the Cerebral Palsies.* Oxford: S.I.M.P. with Blackwell scientific Publications Ltd. Philadelphia: J.B. Lippincott Co.

American Psychiatric Association. (1987). *Diagnostic and Statistical Manual of Mental Disorders (3rd ed., rev).* Washington, DC: American Psychiatric Association.

Annet, M. (1970). The growth of Manual Preference and Speed. *British Journal of Psychology*, **61,** 545-558.

Ayres, A.J. (1972). *Sensory Integration and learning Disorders.* Western Psychological Services.

Ayres, A.J. (1979). *Sensory Integration and the Child.* Western Psychological Services.

Ayres, A.J. (1980). *Southern California Sensory Integration Tests* (rev.ed.). Western Psychological Services.

Baer, D.M. (1977). Perhaps it would be better not to know everything. *Journal of Applied Behaviour Analysis*, **10**, 167-172.

Bax, M.C.O. (1964). Terminology and Classification of Cerebral Palsy. *Developmental Medicine and Child Neurology,* **6**, 295-307.

Brinkman, J., Kuypers, H.C.H.M. (1973). Cerebral Control of Contralateral and Ipsilateral Arm, Hand and Finger MOvements in the split Brain Rhesus Monkey. *Brain,* **96,** 653-674.

Bruininks, R.H. (1974). Physical and Motor development of Retarded Persons [Ellis, N. R. Ed.]. *International Review of research in Mental Retardation.* New York Academic Press.

Clancy, H., Clark, M.J. (1990). *Occupational Therapy with Children.* Churchill Livingstone.

Cummins, R.A. (1988). *The Neurologically Impaired Child, Doman-Delacato Techniques Reappraised.* Croom Helm: London.

Croce, R., DeParpe, J. (1989). A Critique of Therapeutic Intervention Programming with Reference to an Alternative Approach Based on Motor Learning Theory. *Physical and Occupational Therapy in Peadiatrics,* **9,** 5-33.

Delacato, C.H. (1959). The Treatment and Prevention of Reading Problems. Springfield: Charles C Thomas.

Delacato, C.H. (1963). The Diagnosis and Treatment of Speech and Reading Problems. Springfield; Charles C. Thomas.

Education Act. (1981). London: H.M.S.O.

Fairgrieve, E.M. (1989). Alternative Means of Assessment; A Comparrision of Standardised Tests Identifying Minimal Cerebral Dysfunction. *British Journal of Occupational Therapy*, **52**(3), 88-92.

Fitts, P., & Posner, M. (1967*). Learning and Skilled Performance in Human Performance. Belmont.* CA;Brooks/Cole.

Frankenburg, W.K., and Dobbs, J.B. (1967). The Denver Developmental Screening Test. *Journal of Peadiatrics*, **71,** 181.

Goodgold-Edwards, S.A., & Cermak, S.A. (1989). Integrating Motor Control and Motor Learning Concepts With Neuropsychological Perspectives on Apraxia and Developmental Dyspraxia. *The American Journal of Occupational Therapy*, **44**, 431-439.

Gordon, N., and McKinlay, I. (1980). *Helping Clumsy children.* Churchill livingstone.

Gesell, A. (1950). *The First Five Years of Life.* Methuen: London.

Gubbay, S. S., (1975). *The Clumsy Child: A Study of a developmental Apraxic and Agnosic Ataxia.* London: Saunders.

Guilfoyle, E., Grady, A.P., Moore, J.C. (1981). *Children Adapted.* Charles B. Slack, Thorofare, New Jersey.

Hall, D., (1991). *Child Health Surveilance*: H.M.S.O.

Hallahan, D.P., & Cruickshank, W.M. (1973). *Psycho-educational Foundations of Learning Disabilities.* Englewood Cliffs, N.J. Prentice Hall.

Hebb, D.O. (1949). *The Organisation of Behaviour.* Wiley: New York.

Henderson, L., Rose, P., & Henderson, S.E. (1992). Reaction Time and Movement Time in Children with a Developmental Coordination Disorder. *Journal of Child Psychology*, **33,** 895-905.

Henderson, S. E., & Barnett, A.L. (1996). *Developmental Movement problems.* Paper in preparation.

Henderson, S. E. (1984). The Henderson Revision of The Test of Motor Impairment. *British Journal of Physical Education.* **15,** 73-75.

Henderson, S. E., and Hall, D., (1982). Concomitants of Clumsiness in Young School Children. *Developmental Medicine and Child Neurology*, **24**, 448-460.

Henderson, S.E. (1986). The Assessment of 'Clumsy' Children; Old and New Approaches. *Journal of Child Psychology and Psychiatry,* **28**, 551-27.

Henderson, S.E., Knight, E., Losse, A., and Jongmans, M. (1991). The Clumsy Child, Are We Doing Enough?. *British Journal of Physical Education. [Research Suppliment.*No. 9.]

Henderson, S.E. and Stott, D.H. (1977). Finding the Clumsy Child; Genises of a Test of Motor Impairment. *Journal of Human Movement Studies*, **3**, 38-48.

Henderson, S.E. and Sugden, D.A. (1992). *Movement Assessment Battery for Children.* The Psychological Cooperation.

Holle, B. (1976). *Motor Development in Children.* Blackwell Scientific Publications, Oxford.

Huss, A.J. (1983). Overview of Sensorymotor Approaches. In Hopkins, H.L., & Smith, H.D. (Eds.), *Occupational Therapy* (p114-123).

Hudson, A.M., Murphy, A.C., & Clunies-Ross, A.A. (1978). Research into the Doman Delcato Method:Implications for Special Educators. *Australian Journal of Special Education*, **2,** 10-17.

Jones, R.R., Weinrott, M.R., & Vaught, R.S. (1977). Effects of Serial Dependency on the Agreement Between Visual and Statistical Inference. *Journal of Applied Behaviour Analysis,* **11,** 277-283.

Kavale, K., & Mattson, P.D. (1983). One Jumped Off The Balance Beam: Meta-Analysis of Perceptual Motor Training. Journal Of Learning Disabilities, **16**, 165-173.

Kazdin A.E. (1976). Stastical Analysis For Single Case Experimental designs. In Hersen, M., & Barlow, D.H. *Single Case Experimental Designs: Strategies for Studying Behaviour Change.* New York: Peramon.

Kazdin, A.E. (1982). *Single-Case Research Design.* Oxford University Press.

Keogh, J.F. (1968). *Analysis of Individual Tasks in the Stotts test of Motor Impairment.* [Technical Report 2- 68]. Los Angeles: University of California.

Keogh, J.F., and Oliver, J.N. (1978). Movement Outcomes as Conceptual Guidelines in the Perceptual Motor Maze. *Journal of Special Education*, **5,** 321-307.

Keogh, J.F., Sugden, D., Reynard, C.L. and Calkins, J.A. (1979). Identfication of Clumsy Children; Comparisions and Comments'. *Journal of Human Movement Studies.* **5,** 32-41.

Keogh, J. and Sugden, D. (1985). *Movement Skill Development.* Macmillan.

Kephart, N.C. (1960). *The Slow Learner in The Classroom.* Merrill: Colombus.

Kephart, C., & Newell, "n.d.". *Tests for gross Motor Functions in Children.* Stoelting Co, 620 Wheat Lane, Wood Dale, Illinois, 60191, USA.

Kerlinger, N.F. (1986). *Foundations of Behavioural Research* (3rd ed.). Holt Reinhart Winston.

Kratochwill, T.R., & Wetzel, R.J. (1977). Observer Agreement, Credibility, and Judgement:Som Considerations in Presenting observer Agreement Data. *Journal of Applied Behaviour Analysis,* **10,** 133-139.

Lam, Y.Y., & Henderson, S.E. (1987). Some applications of The Henderson Revision Of the Test of motor impairment. *British Journal of Educational Psychology,* **57,** 389-400.

Laszlo, J.I., & Bairstow, P.J. (1985). *Perceptual-Motor Behaviour; Developmental Assessment and Therapy.* Eastbourn; Holt Saunders.

Lee, T.D., Swanson, L.R., Hall, A.L. (1991). What is Repeated In a Repetition? Effects of Practice Conditions On Motor Skill Acquisition. *Physical Therapy*, **71**, 150-156.

Lewko, J.H. (1976). Current Practices in Evaluating Motor Behaviour of Disabled Children. *American Journal of Occupational Therapy*, **23,** 413-419

Loria, C., (1980).Relationship of Proximal and Distal Function in Motor Development. *Physical Therapy* **60**, 167-172.

Losse, A., Henderson, S.E., Elliman, D., Hall, D., Knight, E., & Jongmans, M. (1991). Clumsiness in Children; Do they Grow Out Of It? A 10 year follow-up study. *Developmental Medicine and Child Neurology*, **33**, 55-68.

McKeith, R. (1974 Sept/Nov). Questions and Answers about Doman-Delacato. *Intellectually Handicapped Child*, 22-25.

McClenaghan, B.A., Gallahue, D.C. (1978). *Fundamental Movement; a Developmental and Remedial Approach.* Philadelphia: W.B. Saunders.

Munro, B.H., & Page, E.B. (1993) .*Stastical Methods for Health Care Research* [2nd ed.]. Lippincott.

Michael, J. (1974). Statistical inference for individual organism research: Mixed blessing or curse? *Journal of Applied Behaviour Analysis* 647-653.

Miyahara, M. (1996). *A Meta-Analysis of Intervention Studies on Children with Developmental Coordination Disorder.* Presented at the Developmental Coordination Disorder Conference in Leeds.

Myers, P., & Hammill, D. (1976). Methods for Learning Disorders [2nd edition]. New York; John Wiley.

Neuhauser, G. (1975). Methods of assessing and recording motor skills and Movement patterns. *Journal of Developmental Medecine and Child Neurology*, **9**, 625-630.

Oseretsky, N.A. (1948). A Metric Scale for Studying the Motor Capacity of Children. *Journal of Consulting Psychology*, 12 - 37.

Ottenbacher, K. (1982). Sensory Integration Therapy; Affect or Effect. *American Journal of Occupational Therapy*, 571-578.

Parsonson, B.S., & Baer, D.M. (1978). *The Analysis and Presentation of Graphic Data, Single-subject research: Strategies for evaluating Change*. New York: Academic Press.

Peters, J.M. (1995). *Evaluation of a Specific Sensory Movement Exercise Group for Clumsy Children.* Unpublished masters thesis, Kings College, University of London.

Polatajko, H., Law, M., Miller, J. (1991). The Effect of a Sensory Integration Programme on Academic Achievement, Motor Performance and Self Esteem in Children Identified as Learning Disabled: Results of a Clinical Trial. *Occupational Therapy Journal of Research, 9 155-176.*

Polatajko, H.J., Kaplan, B.J., and Wilson, B.N. (1992). Sensory Integration Treatment for Children With Learning Disabilities; Its Status 20 years Later. *American Occupational Therapy Journal Of Research,* **12,** 323-341.

Poole, J.L. (1991). Application of Motor Learning Principles in Occupational Therapy; *American Journal of Occupational Therapy*, **45**, 531-537.

Rarick, G.L., Dobbins, D.A., and Broadhead, G.D. (1976). *The Motor Domain And its Correlates in the Educationally Handicapped Children.* Englewood Cliffs, New Jersey: Prentice Hall.

Rarick, G.L., & Widdop, J.H. (1970). The Physical Fitness and Motor Performance of Educable Mentally Retarded Children. *Exceptional Children*, **36,** 509-519.

Revusky, S.H. (1967). Some Statistical Treatments Compatible with Individual Organism Methology. *Journal of Experimental Analysis of Behaviour,* **10,** 319-330.

Risley, T.R. (1970). *Behaviour Modification: An Experimental-Therapeutic endeavor, Behaviour Modification and Ideal Mental Health Services.* Calgery, Alberta; University of Calgery Press.

Rosenbaum, D.A. (1991). *Human Motor Control.* Academic Press.

Rothwell, J.C., Traub, M., Day, B., Obeso, J., Thompson, P., & Marsden, C. (1982). Manual Motor Performance in a deafferented man. *Brain*, **105**, 515-542.

Russell, J.P.(1988). *Graded Activities For Children With Learning Difficulties.* Cambridge Educational.

Rutter, M. (1977). Classification. In M. Rutter & L. Hersov (Eds.), *Child Psychiatry: Modern Approaches.* Oxford Blackwell Scientific.

Schaffer, R. (1984). Sensory Integration with Learning Disabled Children: A Critical Review. *Canadian Journal of Occupational Therapy,* **51,** 73-77.

Schnelle, J.F., Kirchner, R.E., McNees, M.P., & Lawler, J.M.(1975)Social Evaluation Research: The Evaluation of Two Police Patrolling Strategies. *Journal of Applied Behaviour Analysis,* **8,** 353-365.

Schmidt, R.A. (1991). *Motor Learning And Performance: From Principles to Practice.* Human Kinetics.

Sidman, M. (1960). *Tactics of Scientific Research.* New York: Basic Books.

Stephenson, E., Dr. McKay, C., & Dr. McKay, T., (1986). *The Child with Motor Learning Difficulties, A guide for Parents and Teachers.* [Booklet] Occupational Therapy Dept., Royal Aberdeen Children's Hospital.

Stott, D.H., Moyes, F.A., & Henderson S.E. (1972). *Test of Motor Impairment.* Slough N.F.E.R. publishing Co. Ltd.

Stott, D.H., Moyes, F.A., & Henderson, S.E. (1984). *Test of Motor Impairment* [Henderson Revision]. Slough N.F.E.R. publishing Co. Ltd.

Sugden, D., & Sugden, L. (1991). The Assessment of Motor Skill Problems in 7-9 year old Children. *British Journal of Educational Psychology*, **61**, 329-345.

Sugden, D. & Wann, C. (1987). The Assessment of Motor Impairment in Children With Moderate Learning Difficulties. *British Journal Of Educational Psychology*, **57** 225-236.

Sugden, D., & Wright, H. (1995). *Helping your Child with Movement Difficulties.* School of Education, University of Leeds.

Tannock, R. (1976). Doman-Delacato Method for Treating Brain Injured Children: An Assessment. *Physiotherapy Canada*, **28**, 203-209.

Tew, B. (1978). Differences Between Welsh and Canadian Children on Parts of the test of Motor Impairment. *Journal of Child Health Care and Development*, **5**, 135-141.

Touwen, B.C.L. (1979). Examination of the Child With Minor Neurological Dysfunction. *Clinics in Developmental Medecine*, **71** London; S.I.M.P./Heinemann.

Warnock Report (1978*). Special Educational Needs*, London HMSO.

Williams, H., & Breihan, S. (1979). (unpublished). *Motor Control tasks for young Children.* University of Toledo.

Wilson, B.N., Kaplan, B.J., Fellowes, S., Grunchy, C., & Faris, P. (1992). The Efficacy of Sensory Integration Treatment Compared to Tutoring. *Physical and Occupational Therapy in Peadiatrics,* **12,** 1-36.

Wright, H.C., Sugden D.A., Richard Ng., & Tan, J. (1994). *Adapted Physical Activity Quarterly,* **11,** 150-157.

Youngson, R. (1995). *The Royal Society of Medicine, Encyclopedia of Family Health.* Bloomsbury Publishing Plc.

APPENDICES

Dear Headteacher,

I am a research student in the School of Education (Division of Health and Human Performance), at Bangor University, currently beginning my second year of a three year Master of Philosophy degree. My study is being supervised by Mrs. Sue Walsh and Dr. Lew Hardy. Part of my project is to identify the incidence of motor learning difficulties in 7/8 year old children attending mainstream schools in Gwynedd.

Motor Learning Difficulties can be identified by using the Movement Assessment Battery for Children (A.B.C.), which assesses children in the areas of manual dexterity, ball skills, static balance and dynamic balance. (Please see below a list of the activities the children would be observed engaging in.) This assessment must be carried out on an individual basis and takes about 30/40 minutes per child.

All primary schools in Gwynedd are being invited to take part in this practical assessment. As stated earlier it will involve classes of 7/8 year olds being tested on an individual basis. This testing will be carried out during the Spring and Summer terms 1994. The children will be tested by myself and an assistant and should involve minimal disruption to their normal school programme. For example, testing could take place during the Physical Education timetable.

All data will be confidential but head teachers will be given feedback on the test. It is envisaged that a small number of children with difficulties will be identified. Should this be the case, guidelines for intervention will be provided and the statistical information will be used to support requests for additional services for those with difficulties. Should you wish to know more about the assessment please do not hesitate to indicate this.

Further enquiries should be made through Mrs. S. Walsh (0248) 382756. I would be grateful if you could complete the accompanying slip and return it in the S.A.E. enclosed.

Yours Faithfully,

Veronica Dempsey Roberts.

The test involves observing the children engaging in 8 tasks which include;

1)Placing pegs on a peg board.
2)Threading a lacing board.
3)Pencil trail.
4)One hand bounce and catch.
5)Throwing bean bag into box.
7)Jumping in squares.
8)Heel to toe walking.

PLEASE COMPLETE AND RETURN THIS SLIP BY JANUARY 10th 1994.

I give my permission for this assessment to be carried out in my school. Please contact me to make the necessary arrangements. Yes / No

I require further information prior to making a decision. Yes / No

Headteacher_____

School_____ Tel_____

Address_____

_____

_____ Signed_____

VERONICA DEMPSEY ROBERTS.

Dear Parent/Guardian,

I am a research student in the School Of Education (Division of Health and Human Performance), at Bangor University.

My area of interest is Motor Skill Development in young children in particular identifying the skills the child has acquired by the age of 7 and 8 years.

To carry out my study I must implement The 'Movement Assessment Battery For Children' which assesses children in the areas of Manual Dexterity, Ball skills, and Balance skills on an individual basis.

The assessment would be carried out by myself and an assistant during the Spring and Summer terms 1994 and should involve minimal disruption to the normal school programme. All information will be treated in strictest confidence.

The information gleaned from this study will help to develop activity programmes for children aimed at enhancing the above skills.

I have kindly been given permission to carry out this study in ---------- by -------- pending your agreement. Should you **NOT** want your child to participate in this project I would be very grateful if you would sign and return to the headmaster, the enclosed slip, by February 4th 1994. In its absence it will be assumed that it is acceptable to you for your child to be included in this study.

Thanking you in anticipation.

Yours sincerely,

Veronica Dempsey Roberts.

FOR THE ATTENTION OF MRS. VERONICA DEMPSEY ROBERTS.

Please return to the Headmaster, Mr. Gareth Hughes by February 4th 1994.

Childs name _____

Address_____

_____

_____

_____

I DO NOT give permission for my child to participate in the outlined study.

Signed_____Parent/Guardian.

DATE _____

Manual Dexterity.

(a) Placing Pegs.

The peg board is placed on the table top mat. On one side of the board corresponding to the preferred hand, lay 12 pegs on the mat. the pegs should be placed in 4 horizontal rows of three, with approximately one inch between the columns and rows. To test the other hand reverse the position of the board and pegs.

Task:

The child holds the board steady with one hand and grasps a peg with the other. The grasped peg must remain in contact with the mat until the child is told to begin. At the signal the child places the pegs in any of the spaces in the board. The child is told that 4 holes will remain unfilled. The examiner should stop timing when the child releases the last peg. Both hands are tested.

Demonstration:

When demonstrating the task, emphasise,

* holding the board steady,
* picking up the pegs and inserting them one at a time,
* using only one hand during a single trial,
* inserting the pegs in any order,
* working as quickly as possible.

Practice phase:

The child is given one practice attempt with each hand. A practice attempt consists of the child placing 6 pegs in the board. If any fault of procedure is observed the examiner should interrupt at the earliest opportunity and give the reminder or re-demonstrate.

Formal trials:

Two for each hand. Present the second trial only if needed to achieve the pass criterion. Test the preferred hand first. No assistance may be given during these trials.

Record:

the number of seconds taken to complete each correct trial. Failed trial (f) if the child commits a procedural fault, i.e.

* picks up more than one peg at a time
* changes hands or uses two hands during a trial

(b)*Threading lace.*

Materials:

Lacing board
lace
Table-top mat
Stopwatch.

Set-up:
Place the task components in a central position in front of the child with the lacing board broadside to the child. Allow the child to choose the hand which holds the lace.

Task:
The child picks up the lace and the board before timing starts. At a signal, the lace is then threaded back and forth through the holes in the lacing board. Stop timing when the lace is through the last hole and the child pulls up the slack in the free end of the lace.

Demonstration:
While demonstrating the task, emphasise;
* threading the lace in and out, not around the edge of the board.
* pulling the lace through sufficiently to leave enough room for the remainder of the threading.
* pulling the of the lace tight after threading through the last hole, to signal completion of the task.
* working as quickly as possible.

Practice phase:
Give the child one practice attempt. A practice attempt shall consist of the child completing two holes on the board. If any fault of procedure is observed the examiner should interrupt at the earliest opportunity and give a reminder or re-demonstrate.

Formal Trials:
TWO. Present the second trial only if needed to achieve the pass criterion. No assistance may be given during these trials.

Record:
Number of seconds taken for a correct lacing.
Failed trial(F) if the child commits a procedural fault, i.e.
* laces around the edge of the board,
* misses a hole in the board.

(c)*Flower Trail.*

Materials:

Flower trails on the record form
Fine tipped red pen
Smooth writing that is not too hard or slippery

Set-up:

The child is seated at the table with both feet on the floor and arms resting comfortably on the table. The flower trail is placed in front of the child with the pen alongside.

Task:

The child draws one continuous line, following the trail without crossing its boundaries. The child is not penalised for lifting the pen provided he or she starts drawing again at the same point. Allow the child to make small adjustments to the angle of the paper (up to 45 degrees) so it is easier to perform the task. Only the preferred hand is tested.

Demonstration:

One of the trials from the Record form can be used in the demonstration and as the childs practice paper. While demonstrating the task, emphasise:

*keeping the pen in contact with the paper
*keeping between the boundary lines
*drawing as slowly as necessary to keep within the boundary lines
*drawing the line in only one direction, especially over the points of the flower.

Practice phase:

Give the child one practice attempt. As this is a time consuming task, only part of the trail need be practised. If the examiner does half of the trail in the demonstration the child could be given the rest to use as practice. If any fault of procedure is observed the examiner should interrupt at the earliest opportunity and give a reminder or re-demonstrate.

Formal trials:

TWO.Present the second trial only if needed to achieve the pass criterion. No assistance may be given during these trials.

Record:

Hand used to perform the task.
Number of errors, i.e. the number of times the drawn line moves outside one of the boundaries. It is not an error to run on a boundary. Count an additional error for each 12mm that the line continues outside the boundary.
Failed trail (F) if the child commits a procedural fault, i.e.
* reverses direction while drawing (this happens most often as the child moves the pen through the points of the flower)
* picks up the pen and starts drawing the line again somewhere else.

Ball Skills.

(a)*One Hand Bounce and Catch.*

Materials:

Tennis ball.

Set-up:

Have the child stand in a clear space away from walls and furniture. The floor surface should be smooth and even.

Task:

The child bounces the ball on the floor and catches it with the same hand. Both hands are tested.

Demonstration:

While demonstrating the task, emphasise

*bouncing the ball by throwing it to the floor with sufficient force for a good rebound.

*catching the ball with only one hand.

*catching the ball in the hand rather than trapping it against the body or clothing.

Practice phase;

Give the child five practice attempts with each hand. If any fault of procedure is observed the examiner should interrupt at the earliest opportunity and give a reminder or re demonstrate. The examiner should not stress the transition between the practice phase and formal trials.

Formal trials:

TEN attempts for each hand. No assistance of any kind may be given during these trials. If, however, the child fails an attempt, the examiner must remind the child of the fault(s) before proceeding to the next trial.

Record:

Number of correctly executed catches out of ten attempts for each hand.

A trial is failed if the child commits a procedural fault, i.e.

*catches the ball with two hands.

*catches the ball by trapping it against the body or clothing.

(b)*Throwing a Bean Bag into a Box.*

Materials:

Bean bag
Target box
Coloured tape

Set-up:

Place the target box on the floor with the short side facing the child. Measure a distance of 6 feet (2m) from the front of the target box and mark it with a short piece of tape.

Task:

The child throws the bean bag into the target box with one hand. Only one hand is tested.

Demonstration:

While demonstrating the task, emphasise;
*remaining behind the line while throwing,
*standing in the position most comfortable for throwing the bag,
*throwing the bag with only one hand.

Practice phase:

Give the child five practice attempts. During these trials the child may change hands if he or she wishes, but must choose only one for the formal tests. The child is not penalised for throwing the bag overhand, but it should be discouraged. If any fault of procedure is observed the examiner should interrupt at the earliest opportunity and give a reminder or re-demonstrate. The examiner should not stress the transition between the practice phase and the formal trials.

Formal trials:

TEN attempts. No assistance may be given during these trials.

Record:

Hand used to perform the task.
Number of successful throws out of ten attempts. As long as part of the beanbag lands inside the box a successful throw is counted.
A trial is failed if the child commits a procedural fault, i.e.
*steps over the line while throwing the bag.

Balance (static)..

Stork Balance.

Materials.

Stopwatch,
Child must wear gym shoes or trainers.

Set-up:
The child should stand in a clear space away from furniture and walls.

Task:
The child stands on one foot and places the sole of the other foot against the side of the supporting knee for up to 20 seconds. The hands are placed on the hips with the fingers facing forward. Once the child has achieved the balance position, start timing. Allow the child to choose the leg on which to balance first. Both legs are tested.

Demonstration:
While demonstrating the task, emphasise:
*keeping the standing foot in place while balancing,
*keeping the bent leg in position,
*keeping the hands on the hips.

Practice phase:
Give the child one practice attempt with each leg for a maximum of 10 seconds. The examiner may help the child assume the balance position. If any fault of procedure is observed the examiner should interrupt at the earliest opportunity and give a reminder or re-demonstrate.

Formal trials:
TWO for each leg. Present the second trial only if needed to achieve a pass criterion. No assistance may be given during these trials.

Record:
Number of seconds (up to 20) the child maintains balance without a procedural fault,i.e.
*moving the standing foot from its original place,
*moving the non-standing foot from the knee,
*taking the hands off the hips.

(2)**Balance (dynamic).**.
(a)*Jumping in squares.*
Materials:
Coloured tape.

Set-up:
Tape down six adjacent squares, each with an inside measurement of 18x18 inches (0.45m), to give an overall length of 9 feet (2.7m).

Task:
The child starts the task standing inside the first square with feet together. The child makes five continuous jumps forward from square to square, stopping inside the last square. The child is not penalised if the feet are slightly apart when landing, provided that balance is maintained. The last jump does not count if the child fails to finish in a balanced, controlled position.

Demonstration:
While demonstrating the task, emphasise;
*jumping inside the squares,
*jumping once inside each square,
*keeping the feet together while jumping,
*finishing the series of jumps in a balanced, controlled position inside the last square- this is achieved by bending the knees to accommodate the jump, and controlling momentum.

Practice phase:
Give the child one practice attempt.
If any fault of procedure is observed the examiner should interrupt at the earliest opportunity and give a reminder or re-demonstrate.

Formal trials:
THREE. Present the second and third trials only if needed to achieve the pass criterion. No assistance may be given during these trials.

Record:
Number of correct and consecutive jumps (maximum of 5) completed without committing a procedural fault,i.e.
*landing on or outside the lines,
*jumping more than once in a square,
*landing with the feet far apart.

(b)*Heel-to-toe walking.*

Materials:

Coloured tape.

Set up:

Tape down a fifteen foot (4.5m) line on the floor. The examiner should assume a position which allows a clear view of the sides of the feet throughout task performance.

Task:

The child walks on the line, placing the heel of one foot against the toe of the other with each step. Fifteen steps are required.

Demonstration:

While demonstrating the task, emphasise:

*keeping the feet straight on the line,

*touching heel to toe with each step.

Practice phase:

Give the child one practice attempt. This should consist of 5 steps. If any fault of procedure is observed the examiner should interrupt at the earliest opportunity and give a reminder or re-demonstrate.

Formal trials:

THREE. Present second and third trials only if needed to achieve the pass criterion. NO assistance may be given during these trials.

Record:

Number of correct consecutive steps the child takes (up to 15) without committing a procedural fault, i.e.

*leaving a space between toe and heel,

*stepping off the line.

CHILD	SCH	HAND	GENDER	Peg	Thread	Flower	SUB1	Ball	Bean	SUB2	Stork	Hop	Line	SUB3	TOTAL
1	1.00	1.00	2.00	.50	1.00	2.00	3.50	.00	.00	.00	1.50	.00	.00	1.50	5.00
2	1.00	1.00	1.00	.00	3.00	.00	3.00	.00	.00	.00	3.00	.00	3.00	6.00	9.00
3	1.00	1.00	1.00	.50	3.00	1.00	4.50	1.50	2.00	3.50	.00	.00	.00	.00	8.00
4	1.00	2.00	1.00	.50	2.00	1.00	3.50	.50	.00	.50	.50	.00	.00	.50	4.50
5	1.00	1.00	2.00	.00	.00	.00	.00	1.00	.00	1.00	.50	.00	.00	.50	1.50
6	1.00	1.00	2.00	1.50	2.00	.00	3.50	.00	1.00	1.00	.50	.00	.00	.50	5.00
7	1.00	1.00	1.00	.00	1.00	.00	1.00	.00	.00	.00	.00	.00	.00	.00	1.00
8	1.00	1.00	1.00	.00	3.00	.00	3.00	.50	.00	.50	.00	.00	.00	.00	3.50
9	1.00	1.00	2.00	.50	4.00	5.00	9.50	1.50	2.00	3.50	3.50	.00	3.00	6.50	19.50
10	2.00	1.00	1.00	2.00	2.00	1.00	5.00	2.00	2.00	4.00	.00	.00	.00	.00	9.00
11	2.00	1.00	1.00	.00	.00	.00	.00	3.50	.00	3.50	2.00	.00	.00	2.00	5.50
12	2.00	1.00	1.00	1.50	3.00	.00	4.50	4.50	2.00	6.50	2.00	.00	.00	2.00	13.00
13	2.00	1.00	2.00	.00	3.00	.00	3.00	.50	.00	.50	.00	.00	.00	.00	3.50
14	2.00	1.00	2.00	.00	1.00	.00	1.00	.00	.00	.00	.00	.00	1.00	1.00	2.00
15	2.00	1.00	2.00	.50	1.00	1.00	2.50	.50	.00	.50	.50	.00	.00	.50	3.50
16	2.00	1.00	2.00	.00	1.00	.00	1.00	.00	.00	.00	.00	.00	.00	.00	1.00
17	3.00	1.00	1.00	1.00	.00	.00	1.00	3.00	.00	3.00	.00	.00	.00	.00	4.00
18	3.00	2.00	1.00	.00	.00	1.00	1.00	.00	.00	.00	.00	.00	.00	.00	1.00
19	3.00	2.00	1.00	.50	1.00	.00	1.50	1.50	.00	1.50	.00	.00	.00	.00	3.00
20	3.00	1.00	1.00	1.50	4.00	2.00	7.50	.00	.00	.00	1.50	2.00	2.00	5.50	13.00
21	3.00	1.00	2.00	.00	3.00	.00	3.00	2.00	.00	2.00	1.00	.00	.00	1.00	6.00
22	3.00	1.00	2.00	.00	1.00	2.00	3.00	.00	1.00	1.00	3.00	.00	.00	3.00	7.00
23	3.00	1.00	2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
24	3.00	1.00	2.00	1.00	4.00	1.00	6.00	2.50	2.00	4.50	.00	.00	.00	.00	10.50
25	3.00	1.00	2.00	.00	1.00	1.00	2.00	1.00	.00	1.00	.50	.00	.00	.50	3.50
26	3.00	1.00	2.00	.00	1.00	1.00	2.00	.00	.00	.00	1.50	.00	.00	1.50	3.50
27	3.00	1.00	2.00	1.50	1.00	.00	2.50	1.00	.00	1.00	.00	.00	.00	.00	3.50
28	3.00	1.00	2.00	1.00	1.00	2.00	4.00	.50	.00	.50	1.00	.00	.00	1.00	5.50
29	3.00	1.00	1.00	.50	2.00	.00	2.50	.00	.00	.00	.00	.00	.00	.00	2.50
30	3.00	1.00	2.00	.00	2.00	.00	2.00	1.00	.00	1.00	.00	.00	.00	.00	3.00
31	3.00	1.00	2.00	.50	3.00	.00	3.50	.00	.00	.00	1.50	.00	.00	1.50	5.00
32	3.00	1.00	2.00	1.50	2.00	1.00	4.50	.50	.00	.50	2.00	.00	.00	2.00	7.00
33	3.00	1.00	2.00	.00	.00	.00	.00	1.00	1.00	2.00	1.00	.00	.00	1.00	3.00

INITIAL SCREENING.

34	3.00	1.00	1.00	.00	1.00	.00	1.00	.00	.00	.00	.00	.00	.00	.00	1.00
35	3.00	1.00	1.00	.50	1.00	1.00	2.50	4.50	1.00	5.50	.00	.00	.00	.00	8.00
36	3.00	1.00	1.00	1.50	1.00	2.00	4.50	5.00	5.00	10.00	.00	.00	.00	.00	14.50
37	3.00	1.00	1.00	.00	4.00	.00	4.00	2.50	1.00	3.50	.00	.00	.00	.00	7.50
38	3.00	1.00	1.00	.50	.00	.00	.50	.00	.00	.00	.50	.00	.00	.50	1.00
39	3.00	1.00	1.00	.00	2.00	2.00	4.00	3.50	.00	3.50	.00	.00	.00	.00	7.50
40	3.00	1.00	1.00	.00	.00	2.00	2.00	.00	.00	.00	.00	.00	.00	.00	2.00
41	3.00	1.00	1.00	.00	.00	2.00	2.00	.00	.00	.00	1.00	.00	.00	1.00	3.00
42	3.00	1.00	1.00	.50	1.00	.00	1.50	1.00	.00	1.00	.50	.00	.00	.50	3.00
43	3.00	1.00	1.00	.50	2.00	3.00	5.50	1.00	.00	1.00	2.50	.00	2.00	4.50	11.00
44	3.00	1.00	2.00	.00	2.00	3.00	5.00	1.00	.00	1.00	.50	.00	1.00	1.50	7.50
45	3.00	1.00	1.00	.00	.00	1.00	1.00	1.00	.00	1.00	.00	.00	.00	.00	2.00
46	3.00	1.00	1.00	.50	4.00	.00	4.50	1.00	.00	1.00	.00	.00	.00	.00	5.50
47	3.00	1.00	1.00	.50	1.00	.00	1.50	.00	.00	.00	.00	.00	.00	.00	1.50
48	3.00	1.00	2.00	1.00	.00	.00	1.00	.50	.00	.50	.00	.00	.00	.00	1.50
49	3.00	2.00	2.00	.50	4.00	.00	4.50	.00	.00	.00	.50	.00	.00	.50	5.00
50	3.00	1.00	2.00	2.50	3.00	.00	5.50	1.50	.00	1.50	2.50	.00	1.00	3.50	10.50
51	3.00	1.00	2.00	.50	3.00	.00	3.50	1.00	1.00	2.00	.00	.00	.00	.00	5.50
52	3.00	1.00	1.00	.50	.00	2.00	2.50	.00	1.00	1.00	.00	.00	.00	.00	3.50
53	3.00	2.00	1.00	.00	3.00	.00	3.00	1.00	2.00	3.00	.00	.00	.00	.00	6.00
54	3.00	2.00	1.00	.00	2.00	.00	2.00	3.50	1.00	4.50	.00	.00	.00	.00	6.50
55	3.00	1.00	1.00	.00	1.00	.00	1.00	.50	.00	.50	.00	.00	.00	.00	1.50
56	3.00	1.00	1.00	.00	1.00	3.00	4.00	1.50	.00	1.50	.00	.00	.00	.00	5.50
57	3.00	1.00	1.00	.00	1.00	.00	1.00	1.50	1.00	2.50	2.00	3.00	1.00	6.00	9.50
58	3.00	1.00	2.00	.50	4.00	3.00	7.50	1.00	.00	1.00	.00	.00	.00	.00	8.50
59	3.00	1.00	2.00	1.00	.00	3.00	4.00	.00	.00	.00	.00	.00	.00	.00	4.00
60	3.00	1.00	2.00	.50	2.00	.00	2.50	.00	.00	.00	.00	.00	.00	.00	2.50
61	3.00	2.00	2.00	.50	4.00	.00	4.50	1.50	1.00	2.50	1.50	.00	.00	1.50	8.50
62	3.00	1.00	1.00	.50	3.00	.00	3.50	.00	.00	.00	.00	.00	.00	.00	3.50
63	3.00	1.00	1.00	.00	.00	.00	.00	.50	.00	.50	.50	.00	.00	.50	1.00
64	3.00	1.00	2.00	2.00	.00	.00	2.00	.50	.00	.50	.00	.00	.00	.00	2.50
65	3.00	1.00	2.00	1.00	.00	1.00	2.00	.50	.00	.50	1.00	.00	.00	1.00	3.50
66	3.00	1.00	2.00	.00	4.00	.00	4.00	.00	.00	.00	.00	.00	.00	.00	4.00
67	3.00	1.00	2.00	.50	3.00	.00	3.50	.00	.00	.00	.00	.00	.00	.00	3.50

INITIAL SCREENING.

68	3.00	1.00	1.00	2.00	.00	.00	2.00	1.50	1.00	2.50	.50	.00	2.00	2.50	7.00
69	3.00	1.00	1.00	1.00	2.00	2.00	5.00	3.00	.00	3.00	1.00	.00	.00	1.00	9.00
70	3.00	1.00	1.00	.00	1.00	2.00	3.00	.50	.00	.50	3.00	.00	.00	3.00	6.50
71	3.00	1.00	1.00	.00	1.00	.00	1.00	.00	.00	.00	.50	2.00	1.00	3.50	4.50
72	4.00	2.00	2.00	3.00	3.00	5.00	11.00	5.00	3.00	8.00	2.00	2.00	3.00	7.00	26.00
73	4.00	1.00	2.00	1.00	3.00	3.00	7.00	.00	1.00	1.00	.00	.00	.00	.00	8.00
74	4.00	1.00	1.00	.00	3.00	1.00	4.00	.50	.00	.50	.00	.00	.00	.00	4.50
75	4.00	1.00	1.00	.00	2.00	.00	2.00	.00	.00	.00	1.50	.00	.00	1.50	3.50
76	4.00	2.00	1.00	.50	3.00	.00	3.50	.00	.00	.00	.00	.00	.00	.00	3.50
77	4.00	2.00	1.00	2.50	3.00	.00	5.50	2.50	1.00	3.50	.00	.00	.00	.00	9.00
78	4.00	1.00	1.00	.50	4.00	.00	4.50	1.00	.00	1.00	.00	.00	.00	.00	5.50
79	4.00	1.00	1.00	.00	1.00	1.00	2.00	1.00	.00	1.00	.00	.00	.00	.00	3.00
80	4.00	1.00	1.00	.00	1.00	.00	1.00	.00	.00	.00	.50	.00	.00	.50	1.50
81	4.00	1.00	2.00	.00	1.00	1.00	2.00	.00	.00	.00	1.00	.00	.00	1.00	3.00
82	4.00	1.00	1.00	.00	3.00	3.00	6.00	.00	.00	.00	.00	.00	.00	.00	6.00
83	4.00	1.00	2.00	.00	.00	3.00	3.00	.50	.00	.50	2.50	.00	.00	2.50	6.00
84	4.00	1.00	2.00	.00	4.00	5.00	9.00	.00	.00	.00	1.50	.00	1.00	2.50	11.50
85	4.00	1.00	2.00	3.00	4.00	4.00	11.00	2.50	2.00	4.50	3.00	.00	1.00	4.00	19.50
86	4.00	1.00	2.00	.00	3.00	3.00	6.00	1.00	.00	1.00	2.00	.00	.00	2.00	9.00
87	4.00	1.00	2.00	2.00	1.00	3.00	6.00	.00	.00	.00	2.00	.00	1.00	3.00	9.00
88	4.00	1.00	1.00	.00	1.00	2.00	3.00	.00	.00	.00	1.00	.00	.00	1.00	4.00
89	4.00	1.00	2.00	.00	3.00	.00	3.00	.50	.00	.50	.00	.00	.00	.00	3.50
90	4.00	1.00	2.00	.50	1.00	3.00	4.50	.50	.00	.50	.00	.00	.00	.00	5.00
91	4.00	1.00	2.00	.00	.00	.00	.00	1.00	.00	1.00	.00	.00	.00	.00	1.00
92	4.00	1.00	2.00	1.00	1.00	2.00	4.00	2.00	.00	2.00	.50	.00	.00	.50	6.50
93	4.00	1.00	2.00	.00	3.00	.00	3.00	3.00	.00	3.00	.00	.00	.00	.00	6.00
94	4.00	1.00	2.00	.00	3.00	2.00	5.00	.50	.00	.50	.00	.00	.00	.00	5.50
95	4.00	1.00	2.00	.50	4.00	.00	4.50	.00	.00	.00	.00	.00	.00	.00	4.50
96	4.00	1.00	1.00	.00	2.00	2.00	4.00	1.00	.00	1.00	1.50	.00	1.00	2.50	7.50
97	4.00	1.00	1.00	.00	2.00	.00	2.00	.50	.00	.50	.00	.00	.00	.00	2.50
98	4.00	1.00	2.00	.00	.00	.00	.00	.50	.00	.50	.50	.00	.00	.50	1.00
99	4.00	1.00	2.00	.00	4.00	1.00	5.00	.50	2.00	2.50	1.00	.00	.00	1.00	7.50
100	4.00	1.00	1.00	1.00	1.00	1.00	3.00	.50	.00	.50	.00	.00	2.00	2.00	5.50
101	4.00	1.00	2.00	4.00	.00	.00	4.00	.00	.00	.00	.00	.00	.00	.00	4.00

INITIAL SCREENING.

102	4.00	2.00	2.00	.50	3.00	2.00	5.50	.00	.00	.00	1.00	.00	3.00	4.00	9.50
103	4.00	2.00	2.00	.00	2.00	2.00	4.00	.00	.00	.00	1.50	.00	.00	1.50	5.50
104	4.00	1.00	2.00	.00	.00	.00	.00	2.00	.00	2.00	2.00	.00	.00	2.00	4.00
105	4.00	1.00	1.00	.00	3.00	.00	3.00	3.50	.00	3.50	.00	.00	.00	.00	6.50
106	4.00	2.00	1.00	.00	4.00	1.00	5.00	.00	.00	.00	.00	.00	.00	.00	5.00
107	4.00	2.00	1.00	.00	3.00	3.00	6.00	4.00	3.00	7.00	.50	.00	.00	.50	13.50
108	4.00	2.00	1.00	.50	3.00	1.00	4.50	.00	2.00	2.00	1.50	.00	.00	1.50	8.00
109	4.00	2.00	1.00	.00	3.00	.00	3.00	.00	1.00	1.00	.00	.00	.00	.00	4.00
110	4.00	1.00	1.00	.00	1.00	.00	1.00	.00	.00	.00	.50	.00	.00	.50	1.50
111	4.00	1.00	1.00	.50	1.00	3.00	4.50	.50	.00	.50	.00	.00	.00	.00	5.00
112	4.00	1.00	1.00	.00	.00	3.00	3.00	.00	.00	.00	.00	.00	.00	.00	3.00
113	4.00	1.00	1.00	1.00	.00	.00	1.00	.00	.00	.00	.00	.00	.00	.00	1.00
114	4.00	1.00	2.00	1.50	4.00	1.00	6.50	.50	.00	.50	.50	.00	.00	.50	7.50
115	4.00	1.00	2.00	.00	4.00	.00	4.00	.50	.00	.50	.50	2.00	.00	2.50	7.00
116	4.00	1.00	1.00	.00	2.00	.00	2.00	2.00	.00	2.00	.50	.00	.00	.50	4.50
117	4.00	1.00	1.00	.00	3.00	2.00	5.00	1.00	1.00	2.00	2.00	.00	1.00	3.00	10.00
118	4.00	1.00	1.00	.00	4.00	.00	4.00	.50	.00	.50	.50	.00	.00	.50	5.00
119	4.00	1.00	1.00	.00	4.00	.00	4.00	1.50	.00	1.50	4.00	.00	5.00	9.00	14.50
120	4.00	1.00	1.00	.50	4.00	2.00	6.50	.50	.00	.50	.50	.00	.00	.50	8.50
121	4.00	1.00	2.00	1.50	3.00	.00	4.50	.50	.00	.50	.50	.00	.00	.50	5.50
122	4.00	2.00	2.00	.50	4.00	1.00	5.50	1.00	.00	1.00	.50	.00	.00	.50	7.00
123	4.00	1.00	2.00	1.00	4.00	.00	4.00	1.00	.00	1.00	2.00	.00	.00	2.00	8.00
124	4.00	1.00	2.00	.00	4.00	1.00	5.00	.00	.00	.00	1.50	.00	.00	1.50	6.50
125	4.00	1.00	2.00	.00	4.00	2.00	6.00	.00	.00	.00	.00	.00	.00	.00	6.00
126	4.00	1.00	1.00	.00	4.00	4.00	8.00	2.00	2.50	4.50	3.00	.00	1.00	4.00	16.50
127	4.00	1.00	2.00	1.50	4.00	3.00	8.50	3.00	.00	3.00	1.50	.00	3.00	4.50	16.00
128	4.00	1.00	2.00	.00	4.00	4.00	8.00	.50	.00	.50	2.50	2.00	.00	4.50	13.00
129	4.00	1.00	1.00	.00	3.00	.00	3.00	1.00	.00	1.00	.00	.00	.00	.00	4.00
130	4.00	2.00	1.00	2.50	4.00	3.00	9.50	.50	.00	.50	1.00	3.00	1.00	5.00	15.00
131	4.00	2.00	2.00	.00	4.00	.00	4.00	.00	.00	.00	1.00	.00	.00	1.00	5.00
132	4.00	1.00	1.00	.00	1.00	.00	1.00	.00	.00	.00	.00	.00	.00	.00	1.00
133	4.00	1.00	1.00	2.50	.00	.00	2.50	.50	.00	.50	.00	.00	.00	.00	3.00
134	4.00	1.00	1.00	.00	1.00	.00	1.00	1.50	2.00	3.50	.50	2.00	.00	2.50	6.00
135	4.00	1.00	1.00	.50	1.00	1.00	2.50	3.00	2.00	5.00	.00	.00	.00	.00	7.50

INITIAL SCREENING.

136	5.00	2.00	2.00	.00	3.00	3.00	6.00	.00	.00	.00	2.00	.00	.00	2.00	8.00
137	5.00	1.00	1.00	.50	1.00	.00	1.50	.00	.00	.00	.00	.00	.00	.00	1.50
138	5.00	1.00	1.00	.00	4.00	.00	4.00	1.50	.00	1.50	.00	.00	.00	.00	5.50
139	5.00	1.00	2.00	2.50	4.00	.00	6.50	4.00	.00	4.00	.00	.00	1.00	1.00	11.50
140	5.00	2.00	2.00	.00	2.00	.00	2.00	3.50	2.00	5.50	.50	.00	.00	.50	8.00
141	5.00	1.00	1.00	.00	3.00	1.00	4.00	1.50	.00	1.50	.00	.00	1.00	1.00	6.50
142	5.00	1.00	1.00	.50	3.00	4.00	7.50	4.50	.00	4.50	1.00	.00	1.00	2.00	14.00
143	5.00	1.00	2.00	.00	4.00	3.00	7.00	1.00	.00	1.00	.00	.00	1.00	1.00	9.00
144	5.00	1.00	2.00	.00	1.00	.00	1.00	.00	2.00	2.00	.50	.00	1.00	1.50	4.50
145	5.00	1.00	2.00	.00	.00	.00	.00	2.50	.00	2.50	.00	.00	.00	.00	2.50
146	5.00	1.00	2.00	.00	3.00	3.00	6.00	.00	.00	.00	.00	.00	.00	.00	6.00
147	5.00	1.00	1.00	.00	2.00	.00	2.00	.50	.00	.50	.50	.00	.00	.50	3.00
148	5.00	2.00	1.00	1.50	4.00	2.00	7.50	.50	1.00	1.50	1.00	.00	.00	1.00	10.00
149	5.00	1.00	2.00	.00	1.00	2.00	3.00	.00	.00	.00	1.50	.00	.00	1.50	4.50
150	5.00	1.00	1.00	.00	.00	.00	.00	.50	.00	.50	.50	.00	.00	.50	1.00
151	5.00	1.00	1.00	1.00	1.00	.00	2.00	1.00	1.00	2.00	2.00	.00	.00	2.00	6.00
152	5.00	2.00	1.00	2.00	1.00	.00	3.00	1.00	.00	1.00	1.00	.00	.00	1.00	5.00
153	5.00	1.00	2.00	.50	1.00	.00	1.50	1.00	.00	1.00	2.00	.00	.00	2.00	4.50
154	5.00	1.00	2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
155	5.00	1.00	1.00	.00	2.00	.00	2.00	1.50	3.00	4.50	.50	.00	.00	.50	7.00
156	5.00	1.00	2.00	2.50	4.00	.00	6.50	1.00	.00	1.00	.00	.00	.00	.00	7.50
157	5.00	1.00	2.00	.00	2.00	4.00	6.00	.00	.00	.00	.00	.00	.00	.00	6.00
158	5.00	1.00	1.00	.00	4.00	3.00	7.00	4.00	4.00	8.00	1.50	.00	.00	1.50	16.50
159	5.00	2.00	1.00	.00	2.00	.00	2.00	.50	.00	.50	.00	.00	.00	.00	2.50
160	5.00	1.00	1.00	2.00	2.00	.00	4.00	.50	.00	.50	.00	.00	.00	.00	4.50
161	5.00	1.00	1.00	.00	4.00	1.00	5.00	.00	.00	.00	.00	.00	.00	.00	5.00
162	5.00	1.00	2.00	.00	.00	.00	.00	4.50	1.00	5.50	3.00	.00	.00	3.00	8.50
163	5.00	2.00	1.00	1.00	1.00	.00	2.00	3.00	.00	3.00	.00	.00	1.00	1.00	6.00
164	5.00	1.00	2.00	1.00	3.00	.00	4.00	.00	.00	.00	.50	.00	.00	.50	4.50
165	5.00	1.00	1.00	.00	3.00	.00	3.00	1.00	.00	1.00	.00	.00	.00	.00	4.00
166	5.00	1.00	2.00	.00	3.00	.00	3.00	1.00	.00	1.00	.00	.00	.00	.00	4.00
167	5.00	1.00	2.00	.50	.00	.00	.50	.50	.00	.50	2.00	.00	.00	2.00	3.00
168	5.00	1.00	1.00	.00	1.00	1.00	2.00	3.00	2.00	5.00	1.00	.00	.00	1.00	8.00
169	5.00	1.00	2.00	.00	.00	.00	.00	1.50	.00	1.50	1.00	.00	.00	1.00	2.50

INITIAL SCREENING.

170	5.00	2.00	1.00	1.00	3.00	3.00	7.00	.00	.00	.00	.50	.00	.00	.50	7.50
171	5.00	1.00	2.00	1.50	4.00	.00	5.50	.00	.00	.00	.50	3.00	1.00	4.50	10.00
172	5.00	1.00	2.00	.00	2.00	.00	2.00	.00	.00	.00	1.00	.00	.00	1.00	3.00
173	5.00	2.00	2.00	.50	.00	.00	.50	1.50	.00	1.50	1.00	2.00	.00	3.00	5.00
174	5.00	1.00	1.00	.00	4.00	.00	4.00	.50	1.00	1.50	.00	.00	.00	.00	5.50
175	5.00	1.00	2.00	2.00	1.00	.00	3.00	.00	.00	.00	.00	.00	.00	.00	3.00
176	5.00	1.00	2.00	.00	1.00	2.00	3.00	.50	.00	.50	.50	.00	.00	.50	4.00
177	5.00	1.00	2.00	.00	.00	.00	.00	.00	1.00	.00	.00	.00	.00	1.00	2.00
178	5.00	1.00	1.00	.00	3.00	.00	3.00	.00	.00	.00	2.00	2.00	.00	4.00	7.00
179	5.00	1.00	1.00	.00	.00	.00	.00	1.00	.00	1.00	.00	.00	.00	.00	1.00
180	5.00	1.00	1.00	.50	4.00	2.00	6.50	.00	.00	.00	.00	.00	.00	.00	6.50
181	5.00	1.00	1.00	.50	4.00	.00	4.50	.50	1.00	1.50	2.50	.00	.00	2.50	7.50
182	5.00	1.00	1.00	.00	.00	2.00	2.00	1.00	.00	1.00	1.50	.00	.00	1.50	4.50
183	5.00	1.00	2.00	.00	2.00	1.00	3.00	.50	.00	.50	1.50	.00	.00	1.50	5.00

APPENDIX D.

TEACHER INTERVENTION
CHILD NO. 1.

WEEK 1 and 2.

MANUAL DEXTERITY.
Balance Paddle. 10 mins

BALL SKILLS.
Throwing and catching balls / bean bags of different sizes through a suspended hoop. 5/10 mins.

Throwing balls / bean bags items of different weights into a box or other suitable target placed at a distance from the child that will ensure success. 5/10mins.

STATIC AND DYNAMIC BALANCE

Hopping races - both bunny hops and hopping on one leg.

Wobble Board - Remove shoes----encourage the child to remain on the board while attempting to balance the disc without letting the sides touch the ground. 5mins.

Notes.

Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out, when, for how long and any other comments you may have.

Thank you for your continued support.
Diolch yn fawr iawn.

WEEK 3.

MANUAL DEXTERITY.
Threading alternate colours on 5 laces against time, encourage to beat previous record each time.

BALL SKILLS.
Throwing and catching balls / bean bags of different sizes through a suspended hoop. 5/10 mins.

Throwing balls / bean bags items of different weights into a box or other suitable target placed a at distance from the child that will ensure success. 5/10mins.

STATIC AND DYNAMIC BALANCE

Wheelbarrow races

Wobble Board- Remove shoes----encourage the child to remain on the board while attempting to balance the disc without letting the sides touch the ground. 5mins.

Notes.

Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out. when, for how long and any other comments you may have.

Thank you for your continued support.
Diolch yn fawr iawn.

Equipment
Bobbins and laces.
Wobble Board.

WEEK 4.

STATIC AND DYNAMIC BALANCE

Mid line mat.

*Stepping crossing mid line. - TIP_TOE PATH. Walk on tip-toes, matching feet to the toe prints on the rug. If the child places a wrong foot on the print, do not correct him. Simply ask.'Does your big toe match the big toe on the rug?'
-SIDEWAYS CROSS-OVER, stand on the first two black feet. Do this slowly and accurately as precise landing on the target foot prints greatly increases the difficulty.

Now lift the left foot over the right and place it on the adjacent redfoot print.

Next take the right foot off the black print and move it to the right red foot print.

Continue crossing one foot over the other to the end of the line.

BALL SKILLS.
Throwing and catching balls / bean bags of different sizes through a suspended hoop. 5/10 mins.
Throwing balls / bean bags items of different weights into a box or other suitable target placed a at distance from the child that will ensure success. 5/10mins.

MANUAL DEXTERITY.
Activities for the writing hand.
*Stand at arm distance away from the wall. Lean on the wall, with the hands flat on it. Keeping the arms straight, use fingers to push away from the wall to get to an upright position. As the child becomes more proficient, move the feet backwards so that there is a greater angle of lean against the wall.
(minimum 20 times.) Record degree of difficulty for the child, observations on fluency of movement.
*A bandage is laid out across the table the child sits at the table trapping the end of the bandage between the wrist of the writing hand and the edge of the table. Using one finger only, try to gather the bandage under the hand.

Notes.
Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out, when, for how long and any other comments you may have.
Thank you for your continued support.
Diolch yn fawr iawn.

WEEK 5.

Manual dexterity.

*Bolts on nuts.-removing and placing against time.
* Trace around partners hand,and shade in ensuring not to go outside the line.

Ball Skills.
Balloons
Strike the Balloon into the air, underarm, from a standing position.

Strike the Balloon into the air, underarm from a kneeling position.

Strike the Balloon into the air, underarm, from a sitting position.

Strike the Balloon, underarm over a rope or through a suspended hoop or hit a target.

Repeat these activities 1-4 using the other hand.

Strike the Balloon with the back of the hands.fists.wrists fore arms.
Using these parts repeat activities as above.

Notes.
Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out, when, for how long and any other comments you may have.
Thank you for your continued support.
Diolch yn fawr iawn.

APPENDIX D.

CHILD NO. 2.

WEEK 1

MANUAL DEXTERITY.
Balance Paddle. 10 mins

BALL SKILLS.
Throwing and catching balls / bean bags of different sizes through a suspended hoop. 5/10 mins.

Throwing balls / bean bags items of different weights into a box or other suitable target placed a ta distance from the child that will ensure success. 5/10mins.

STATIC AND DYNAMIC BALANCE

Hopping races - both bunny hops and hopping on one leg.

Wobble Board- Remove shoes—encourage the child to remain on the board while attempting to balance the disc without letting the sides touch the ground. 5mins.

Notes.

Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out, when, for how long and any other comments you may have.
Thank you for your continued support.
Diolch yn fawr iawn.

WEEK 2, 3 and 4.

MANUAL DEXTERITY.

Activities for the writing hand.
* Stand at arm distance away from the wall. Lean on the wall, with the hands flat on it. Keeping the arms straight, use fingers to push away from the wall to get to an upright position. As the child becomes more proficient, move the feet backwards so that there is a greater angle of lean against the wall.
(minimum 20 times.) Record degree of difficulty for the child, observations on fluency of movement.

* A bandage is laid out across the table the child sits at the table trapping the end of the bandage between the wrist of the writing hand and the edge of the table. Using fingers only, try to gather the bandage under the hand.

As the child progresses she can be timed, this time can be recorded and the child attempts to beat these times during subsequent attempts.

BALANCE.
*Bunny jumps.— Crouch down, place hands a shoulder width apart, and kick feet in the air. Ask the child to keep their feet in the air as long as possible.
(minimum-20 jumps)

*From a crouch position, with hands flat on the groung, try to touch a ball with the forehead without moving it . The ball is placed slightly in front of the hands. Start with a large ball progressing to a tennis ball. (5 mins)

Record-size of ball being used and degree of success.

BALL SKILLS.
Throwing and catching balls / bean bags of different sizes through a suspended hoop. 5/10 mins.

Throwing balls / bean bags items of different weights into a box or other suitable target placed at a distance from the child that will ensure success. 5/10mins.

Notes.
Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.If possible this programme should be carried out twice weekly .Please note on the comments sheet which activities have been carried out, when. for how long and any other comments you may have.

Thank you for your continued support.
Diolch yn fawr iawn.

WEEK 5.

MANUAL DEXTERITY.
* Bolts on nuts.-removing and placing against time.

* A bandage is laid out across the table the child sits at the table trapping the end of the bandage between the wrist of the writing hand and the edge of the table. Using one finger only, try to gather the bandage under the hand.

BALL SKILLS.
* Throwing balls / bean bags items of different weights into a box or other suitable target placed at a distance from the child that will ensure success. 5/10mins.

* Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.

If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out, when, for how long and any other comments you may have.
Thank you for your continued support.
Diolch yn fawr iawn.

WEEK 6.

STATIC AND DYNAMIC BALANCE

Mid line mat.

* Stepping crossing mid line. - TIP_TOE PATH, Walk on tip-toes, matching feet to the toe prints on the rug. If the child places a wrong foot on the print, do not correct him. Simply ask,'Does your big toe match the big toe on the rug?'
-SIDEWAYS CROSS-OVER, stand on the first two black feet. Do this slowly and accurately as precise landing on the target foot prints greatly increases the difficulty.

Now lift the left foot over the right and place it on the adjacent redfoot print.

Next take the right foot off the black print and move it to the right red foot print.

Continue crossing one foot over the other to the end of the line.

Wheel-Barrow races.

BALL SKILLS.
Throwing and catching balls / bean bags of different sizes through a suspended hoop. 5/10 mins.

Throwing balls / bean bags items of different weights into a box or other suitable target placed at a distance from the child that will ensure success. 5/10mins.

*Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out, when, for how long and any other comments you may have.
Thank you for your continued support.
Diolch yn fawr iawn.

APPENDIX D.

CHILD NO. 6

WEEK 1.

MANUAL DEXTERITY

Lacing shoes against time.
Bolts on nuts.-removing and placing against time.

Ball skills
Throwing balls of different sizes, through hoops, held by fellow students or Teacher.
Throwing Bean bags, into a hoop or box placed on the floor.
Throwing and catching ball of different sizes.

Static and Dynamic Balance
Hopping races and bunny-hop races.

Notes.

Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out, when, for how long and any other comments you may have.
Thank you for your continued support.
Diolch yn fawr iawn.

WEEK 2.
Ball skills
Throwing balls of different sizes, through hoops, held by fellow students or Teacher.
Throwing Bean bags, into a hoop or box placed on the floor.
Throwing and catching ball of different sizes.

Static and Dynamic Balance
Hopping races and bunny-hop races.

Notes.

Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out, when, for how long and any other comments you may have.
Thank you for your continued support.
Diolch yn fawr iawn.

WEEK 3.

Manual dexterity.

Bolts on nuts.-removing and placing against time.

Ball skills
Throwing balls of different sizes, through hoops, held by fellow students or Teacher.
Throwing Bean bags, into a hoop or box placed on the floor.
Throwing and catching ball of different sizes.

Balloons
Strike the Balloon into the air, underarm, from a standing position.

Strike the Balloon into the air, underarm from a kneeling position.

Strike the Balloon into the air, underarm, from a sitting position.

Strike the Balloon, underarm over a rope or through a suspended hoop or hit a target.

Repeat these activities 1-4 using the other hand.

Strike the Balloon with the back of the hands.fists.wrists fore arms.
Using these parts repeat activities as above.
Repeat the activities using a paper plate rolled up news-paper, paper plate or table tennis bat.

Static and Dynamic Balance
Hopping races and bunny-hop races.

Notes.

Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out, when, for how long and any other comments you may have.
Thank you for your continued support.
Diolch yn fawr iawn.

WEEK 4 AND WEEK 5.

Week 4. 20/6/95.

Ball skills.- Using yellow therapy ball.

*Bouncing and catching - ask the child to bounce and catch the ball on his own.
Throwing and catching - ask child to throw to the other person and bounce to the other person.

*Bocha-Place the white ball at the opposite end of the room ask the child to throw the coloured balls as near as possible to target white ball.

*Wheel - barrow races.
Notes.

Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out, when, for how long and any other comments you may have.
Thank you for your continued support.
Diolch yn fawr iawn.

WEEK 6.
(week 6) 4/7/95.

Ball Skills.(Using a variety of balls, starting with a large one and progressing to smaller ones.)

A. 1. Using different parts of both hands , guide a ball between and around an obstacle course made from bean bags, ropes, skittles, etc.

2. Sitting on the floor, legs straight feet together, place the ball on the ankles-raise the legs
and catch the ball as it rolls down the legs.

B. 1. Kneeling, hold the ball at arms length. Open the hands to drop the ball and clap the hands gently as it bounces up.
2. As in 1.,but gradually the hands, instead of meeting the sides of the ball, begin to form a basket under the ball.
3. As in 1. and 2. but from a standing position.
4. As in 3. but throw the ball down gently to bounce.
5. Throw the ball up with two hands and catch it with two hands.
6. Throw the ball up with one hand and catch it with two hands.
7. (in pairs) Throw and catch the ball standing a short distance apart.
8. (in pairs)Bounce the ball to the partner for catching.
9. (individually) Throw the ball to the wall, allow it to bounce, then catch it.
10.(in pairs) Throw a ball onto a wall for a partner to catch, allowing the ball to bounce first.

Skipping rope.
B. 1. Bunch up the rope in both hands, toss it in the air, and catch it with both hands.
2. As in 1., but toss the rope up with one hand and catch it with two.
3. As in 1. and 2. .altering high and low throws, (limit the height of the high throws).
4. (in pairs) Toss and catch the rope.

Notes.

Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out, when, for how long and any other comments you may have.

WEEK 7.

(week 7, 10/7/95)
*Threading Board with cord, right to left, left to right, until all the cord is used. This must be timed and the child encouraged to beat her previous time.

* 5 Coffee Jars (any screw top jars), unscrew all the tops, and rescrew. This activity should be timed and the child encouraged to beat her previous time.

Sponge Ball.
Strike the Sponge ball into the air, underarm, from a standing position.

Strike the Sponge ball into the air, underarm from a kneeling position.

Strike the Sponge ball into the air, underarm, from a sitting position.

Strike the Sponge ball, underarm over a rope or through a suspended hoop or hit a target.

Repeat these activities 1-4 using the other hand.

Strike the Sponge Ball with the back of the hands,fists,wrists fore arms.
Using these parts repeat activities as above.

Notes.

Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out, when, for how long and any other comments you may have.
Thank you for your continued support.
Diolch yn fawr iawn.

APPENDIX D.

CHILD NO. 7.

Week 1.

Timed Wheel-barrow races.

Throwing a number of balls (no less than 8) through a hoop held by teacher or peer.This activity is to be timed, encouraging Fay to beat her previous record each time.

*A bandage is laid out across the table the child sits at the table trapping the end of the bandage between the wrist of the writing hand and the edge of the table. Using fingers only, try to gather the bandage under the hand.

As the child progresses she can be timed, this time can be recorded and the child attempts to beat these times during subsequent attempts.

Notes.

Please record the activities that have been carried out, the time taken and any subsequent improvement.

Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out, when, for how long and any other comments you may have.
Thank you for your continued support.
Diolch yn fawr iawn.

WEEK 2.

Timed Wheel-barrow races.

Throwing a number of balls (no less than 8) through a hoop held by teacher or peer.This activity is to be timed, encouraging Fay to beat her previous record each time.

*A bandage is laid out across the table the child sits at the table trapping the end of the bandage between the wrist of the writing hand and the edge of the table. Using fingers only, try to gather the bandage under the hand.

As the child progresses she can be timed, this time can be recorded and the child attempts to beat these times during subsequent attempts.

Balloons (Keep the balloon from touching the ground)

Strike the Balloon into the air, underarm, from a standing position.

Strike the Balloon into the air, underarm from a kneeling position.

Strike the Balloon into the air, underarm, from a sitting position.

Strike the Balloon, underarm over a rope or through a suspended hoop or hit a target.

Repeat these activities 1-4 using the other hand.

Strike the Balloon with the back of the hands,fists,wrists fore arms.
Using these parts repeat activities as above.

Notes.

Please record the activities that have been carried out, the time taken and any subsequent improvement.

Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out, when, for how long and any other comments you may have.
Thank you for your continued support.
Diolch yn fawr iawn.

WEEK 3
*Threading Board with cord, right to left, left to right, until all the cord is used. This must be timed and the child encouraged to beat her previous time.

*Timed Wheel-barrow races.

Throwing a number of balls (no less than 8) through a hoop held by teacher or peer.This activity is to be timed, encouraging Fay to beat her previous record each time.

*A bandage is laid out across the table the child sits at the table trapping the end of the bandage between the wrist of the writing hand and

the edge of the table. Using one finger at a time only, try to gather the bandage under the hand.

As the child progresses she can be timed, this time can be recorded and the child attempts to beat these times during subsequent attempts.

Notes.

Please record the activities that have been carried out, the time taken and any subsequent improvement.

Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out, when, for how long and any other comments you may have.
Thank you for your continued support.
Diolch yn fawr iawn.

WEEK 4.

Bocca - Place the white ball 8ft from the child, throw the red and blue balls (or roll), as near as possible to the white one. This activity should be timed . The child should be encouraged to get as many balls as near as possible to the white one in the least amount of time.

* Clothes pegs. Using index finger and thumb only, place 15, pegs around the edge of the lunch box. This activity should be timed and the child encouraged to beat her previous time.

*Balloons (Keep the balloon from touching the ground)
Strike the Balloon into the air, underarm, from a standing position.
Strike the Balloon into the air, underarm from a kneeling position.
Strike the Balloon into the air, underarm, from a sitting position.
Strike the Balloon, underarm over a rope or through a suspended hoop or hit a target.
Repeat these activities 1-4 using the other hand.

Strike the Balloon with the back of the hands,fists,wrists fore arms.
Using these parts repeat activities as above.
Please record the activities that have been carried out, the time taken and any subsequent improvement.

Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out, when, for how long and any other comments you may have.
Thank you for your continued support.
Diolch yn fawr iawn

APPENDIX D.

CHILD NO. 8.

WEEK 1

Manual Dexterity
Lacing shoes against time.
Bolts on nuts.-removing and placing against time.

Ball skills
Throwing balls of different sizes, through hoops, held by fellow students or Teacher.
Throwing Bean bags, into a hoop or box placed on the floor.
Throwing and catching ball of different sizes.

Static and Dynamic Balance
Hopping races and bunny-hop races.

Great difficulty noted with nuts and bolts.

Notes.

Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out, when, for how long and any other comments you may have.
Thank you for your continued support.
Diolch yn fawr iawn.

WEEK 2.

Manual dexterity..
Bolts on nuts.-removing and placing against time.

Activities for the writing hand.
*Stand at arm distance away from the wall. Lean on the wall, with the hands flat on it. Keeping the arms straight, use fingers to push away from the wall to get to an upright position. As the child becomes more proficient, move the feet backwards so that there is a greater angle of lean against the wall.
(minimum 20 times.) Record degree of difficulty for the child, observations on fluency of movement.

*Bunny jumps.— Crouch down, place hands a shoulder width apart, and kick feet in the air. Ask the child to keep their feet in the air as long as possible.
(minimum-20 jumps)

*From a crouch position, with hands flat on the groung, try to touch a ball with the forehead without moving it . The ball is placed slightly in front of the hands. Start with a large ball progressing to a tennis ball. (5 mins)

Record-size of ball being used and degree of success.

*A bandage is laid out across the table the child sits at the table trapping the end of the bandage between the wrist of the writing hand and the edge of the table. Using fingers only, try to gather the bandage under the hand.

As the child progresses she can be timed, this time can be recorded and the child attempts to beat these times during subsequent attempts.
Ball Skills.
Throwing and catching balls / bean bags of different sizes through a suspended hoop. 5/10 mins.

Throwing balls / bean bags items of different weights into a box or other suitable target placed at a distance from the child that will ensure success. 5/10mins.

Notes.

Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out, when, for how long and any other comments you may have.

Thank you for your continued support.

Diolch yn fawr iawn.
WEEK 3 AND 4.
Activities for the writing hand

Bocha-Place the white ball at the opposite end of the room ask the child to throw the coloured balls as near as possible to target white ball.

*Stand at arm distance away from the wall. Lean on the wall, with the hands flat on it. Keeping the arms straight, use fingers to push away from the wall to get to an upright position. As the child becomes more proficient, move the feet backwards so that there is a greater angle of lean against the wall.
(minimum 20 times.) Record degree of difficulty for the child, observations on fluency of movement.

*Bunny jumps.--- Crouch down, place hands a shoulder width apart, and kick feet in the air. Ask the child to keep their feet in the air as long as possible.
(minimum-20 jumps)

*From a crouch position, with hands flat on the groung, try to touch a ball with the forehead without moving it . The ball is placed slightly in front of the hands. Start with a large ball progressing to a tennis ball. (5 mins)

Record-size of ball being used and degree of success.

*A bandage is laid out across the table the child sits at the table trapping the end of the bandage between the wrist of the writing hand and the edge of the table. Using fingers only, try to gather the bandage under the hand.

As the child progresses she can be timed, this time can be recorded and the child attempts to beat these times during subsequent attempts.
BALL SKILLS.
Throwing and catching balls / bean bags of different sizes through a suspended hoop. 5/10 mins.

Throwing balls / bean bags items of different weights into a box or other suitable target placed at a distance from the child that will ensure success. 5/10mins.

Notes.

Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out, when, for how long and any other comments you may have.
Thank you for your continued support.
Diolch yn fawr iawn.

WEEK 5.
* 'In pairs', activities from Bethan's activity programme (ball skills and skipping rope.).

* Clothes pegs. Using index finger and thumb only, place 15, pegs around the edge of the lunch box. This activity should be timed and the child encouraged to beat her previous time.

* Tear paper into strips along the black lines (please keep these in the bag provided.).

* Match the tips of your right hand with those of your left,and push hands together as hard as you can.

* In pairs match the tips of each finger and thumb with those of your partner, push as hard as you can.

BALL SKILLS.
Throwing and catching balls / bean bags of different sizes through a suspended hoop. 5/10 mins.

Throwing balls / bean bags items of different weights into a box or other suitable target placed at a distance from the child that will ensure success. 5/10mins.

Notes.

Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out, when, for how long and any other comments you may have.

Thank you for your continued support.
Diolch yn fawr iawn.
WEEK 6.
*Threading Board with cord, right to left, left to right, until all the cord is used. This must be timed and the child encouraged to beat her previous time.

* 5 Coffee Jars (any screw top jars), unscrew all the tops, and rescrew. This activity should be timed and the child encouraged to beat her previous time.

Sponge Ball.
Strike the Sponge ball into the air, underarm, from a standing position.

Strike the Sponge ball into the air, underarm from a kneeling position.

APPENDIX D.

Strike the Sponge ball into the air, underarm, from a sitting position.

Strike the Sponge ball, underarm over a rope or through a suspended hoop or hit a target.

Repeat these activities 1-4 using the other hand.

Strike the Sponge Ball with the back of the hands,fists,wrists fore arms.
Using these parts repeat activities as above.

Notes.

Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out, when, for how long and any other comments you may have.
Thank you for your continued support.
Diolch yn fawr iawn.

RECORDING. (Please record, the activities the child has engaged in from the programme each week. Please note time taken where indicated and any other observations you may have. For the purpose of this study it is important to note that there has not been an opportunity to carry out the activities, should this be the case.)

COMMENTS.

APPENDIX D.

RESEARCHER INTERVENTION

WEEK 1. (CHILD 5)
MANUAL DEXTERITY

Threading - Bobbins on Laces. Thread bobbins on lace matching colour, alternating colour etc.

Dot-to-Dot pictures. Ask the child to complete the first 5 dot-dot pictures in the book provided.

BALL SKILLS.
Bouncing and catching - ask the child to bounce and catch the ball on his own.
Throwing and catching - ask child to throw to the other person and bounce to the other person.

BALANCE.
Wobble board. - Ask child to remove shoes and socks and attempt to stay on the wobble board, encourage the child to shift his/her weight from one foot to the other.

Stepping crossing mid line. - TIP_TOE PATH, Walk on tip-toes, matching feet to the toe prints on the rug. If the child places a wrong foot on the print, do not correct him. Simply ask,'Does your big toe match the big toe on the rug?'
-SIDEWAYS CROSS-OVER, stand on the first two black feet. Do this slowly and accurately as precise landing on the target foot prints greatly increases the difficulty.

Now lift the left foot over the right and place it on the adjacent redfoot print.

Next take the right foot off the black print and move it to the right red foot print.

Continue crossing one foot over the other to the end of the line.

NOTE (ignore little and big cross over section of the mat for this session)

EQUIPMENT.
Bobbins and laces.
Dot-to-dot book
Yellow therapy Ball.
Wobble Board.
Crossing Mid-line rug.

WEEK 2 CHILD 5; WEEK 1 CHILD 4.

MANUAL DEXTERITY

Threading - Bobbins on Laces. Thread bobbins on lace matching colour, alternating colour etc.

Dot-to-Dot pictures. Ask the child to complete the first 5 dot-dot pictures in the book provided.

BALL SKILLS.
Bouncing and catching - ask the child to bounce and catch the ball on his own.
Throwing and catching - ask child to throw to the other person and bounce to the other person.

BALANCE.
Wobble board. - Ask child to remove shoes and socks and attempt to stay on the wobble board, encourage the child to shift his/her weight from one foot to the other.

Stepping crossing mid line. - TIP_TOE PATH. Walk on tip-toes, matching feet to the toe prints on the rug. If the child places a wrong foot on the print, do not correct him. Simply ask,'Does your big toe match the big toe on the rug?'
-SIDEWAYS CROSS-OVER, stand on the first two black feet. Do this slowly and accurately as precise landing on the target foot prints greatly increases the difficulty.

Now lift the left foot over the right and place it on the adjacent redfoot print.
Next take the right foot off the black print and move it to the right red foot print.
Continue crossing one foot over the other to the end of the line.

NOTE (ignore little and big cross over section of the mat for this session)
WEEK 3 CHILD 5; WEEK 2 CHILD 4.
MANUAL DEXTERITY

Threading - Bobbins on Laces. Thread bobbins on lace matching colour, alternating colour etc.

Dot-to-Dot pictures. Ask the child to complete the first 5 dot-dot pictures in the book provided.

BALL SKILLS.
Bouncing and catching - ask the child to bounce and catch the ball on his own.
Throwing and catching - ask child to throw to the other person and bounce to the other person.

BALANCE.
Wobble board. - Ask child to remove shoes and socks and attempt to stay on the wobble board, encourage the child to shift his/her weight from one foot to the other.

Stepping crossing mid line. - TIP_TOE PATH, Walk on tip-toes, matching feet to the toe prints on the rug. If the child places a wrong foot on the print, do not correct him. Simply ask,'Does your big toe match the big toe on the rug?'
-SIDEWAYS CROSS-OVER, stand on the first two black feet. Do this slowly and accurately as precise landing on the target foot prints greatly increases the difficulty.

Now lift the left foot over the right and place it on the adjacent redfoot print.

Next take the right foot off the black print and move it to the right red foot print.

Continue crossing one foot over the other to the end of the line.

NOTE (ignore little and big cross over section of the mat for this session)

WEEK 4&5 CHILD 5; WEEK 3&4 CHILD 4

MANUAL DEXTERITY.
Threading - Bobbins on Laces. Thread bobbins on lace matching colour, alternating colour etc. Ask child to do this as quickly as possible.

Complete 5 Trail drawings.

BALL SKILLS.
Bouncing and catching - ask the child to bounce and catch the ball on his own.
Throwing and catching - ask child to throw to the other person and bounce to the other person.

Bocha-PLace the white ball at the opposite end of the room ask the child to throw the coloured balls as near as possible to target white ball.
Static and Dynamic Balance
Wobble board. - Ask child to remove shoes and socks and attempt to stay on the wobble board, encourage the child to shift his/her weight from one foot to the other.

BALANCE
Stepping crossing mid line. - TIP_TOE PATH, Walk on tip-toes, matching feet to the toe prints on the rug. If the child places a wrong foot on the print, do not correct him. Simply ask,'Does your big toe match the big toe on the rug?'
Wheel-barrows about the room.

NOTE (ignore little and big cross over section of the mat for this session)

EQUIPMENT.
Bobbins and laces.
Trail pictures.
Yellow therapy Ball.
Bocha.
Wobble Board.
Crossing Mid-line rug.

NOTE—AT ALL TIMES ENCOURAGE THE CHILD TO SUCCEED. SUGGEST DIFFERENT STRATEGIES THAT MAY HELP THE CHILD TO SUCCEED. ONCE SUCCESS HAS BEEN ACHIEVED, ENCOURAGE THE CHILD TO INCREASE HIS/HER SPEED AT THE ACTIVITY AS APPROPRIATE.

WEEK 6 CHILD 5; WEEK 5 CHILD 4; WEEK 1 CHILD 3.

Ball skills

Throwing balls of different sizes, through hoops, held by fellow students or Teacher.
Throwing Bean bags, into a hoop or box placed on the floor.
Throwing and catching ball of different sizes.

Throwing balls of different sizes around the group in a circle.
Standing in a circle, (have 3 different size balls on the go,) call someones name at random and pass the ball encouraging the passing to become faster and faster.

Balloons
Strike the Balloon into the air. underarm, from a standing position.

Strike the Balloon into the air, underarm from a kneeling position.

Strike the Balloon into the air, underarm, from a sitting position.

Strike the Balloon, underarm over a rope or through a suspended hoop or hit a target.

Repeat these activities 1-4 using the other hand.

Strike the Balloon with the back of the hands,fists,wrists fore arms.
Using these parts repeat activities as above.

Static and Dynamic Balance
Wobble board. - Ask child to remove shoes and socks and attempt to stay on the wobble board, encourage the child to shift his/her weight from one foot to the other.

Stepping crossing mid line. - TIPTOE PATH, Walk on tip-toes, matching feet to the toe prints on the rug. If the child places a wrong foot on the print, do not correct him. Simply ask,'Does your big toe match the big toe on the rug?'
Wheel-barrows about the room.

NOTE---AT ALL TIMES ENCOURAGE THE CHILD TO SUCCEED. SUGGEST DIFFERENT STRATEGIES THAT MAY HELP THE CHILD TO SUCCEED. ONCE SUCCESS HAS BEEN ACHIEVED, ENCOURAGE THE CHILD TO INCREASE HIS/HER SPEED AT THE ACTIVITY AS APPROPRIATE.

WEEK 7 CHILD 5; WEEK 6 CHILD 4; WEEK 2 CHILD 3.
Manual dexterity.
Bolts on nuts.-removing and placing against time.

Balance Paddle. 10 mins

Activities for the writing hand.
*Stand at arm distance away from the wall. Lean on the wall, with the hands flat on it. Keeping the arms straight, use fingers to push away from the wall to get to an upright position. As the child becomes more proficient, move the feet backwards so that there is a greater angle of lean against the wall.
(minimum 20 times.) Record degree of difficulty for the child, observations on fluency of movement.

*Bunny jumps.— Crouch down, place hands a shoulder width apart, and kick feet in the air. Ask the child to keep their feet in the air as long as possible.
(minimum-20 jumps)

*From a crouch position, with hands flat on the ground, try to touch a ball with the forehead without moving it . The ball is placed slightly in front of the hands. Start with a large ball progressing to a tennis ball. (5 mins)

Record-size of ball being used and degree of success.

*A bandage is laid out across the table the child sits at the table trapping the end of the bandage between the wrist of the writing hand and the edge of the table. Using fingers only, try to gather the bandage under the hand.

As the child progresses she can be timed, this time can be recorded and the child attempts to beat these times during subsequent attempts.

Ball skills

Throwing balls of different sizes, through hoops, held by fellow students or Teacher.
Throwing Bean bags, into a hoop or box placed on the floor.
Throwing and catching ball of different sizes.
Throwing balls of different sizes around the group in a circle.
Standing in a circle. (have 3 different size balls on the go,) call someones name at random and pass the ball encouraging the passing to become faster and faster.

NOTE---AT ALL TIMES ENCOURAGE THE CHILD TO SUCCEED. SUGGEST DIFFERENT STRATEGIES THAT MAY HELP THE CHILD TO SUCCEED. ONCE SUCCESS HAS BEEN ACHIEVED, ENCOURAGE THE CHILD TO INCREASE HIS/HER SPEED AT THE ACTIVITY AS APPROPRIATE.

WEEK 8 CHILD 5; WEEK 7 CHILD 4; WEEK 3 CHILD 3.
Manual dexterity.
*One dot-to-dot and one trail picture

*Threading Board with rope.

*Bolts on nuts.-removing and placing against time.
*A bandage is laid out across the table the child sits at the table trapping the end of the bandage between the wrist of the writing hand and the edge of the table. Using fingers only, try to gather the bandage under the hand.

*Balance Paddle.

Ball skills

*Throwing balls of different sizes, through hoops, held by fellow students or Teacher.
*Throwing Bean bags, into a hoop or box placed on the floor.
*Throwing and catching ball of different sizes.
*Throwing balls of different sizes around the group in a circle.
*Standing in a circle, (have 3 different size balls on the go,) call someones name at random and pass the ball encouraging the passing to become faster and faster.

*Wheel-barrows about the room.

NOTE---AT ALL TIMES ENCOURAGE THE CHILD TO SUCCEED. SUGGEST DIFFERENT STRATEGIES THAT MAY HELP THE CHILD TO SUCCEED. ONCE SUCCESS HAS BEEN ACHIEVED, ENCOURAGE THE CHILD TO INCREASE HIS/HER SPEED AT THE ACTIVITY AS APPROPRIATE.

Equipment:
Dot-dot picture.
Balance Paddle.
Trail Picture.
Threading Board.
Nuts and Bolts board.
Balls.
Bandage.

WEEK 9 CHILD 5; WEEK 8 CHILD 4; WEEK 4 CHILD 3.
MANUAL DEXTERITY
* Bolts on nuts.-removing and placing against time.
*Stand at arm distance away from the wall. Lean on the wall, with the hands flat on it. Keeping the arms straight, use fingers to push away from the wall to get to an upright position. As the child becomes more proficient, move the feet backwards so that there is a greater angle of lean against the wall.
(minimum 20 times.) Record degree of difficulty for the child, observations on fluency of movement.
* Match finger tips against partner and push against partner.
Playdoh.
PLace clothes pegs on the edge of a lunch box thumb opposing, index, middle, ring. and little finger.
BALL SKILLSBocha-PLace the white ball at the opposite end of the room ask the child to throw the coloured balls as near as possible to target white ball.
Group standing in a circle, pass three balls of different sizes, Tennis. med' ball and football),
calling each other by name.
One Ball- hot potatoe. callin the name of the persion you are going to pass the ball to. passing the ball as quickly as possible.
Throwing balls through hoops.

BALANCE.
Wheel barrow races.
Notes.

Try to ensure success in the activities and give tips an how performance can be improved. to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out. when. for how long and any other comments you may have.

Thank you for your continued support.
Diolch yn fawr iawn.

WEEK 10 CHILD 5; WEEK 9 CHILD 4; WEEK 5 CHILD 3.
MANUAL DEXTERITY
*Threading Board with rope.
* Shape sorting timed.
Draw around partners hand and colour in.
Free play with play doh.
5 Bottles with different screw top lids, different sizes. Put the tops on rhee bottles. This activity was timed.

BALL SKILLS
Throwing balls of different sizes, through hoops, held by partner.
Throwing Bean bags, into a hoop or box placed on the floor.
Throwing and catching ball of different sizes.
Throwing balls of different sizes around the group in a circle.
Standing in a circle, (have 3 different size balls on the go,) call someones name at random and pass the ball encouraging the passing to become faster and faster.

BALANCE.
Hopping races.
Notes.

Try to ensure success in the activities and give tips an how performance can be improved, to achieve success.
If possible this programme should be carried out twice weekly .
Please note on the comments sheet which activities have been carried out, when, for how long and any other comments you may have.

Thank you for your continued support.

Diolch yn fawr iawn.

APPENDIX E.

CHILD	GEN	AGBAND	TEST	SUB1	SUB2	SUB3	TOTAL
1.00	1.00	1.00	1.00	7.50	4.50	2.00	14.00
1.00	1.00	1.00	1.00	3.00	5.00	2.00	10.00
1.00	1.00	1.00	1.00	7.00	7.00	2.00	16.00
1.00	1.00	1.00	1.00	5.00	5.50	0.50	11.00
1.00	1.00	1.00	1.00	4.50	9.00	2.50	16.00
1.00	1.00	1.00	1.00	4.50	4.00	2.00	10.50
1.00	1.00	1.00	1.00	7.50	3.00	3.50	14.00
1.00	1.00	1.00	2.00	4.00	7.00	3.00	14.00
1.00	1.00	1.00	2.00	3.00	0.50	3.50	7.00
1.00	1.00	1.00	2.00	2.50	2.00	3.00	7.50
1.00	1.00	1.00	2.00	5.00	0.00	1.00	6.00
1.00	1.00	1.00	2.00	4.00	2.50	2.50	9.00
2.00	1.00	1.00	1.00	7.00	8.00	1.50	16.50
2.00	1.00	1.00	1.00	4.00	6.50	4.50	15.00
2.00	1.00	1.00	1.00	10.00	3.50	5.50	19.00
2.00	1.00	1.00	1.00	9.00	2.00	7.00	18.00
2.00	1.00	1.00	1.00	7.50	1.00	6.00	14.50
2.00	1.00	1.00	1.00	7.50	1.00	7.50	16.00
2.00	1.00	1.00	2.00	7.00	1.50	3.00	11.50
2.00	1.00	2.00	2.00	14.00	0.00	7.50	21.50
2.00	1.00	2.00	2.00	13.00	3.00	5.50	21.50
2.00	1.00	2.00	2.00	14.50	2.00	2.00	18.50
3.00	2.00	1.00	1.00	11.00	4.50	4.00	19.50
3.00	2.00	1.00	1.00	9.00	5.50	2.00	16.50
3.00	2.00	1.00	1.00	10.00	1.00	4.00	15.00
3.00	2.00	1.00	1.00	11.50	2.50	2.50	16.50
3.00	2.00	1.00	1.00	11.00	1.00	3.00	15.00
3.00	2.00	1.00	1.00	11.50	2.00	5.00	18.50
3.00	2.00	1.00	1.00	9.00	2.00	3.00	14.00
3.00	2.00	1.00	1.00	10.50	4.50	8.50	23.50
3.00	2.00	1.00	2.00	9.00	2.50	6.50	19.00
3.00	2.00	1.00	2.00	8.50	2.00	2.50	13.00
3.00	2.00	1.00	2.00	2.50	0.50	5.50	8.50
3.00	2.00	1.00	2.00	8.50	0.00	2.50	11.00
4.00	1.00	1.00	1.00	9.50	0.50	5.00	15.00
4.00	1.00	1.00	1.00	6.00	1.50	6.50	14.00
4.00	1.00	1.00	1.00	8.50	0.00	6.50	15.00
4.00	1.00	1.00	1.00	8.50	3.50	5.50	17.50
4.00	1.00	1.00	1.00	10.00	1.50	5.50	17.00
4.00	1.00	1.00	1.00	12.00	1.50	5.50	16.00
4.00	1.00	1.00	2.00	10.00	1.50	3.50	15.00
4.00	1.00	1.00	2.00	7.50	3.00	6.50	17.00
4.00	1.00	1.00	2.00	10.50	2.00	7.50	20.00
4.00	1.00	1.00	2.00	9.50	0.50	2.00	12.00
4.00	1.00	1.00	2.00	7.50	0.50	1.00	9.00
4.00	1.00	1.00	2.00	5.50	0.50	7.50	13.50
4.00	1.00	2.00	2.00	13.50	3.00	10.00	26.50
4.00	1.00	2.00	2.00	7.50	0.00	9.50	17.00
4.00	1.00	2.00	2.00	10.00	1.00	9.00	20.00
5.00	2.00	1.00	1.00	11.00	8.00	7.00	26.00
5.00	2.00	1.00	1.00	9.00	8.00	9.00	26.00
5.00	2.00	1.00	1.00	12.50	6.00	8.00	26.50
5.00	2.00	1.00	1.00	12.00	8.00	9.50	29.50
5.00	2.00	1.00	1.00	6.50	4.50	5.00	16.00
5.00	2.00	1.00	1.00	11.50	5.00	6.50	23.00

PRE / POST INTERVENTION SCORES.

5.00	2.00	1.00	1.00	10.00	7.50	11.50	29.00
5.00	2.00	1.00	2.00	11.00	6.50	7.50	25.00
5.00	2.00	1.00	2.00	11.50	8.50	5.50	25.50
5.00	2.00	1.00	2.00	10.00	5.00	6.00	21.00
5.00	2.00	1.00	2.00	11.00	1.50	8.50	21.00
5.00	2.00	1.00	2.00	11.00	1.00	9.00	21.00
5.00	2.00	1.00	2.00	8.00	4.50	6.00	18.50
5.00	2.00	1.00	2.00	9.50	2.00	10.50	22.00
5.00	2.00	1.00	2.00	7.00	3.00	4.50	14.50
5.00	2.00	1.00	2.00	7.50	4.00	4.00	15.50
5.00	2.00	1.00	2.00	11.00	2.00	2.50	15.50
6.00	1.00	1.00	1.00	4.50	10.00	0.00	14.50
6.00	1.00	1.00	1.00	2.00	8.00	2.50	12.50
6.00	1.00	1.00	1.00	4.00	7.00	2.00	13.00
6.00	1.00	1.00	1.00	5.00	7.50	3.00	15.50
6.00	1.00	1.00	1.00	5.00	6.00	3.00	14.00
6.00	1.00	1.00	1.00	5.00	8.00	2.00	15.00
6.00	1.00	1.00	1.00	6.50	3.00	3.50	13.00
6.00	1.00	1.00	1.00	7.50	7.00	2.50	17.00
6.00	1.00	1.00	2.00	3.50	9.00	0.00	12.50
6.00	1.00	2.00	2.00	7.50	5.50	0.00	13.00
6.00	1.00	2.00	2.00	8.00	5.50	3.00	16.50
6.00	1.00	2.00	2.00	6.50	5.00	4.50	16.00
6.00	1.00	2.00	2.00	5.50	4.50	4.00	14.00
6.00	1.00	2.00	2.00	5.00	5.00	0.00	10.00
6.00	1.00	2.00	2.00	7.00	2.00	0.00	9.00
7.00	1.00	1.00	1.00	7.50	0.00	5.50	13.00
7.00	1.00	1.00	1.00	8.50	0.50	2.50	11.50
7.00	1.00	1.00	1.00	6.00	0.00	4.50	10.50
7.00	1.00	1.00	1.00	6.50	0.50	6.50	13.50
7.00	1.00	1.00	1.00	4.00	0.50	3.00	7.50
7.00	1.00	1.00	1.00	4.00	1.00	3.50	8.50
7.00	1.00	1.00	1.00	7.50	2.00	2.00	11.50
7.00	1.00	1.00	1.00	4.50	1.00	2.50	8.00
7.00	1.00	1.00	1.00	3.00	0.00	2.50	5.50
7.00	1.00	1.00	1.00	5.50	0.00	8.00	13.50
7.00	1.00	1.00	2.00	7.00	1.50	6.50	15.00
7.00	1.00	1.00	2.00	5.50	2.00	5.00	12.50
7.00	1.00	1.00	2.00	8.50	0.50	4.00	13.00
7.00	1.00	1.00	2.00	4.50	1.00	5.00	10.50
8.00	1.00	1.00	1.00	5.50	1.00	4.50	11.00
8.00	1.00	1.00	1.00	10.50	1.50	5.00	17.00
8.00	1.00	1.00	1.00	9.00	3.00	4.50	16.50
8.00	1.00	1.00	1.00	10.00	5.00	2.00	17.00
8.00	1.00	1.00	1.00	8.00	8.00	4.00	20.00
8.00	1.00	1.00	1.00	11.00	5.50	4.00	20.50
8.00	1.00	1.00	1.00	5.00	2.50	5.50	13.00
8.00	1.00	1.00	1.00	6.50	3.50	3.00	13.00
8.00	1.00	1.00	1.00	5.50	0.50	7.50	13.50
8.00	1.00	1.00	2.00	8.00	3.00	6.50	17.50
8.00	1.00	1.00	2.00	7.50	0.00	5.50	13.00
8.00	1.00	1.00	2.00	9.00	0.50	0.00	9.50
8.00	1.00	1.00	2.00	7.00	1.00	5.00	13.00
8.00	1.00	1.00	2.00	4.00	0.00	7.50	11.50
8.00	1.00	1.00	2.00	7.50	0.50	3.50	11.50

PRE / POST INTERVENTION SCORES.