# INTRODUCTION

*How children can compensate for deficiencies is still largely unknown. Studies are needed which focus on 'mechanisms' which may explain why some children develop problem behaviours whereas others do not. ... In such studies various disciplines ... have to contribute to a problem-centred approach to the study of ... neurobehavioural relationships. ... What is required for researchers to really cooperate in interdisciplinary studies? The following factors may be important: a tendency to cross the borders of one's own discipline; a strong belief in 'intuitions', combined with a need for methodological rigour and a strong 'curiosity'; a fascination for the phenomena - one has to be a 'looker' and not take 'variables' as the reality; the willingness to take risks, to follow new lines of thinking.*

(Kalverboer 1993, p. 176)

Growing opinion in physical education, suggests there are far too many Australian children who cannot perform the simplest of motor tasks (Walkley, Holland, Treloar & Probyn-Smith 1993). These children would enjoy physical activity, even with their poor skill levels, if not for the embarrassment and all too often ridicule in failure. If they were to develop their skill to its full potential the ridicule would diminish and the experience of success in performance would be a motivating force. Currently, the situation for physical education activities, sporting teams, dance groups and the like, sees only the talented succeed. Those with poor skills usually withdraw and regress, missing out on experiencing the magic of movement in dance, gymnastics, sports or games, which is a fundamental right of every child. Regardless of their eventual likes or dislikes in recreational pursuits, all children enjoy movement experiences if they possess an appropriate skills base. This skill base can ensure at least a level of proficiency that sees embarrassing ineptitude as an infrequent experience, rather than the norm. All children should be helped to develop their movement skills to this basic level.

The heterogeneous nature of clumsy children makes it difficult to give a concise definitive statement of the characteristics of clumsiness. Although they have no apparent physical impairment as soon as they start to move they appear inefficient, awkward and ungainly. Hulme and Lord (1986) have adopted a broad definition for clumsiness seeing it as, impaired motor performance of a degree sufficient to interfere seriously with many activities essential to daily life, such as feeding and dressing, or school tasks involving motor activity and physical play activities. Children labelled as clumsy, are those who exhibit these motor difficulties, for no apparent or obvious reasons. The cause of the problem is usually a combination of factors and, because of the multi-dimensional nature of their difficulties, it is not easy to generalise on the population as a whole. Recent literature has established that there is a small but significant number of children who are regarded as clumsy. In the average

classroom, there may be two or three children who experience difficulty with movement tasks (Hoare & Larkin 1991b).

The start of school is a crucial time as it is during this period that motor dysfunction or coordination problems will be exposed. When first entering school, children's physical abilities are vital to their adaptation and learning of skills used in drawing, writing and physical education. Not only are clumsy children's ability to adapt and learn basic skills at risk but they can be much slower, less precise in their motor behaviour and indicate a higher frequency of learning difficulties with subsequent emotional problems due to frustration (Sovik & Maeland 1986). School is also the setting for informal play, where clumsy children are often ostracised and/or the last one chosen for games (Adler 1982). Clumsy children have been observed as poorly behaved and less socially accepted than their well coordinated peers (Kalverboer, deVries & van Dellen 1990). Negative behaviours of clumsy children are often misinterpreted by teachers and parents as wilful acts of disagreement when they are more accurately manifestations of motor impairment (Rose 1994). They may experience frustration at home with the difficulties of performing daily tasks which involve fine motor coordination, manipulation of buttons, tying shoes and coordinating body segments to dress themselves. The dishevelled appearance of some clumsy children is an outward manifestation of their lack of coordination.

Clumsy children have a lower global self-worth than their normal peers. The evaluation of self-worth is based upon the four domains of athletic, academic, social and physical competence. Clumsy children have a lower athletic and physical self-esteem, lower perceived physical competence and lowered social self-esteem, which is often manifested by social isolation (Rose 1994; Schoemaker & Kalverboer 1994). From a variety of settings, in the home and at school, clumsy children face the consequences of lowered physical competency in the forms of frustration, anxiety, lowered global self-worth, and social isolation. Teachers, peers and parental reactions to the symptoms of motor impairment often contribute negatively to the self-concept of the child. This lack of physical competence impacts on the child's social development, adversely affecting the formation of a positive self-concept and likelihood of accomplishments in later life.

**The Need for the Research**

The study of clumsy children is multi-dimensional, requiring a multi-disciplinary approach to research into understanding the nature of the condition. The plethora of explanations for, and the diversity of, characteristics of clumsiness has led to a diverse set of opinions with regard to definition, possible causes, implications for and prognosis of children with movement difficulties. The study of children with movement difficulties is far behind that of other

childhood disorders (Henderson, May & Umney 1989) and many theories have been suggested to describe the condition, which have only produced conflicting explanations. Research to date does not explain fully all aspects of the clumsy child (Larkin & Hoare 1991) because of the heterogeneous nature of the condition and this diversity of opinion. Clearly then, as pointed to by Kalverboer (1993), there is a need for studies which "cross the borders" (p.176) of a variety of disciplines in their implementation. This study, by taking an holistic approach to researching into the characteristics of clumsiness, attempts to overcome these difficulties in previous research studies and take an interdisciplinary view.

**The Purpose of the Research**

This study focuses on a broad view of clumsiness, in an attempt to take account of as many characteristics of clumsiness as possible. In taking an holistic view the study moves from identification, through assessment and nature to remediation to provide a comprehensive investigation of the issues. These important research issues are outlined as a result of reviewing the literature, which lead to the formulation of the objectives directing the study. Specifically, four questions are addressed that provide information relevant to the general theme, i.e., characteristics which identify clumsy children and the classification of these characteristics. The primary purpose of the study is to document those characteristics into useful information for teachers and others who deal with these children. Therefore, in carrying out the research in as natural a setting as possible, within certain constraints, the study examines a group of children across a wide range of parameters, in order to fulfil that purpose.

**The Organisation of the Thesis**

The review of literature presented in Chapter 1, provides a background for the investigation, in describing the findings of contemporary research, together with description of various theories. The chapter examines the scope and extent of the problem, in particular the suggested causes of clumsiness, proffering a model for empirical scrutiny. The chapter looks also at strategies used for dealing with the problem, and aspects of how skilled performance is assessed and predicted in relation to motor proficiency. The concluding section draws together the major themes determined by the review and advocates a series of research questions which merit investigation.

Chapter 2 outlines how the research was conducted by describing the experimental design. It begins with the context in which the investigation took place and factors considered in the planning of the study, including limitations and constraints placed upon the research for a variety of reasons. Next, the chapter describes the research design leading on to a description of the major participants and instrumentation, used in the conduct of the study. The final

section outlines the data analysis plan applied in formulating the reporting of results in Chapters 3, 4, 5 and 6.

These four chapters present an analysis and discussion of the results, using a combination of analytical techniques. Chapter 3 presents the collected data in a descriptive fashion, providing an overall perspective on the children in the study, and giving important background information for subsequent analysis. As a consequence of the findings a supplementary study was carried out. Chapter 4 outlines this supplementary study which compared a normal population of children with those in the study group. Chapter 5 describes a statistical analysis of a selected proportion of the data used to profile the group and of the group itself. A cluster analysis was applied to both the variables and characteristics of the children in the study. The scope of chapters 3, 4 and 5 does not allow a complex analysis of individuals and, given the multi-dimensional nature of the clumsy child, benefit can be gained from probing individual cases. Through three case profiles, Chapter 6 develops a comprehensive view to accommodate the heterogeneity of the problems associated with the multitudinous set of possible causes and consequences of clumsiness.

The study considered a variety of factors concerning the clumsy child, in taking an holistic view, and the results are linked together in the final chapter. This chapter summarises the study, giving an overview and discussing the findings. There is a description of the focus of the research, elaborating on the general research theme and research questions. Furthermore, Chapter 7 provides a synopsis of the results from the previous four chapters and discusses the implications of the investigation, from both a practical and research perspective. The chapter concludes with a discussion of the relevance of the research within the context of the study of human behaviour.

# Chapter 1

# REVIEW OF LITERATURE

*Systematic research into clumsiness is in the developing stages. Motor control problems experienced by these children are not understood. For some the problem may lie in the integration of sensory and motor functions, for others it could be the central motor or more peripheral neuromuscular apparatus. Even fundamental movement patterns of these children have not been established.*

(Larkin & Hoare 1991, p. 160)

## Introduction to Chapter

Larkin and Hoare (1991), pointing to the status of research which may enhance the understanding of the clumsy child, have indicated its developing nature. The study of children with movement difficulties is far behind that of other childhood disorders (Henderson, May & Umney 1989). However, many notional theories have been suggested to explain motor clumsiness over the years, some based on clinical observation and others on studies which have produced only conflicting explanations. As Larkin and Hoare (1991) indicated, the research to date does not explain fully all aspects of the clumsy child.

This review of literature provides a background for the proposed investigation and describes the findings of contemporary research together with a description of the relevant theoretical frameworks. The chapter is organised into four sections. The first three provide: an examination of the scope and extent of the problem; a look at strategies used for dealing with the problem; and, aspects of how skilled performance is assessed and predicted, particularly in relation to motor proficiency. The fourth section draws together the main themes identified in the review and espouses a series of research questions worthy of empirical investigation.

## SCOPE AND EXTENT

A valuable background to the understanding of the scope and extent of the difficulties encountered by the clumsy child is provided by an examination of a number of issues, these include: various definitions and the terminology used; the incidence of the problem; and, possible causes of the condition. To outline a normal motor development pattern in children and the departure from this pattern seen in clumsy children is also of great value in understanding the nature of the problem. This section reviews these topics, giving a broad perspective on what clumsiness means.

## MOTOR DEVELOPMENT IN CHILDREN

It is appropriate to examine briefly stages through which a child is expected to pass in a normal pattern of motor development. Although patterns of development have not yet been established accurately for clumsy children (Larkin & Hoare 1991) - despite the trend to move away from the traditional neurodevelopmental approach (identified later in this section) - normal developmental milestones in motor abilities can give clues to any problem arising (Sugden 1990). In describing these, reference is made to important stages relevant to the identification of clumsy children and the changes that children experience due to growth and development. Following this, an overview of the motor proficiency of clumsy children is provided and the section concludes with a description of changes in approach to motor development research.

### Stages in Motor Development

Changes in children due to growth and development are accompanied by biological change. These biological changes can be examined through a number of aspects. There are changes due to hereditary and neurological adaptation, physical growth changes and physiological changes. The body's central processing mechanism, the brain, undergoes rapid changes in the early years of childhood. During the course of neurological adaptation the brain's two main hemispheres establish special functions and lateralisation. Aspects of motor functioning, e.g., hand-eye coordination, accompany this neurological change. Physical growth and the development of sexual maturity have a significant affect on body size and proportions. Anatomical dimensions change at differing rates throughout childhood and greatly affect motor skill development. Physiological changes during childhood can also have a tremendous bearing on the ability to perform physical tasks. Changes in the structure of the cardio-respiratory system, for instance, accompany the child's increasing capacity for sustained physical activity. These different facets of the developing child contribute with learning and the environment to the organisation of motor development in the growing child. Biological change provides a 'backdrop' for motor development to occur (Gabbard 1992).

Motor development occurs in a similar way to the other major developmental parameters of the child, such as physical growth, intellectual capacity and psychosocial skills. Certain stages can be identified in motor development (Gabbard 1992) in a similar fashion to the way that they occur for these other parameters. Although Sugden (1991) stressed that these stages cannot be regarded as distinct, they can be seen as general descriptive phases of motor development. Gallahue (1993) suggested four age periods in childhood, in which different developmental processes affect motor development. The phases he identified are reported in Table 1.1.

The first phase in development is referred to as the reflexive movement phase. It occurs during infancy and consists mainly of innate motor patterns and reflexes. Many of these patterns, such as the moro reflex (a startle response), soon disappear. Some of these reflexes persist if built upon, developing into desirable motor patterns for future activity, such as the swimming reflex, which can be encouraged during infancy into a more mature skill. Other reflexive patterns disappear initially, developing later as a similar movement skill, e.g., the walking or stepping reflex is present in the new-born and reappears as the neuromuscular systems develop (Haywood 1993; Vinter 1990). In the rudimentary movement phase, most reflexes have been inhibited and persistence of reflexive movement beyond the general disappearance stage could indicate some developmental problem (Bee & Mitchell 1984). Once reflexes have been inhibited, movement patterns begin to appear that lay the foundation for future development.

Gabbard, Le Blanc and Lowry (1987) suggested certain movement skills occur not only at Gallahue's rudimentary stage but are observed also at earlier stages and extend into the fundamental movement phase. These particular movements, such as rolling or crawling in infancy, or walking and jumping at the toddler stage (Arnheim & Sinclair 1979), are part of a phylogenetic motor development pattern (East 1983). This pattern is cephalocaudal in nature (Rarick 1980), with "development proceeding from the head downward" (Eichstaedt & Kalakian 1993, p. 99). Thus, infants learn to sit up and use their upper limbs, progress to the more complex use of the lower limbs at the toddler stage. Mastery and refinement of these early phylogenetic skills are required before the learning of more advanced ontogenetic skills (O'Brien 1991a; East 1983).

**Table 1.1 : Phases of Motor Development**
(adapted from Gallahue 1993, pp. 23-31; Gabbard 1992, pp. 10-11)

| Phase of Motor Development | Approximate Age of Occurrence | Characteristics |
|---|---|---|
| Reflexive movement | Pre-natal to 12 months | • Information encoding<br>• Information decoding |
| Rudimentary movement | Birth to 2 years | • Reflex inhibition<br>• Pre-control |
| Fundamental movement | 2 years to 7 years | • Exploring and discovery<br>• Beginner and novice stages<br>• Transition to more mature patterns |
| Sport-related movement | 7 years to 14+ years | • Transition and mastery of specific and/or more specialised skills |

After infancy there is an orderly development of motor ability along a continuum from two-to-twelve years of age (Roy, Elliott, Dewey & Square-Storer 1990). At about the stage when children first attend a pre-school or kindergarten, fundamental movement patterns begin to emerge. This fundamental movement phase lays a foundation for more specific motor skills to be developed in the future (Gallahue 1993). Each isolated skill may depend on a previous single skill for readiness, and each phase in development depends on mastery of the previous phase for readiness to learn tasks within a new phase. Current opinion advocates that during this stage in motor development, remedial programs for children with movement problems should begin (Lockwood, Larkin & Wann 1987), with physical education experiences focused generally on those fundamental movement skills.

Having developed skills like running, jumping, simple ball-handing skills and the like, children are ready for more specific movement activity. They can now begin to participate in games, dance, tumbling and modified sporting activity. This is the stage Gallahue terms 'sport-related movement phase', reflecting in its title society's obsession with sport as being the only medium for more sophisticated movement skills. However, the notion of this stage being more specific and complex in its required motor activity is perhaps implied by the term sport. It may be preferable to re-name the stage 'Activity - Specific Movement Phase', which encompasses all the media through which movement skills can occur, including all non-sporting physical activity. It is at this stage where many children experience difficulty with fundamental movement patterns, with subsequent psychological problems developing, due to the importance placed upon physical prowess in contemporary culture (Short, Crawford & Johnston 1984).

**Readiness for Motor Learning**

The principle of there being a readiness for the development of motor skills is generated from Gallahue's stages, in conjunction with neurological evidence that brain development does not facilitate the learning of more complex motor sequences until about seven years of age (Luria 1980). This principle, similar to readiness for reading in young children, should be adopted to maximise the effect of remediation. This requires identification and intervention to occur at the stage when children are best able to be assessed and most receptive to special programs. Sovik and Maeland (1986) recognised the start of school as a crucial period for the learning of motor skills, as many vital skills depend on motor ability for mastery, e.g., writing, drawing and physical education activities. Lockwood, Larkin and Wann (1987) recommended prompt intervention in early childhood and much of the literature supports the identification of difficulties as soon as possible.

The optimal age at which intervention programs should be applied is open to interpretation. O'Brien (1991a) suggested more mature levels of the fundamental movement patterns do not emerge until about seven years. Short, Crawford and Johnston (1984) recommended intervention at five rather than seven years, due to problems of self-concept and inappropriate behaviour being avoided. However, their study of approximately fifteen-hundred children showed that, in response to a physical activity program, both fine and gross motor skill development occurred more rapidly at seven than five years. Denckla (1974) identified a plateau at about eight years in the motor performance of normal children, thereby indicating that beyond seven years the commencement of special programs would be past the optimal period of effectiveness. As a result, it would seem reasonable to commence identification or screening procedures at five years, in order to implement programs in the child's sixth and seventh year.

**Motor Proficiency in Clumsy Children**

Even if there is no systematic screening for motor difficulties, it is usually when a child enters school that motor problems are observed (Sovik & Maeland 1986). Gubbay (1975) stated that all developing children are clumsy, although some are abnormally clumsy and the latter are the ones who may be labelled as such. It would appear that children who are labelled in this way (i.e., referred to as clumsy or poorly coordinated) all have problems learning and performing movement, yet in other ways they may be normal. Sovik and Maeland (1986) disputed this assertion, suggesting clumsy children are slower and less precise in their motor behaviour than other children. They cited studies which indicate that there is also a higher frequency of learning difficulties among children defined as clumsy, than among other normal children of the same age. In addition, Sovik and Maeland (1986) suggested that emotional problems seem to occur as a consequence of learning or performance problems. This difference of opinion probably results from a difference in definition rather than contradictions in the evidence. The inclusion of a section outlining definitions and terminology used for the condition addresses these issues later in the chapter.

Gordon and McKinlay (1980) suggested the difficulties clumsy children experience in motor coordination are out of proportion to their general level of competence. Their lack of ability may lead to secondary emotional problems but there is no single cause or consequence. Clumsy children are not a homogeneous group (Henderson 1987) and the variation in the nature of their motor difficulties is matched by the variation in accompanying problems outside the motor domain. According to Lockwood, Larkin and Wann (1987), referring to clumsiness as a generic term is inappropriate for the same reasons. They argued that to do so would be akin to adopting concepts like 'general motor ability', long since abandoned in favour of 'specific motor abilities' (Henry 1968).

Clumsy children are unable to execute culturally normative skills proficiently, although they may exhibit intelligence levels within the normal range. These children exhibit poor school achievement, such as delay in acquiring hand dominance, immature drawings, handwriting of poor quality, and sometimes difficulties with reading and spelling (Sovik & Maeland 1986). Clumsy children have difficulty in memorising movements and take longer to complete tasks. They are likely to withdraw if their teachers do not understand their problems and often a clumsy child's movements are interpreted incorrectly (Stewart 1990). Clumsy children cannot keep up with their peers in sport (Cermak 1985) and are frequently the last to be chosen for a team, or excluded from an activity.

Clumsiness can have a negative affect on self-esteem and confidence, and as a result such children may be unable to participate in normal games and active leisure pursuits (Tremayne 1995). Some of these children prefer to play more sedentary games, to play alone, or to play with younger children (Revie 1991). There is an increasing awareness that help must be given at an early age if secondary emotional and behavioural disorders, or long term negative attitudes to physical activity are to be prevented. Many educators and therapists have noted that the clumsy child is often whiney, manipulative and somewhat negative. This may be a reaction to failure, creating a poorly defined self-concept and may lead to a lack of emotional stability (Cermak 1985). Short, Crawford and Johnston (1984) indicated that the probable effects of the continual frustration clumsy children experience, at home, in the classroom and playground, often leads to the development of an 'I can't' attitude. Many of these children often assume the role of the class clown or bully to compensate.

**Emerging Frameworks for Understanding Motor Development and Coordination**

The hierarchical neurodevelopmental approach to understanding motor development and coordination of movement, described above, gives a neat compartmental framework through which to analyse human movement. However, it is regarded by some as a rather simplified or reductionist view and in recent years a more holistic or ecological approach to understanding aspects of movement has been taken. Fentress (1986) suggested that any model of the development of motor coordination in humans should stress its "dynamic, relational and multileveled nature" (p. 101), as the processes involved are highly complex and interrelated. For instance, there is a strong link between neurological development and the growth of the musculoskeletal system This emphasises that changes to the control mechanisms, through learning for example, must have a biomechanical context (Sporns & Edeleman 1993). Although the traditional approaches to analysing motor development have been useful because they isolate certain functions and reduce variability, they do not explain fully the mechanisms which underlie change in coordinated movement (Thelen 1986).

The dynamic systems approach, advocated by Turvey and Fitzpatrick (1993), provides an alternative to the traditional compartmental approaches and accommodates the heterogeneous nature of motor clumsiness. This approach is based on three fundamental assumptions summarised by Haywood (1993). First, there is scope for the self-organisation of groups of muscles, independent of central control mechanisms. Second, in any action or learning of an action there is a complex and cooperative interplay between the physiological systems of the body. Third, development can be discontinuous in nature, for example new movement patterns can replace old ones rather than develop continuously from the old ones. The importance of this dynamic approach is that it determines the need for understanding motor development issues are holistic and interrelated. However, this does not exclude segmental assessment of discrete facets of the multi-dimensional system necessarily, as the techniques of assessment and comparison are based upon sound research, albeit dated in the eyes of the advocates of the ecological approach. Furthermore, a pragmatic view can be taken as Cratty (1994) has suggested when recommending that the study of movement disorders be approached from a number of perspectives. Consequently, all valid approaches to the research process can be considered and adopted where appropriate.

## TOWARDS A DEFINITION AND EXPLANATION OF CLUMSINESS

There is an abundance of descriptions and alternative titles given to children who display movement qualities that are regarded below the range of normal movement ability. Some prefer not to label children as clumsy, favouring the use of the term specific motor disabilities. Attempts to define or stereotype clumsy children have been limited, as the nature of the condition is characterised by diversity and a range of determinants peculiar to the individual (Schoemaker & Kalverboer 1990). This sub-section attempts to clarify the definition of clumsiness and describes some of the related terminology.

### Definitions

Clumsiness does not have a single cause and the term clumsy often masks specific problems and the particular way that a poorly coordinated child may perform any given movement task (Larkin & Hoare 1991). The terms 'clumsy' and 'uncoordinated' are used by various professionals and researchers to describe those children whose movement problems are not due to brain dysfunction, neuromuscular disorders, or any other identifiable debilitating condition. In the main, these children are fairly normal and healthy. In defining the clumsy child, many authors and research reports (Knuckey & Gubbay 1983; Johnston, Short & Crawford 1987; Sovik & Maeland 1986; Hoare & Larkin 1991a; Larkin & Hoare 1991) have cited the definition of Gubbay (1975, p. 39), namely:

> the clumsy child, is to be regarded as one who is mentally normal, without bodily deformity, and whose physical strength, sensation and coordination are virtually normal by the standard of routine conventional skilled assessment, but whose ability to perform skilled purposive movement is impaired.

Others have used such terms as moto· impairment, poorly coordinated (Johnston, Crawford, Short, Smyth & Moller 1987), dysp·axia (Cermak 1985), difficulty learning motor tasks (Revie & Larkin 1993a) or developm·ntal coordination disorder (Polatajko, Mcnab, Anstett, Malloy-Miller, Murphy & Noh 1995).

The clumsy child, according to Pyfer (1988), is an example of an immature mover. One characterised by awkward locomotior patterns, poor hand-eye coordination and slowness in learning motor skills. Arnheim and Sinclair (1979) defined clumsy children as those who have motor learning difficulties and display asychronous and inefficient motor behaviour when attempting to carry out common tasks. The mention of common tasks raises the issue of the norms and expectancies of the child's environment (Sovik & Maeland 1986). It would appear that an inability to perform the required movements of normal living in a culturally acceptable way colours any definition of clumsiness.

Short, Crawford and Johnston (1984) referred to clumsy children as those who "often bump into chairs and desks, collide with other people and drop things" (p. 33). These children lag behind their peers when learning gross motor skills such as hopping, skipping, jumping, balancing and ball activities. Classroom activities frustrate them because of a lack of fine motor skill control. They break penci points, have difficulty using scissors and rulers, often have very poor handwriting and life at home may be disorganised and frustrating. Sovik and Maeland (1986) stated that, when comparing a clumsy child with a normal child of the same age, the clumsy child may fail to some extent in these everyday tasks. This is due mainly to slower, less precise motor behaviour and an inability to gain advantage from the perceptual-motor feedback systems in performing psychomotor skills.

The affects of clumsiness are not restricted to movement tasks and other problems can occur as a consequence (Kalverboer 1993). These include behavioural problems, learning difficulties and difficulties with articulation (Sovik & Maeland 1986; Stewart 1990; Kalverboer, de Vries & van Dellen 1990). More recently the condition has become accepted, in a clinical sense, with both the World Health Organisation (Cooper 1994) and the American Psychiatric Association (1994) having listed, classified and defined the disorder. Their definitions emphasise a lack of coordination which is not commensurate with a child's age or level of intelligence and cannot be attributed to any neurological or medical deficit which can be readily identified.

Confusion over the definition of 'clumsy' may lead to apparent disagreement over various aspects of clumsiness, as mentioned in the previous section. However, such disagreement may well be a consequence of misinterpretation of definition rather than the nature of the problem. The differing interpretations of these definitions reflect the scope of the problem, influence the style of research used and the results that the research yields.

A definition should reflect the diversity of the problem as indicated in the following definition. Clumsy children have:

> coordination problems when performing perceptual-motor tasks with movement patterns that are markedly inefficient by comparison with age matched children. They have difficulty controlling the speed, force and direction of the movement. When coordinating limbs, problems can present with the sequencing and timing. They may have difficulties with activities where environmental timing is imposed on the movement organisation ... and/or activities where outside timing is not important .... Their problems can be aggravated by the different perceptual demands ... of the task. The perceptual motor profiles of these children vary as does their slowed rate of motor learning. The movement difficulties may occur in isolation or in conjunction with associated learning, speech, behavioural or social problems.
>
> (Hoare & Larkin 1991b, p. 3)

**Related Terminology and Descriptions**

In advocating the term, children with movement difficulties, Henderson, May and Umney (1989, p. 1) sought consistency with other contemporary terms (e.g., reading difficulties). They tried to avoid disease-based terms, like dyspraxia or those with negative connotations, such as clumsy. When adopting the classification, developmental coordination disorder (DCD), Polatajko et al. (1995) have the latter advantage but have not avoided a disease-based term. Although DCD is now the officially recognised term (American Psychiatric Association 1994), many authors still use clumsy or clumsiness as a descriptor for the condition (Larkin & Hoare 1992; Geuze & Borger 1993; Schoemaker & Kalverboer 1994). However, DCD is becoming more accepted as the appropriate term for this condition and it is being used increasingly in the current literature (Geuze & Kalverboer 1994; Wright, Sugden, Ng & Tan 1994).

Some writers have clinically distinguished between the uncoordinated or clumsy child and the dyspraxic child. Experienced therapists say that clumsy and uncoordinated children know how to approach a task but seem to be clumsy in its execution. Gubbay (1975) defined the dyspraxic child as a clumsy child whose ability to perform skilled movement is impaired, despite normal intelligence and normal findings on conventional neurological examinations. It would seem for Gubbay that normal intelligence and function is of importance in the definition, as once an impairment is identifiable, then the child is no longer labelled dyspraxic (read clumsy) but has another label to explain the symptoms.

Dyspraxic children, according to Cermak (1985), have difficulty planning for movement and have not developed their motor skills properly. She maintained there are differing types of motor planning disorders in children, therefore they cannot be treated in a unitary fashion. This view of dyspraxia was supported, in part by Ayres (1979) in that she believed the dyspraxic child finds difficulty in motor planning but she has tried to argue a unitary link. In

subsequent studies, Ayres, Mailloux and Wendler (1987) could neither support that there are different types of dyspraxic disorder nor that dyspraxia is unitary in nature. However, these two principal authors differed markedly in describing apraxia, one suggested apraxia as just more severe than dyspraxia (Ayres 1979) and the other that apraxia is the loss of an already learned movement (Cermak 1985), diminishing its relationship with dyspraxia.

Referring to clumsiness in some learning disabled children as developmental dyspraxia, Ayres (1972a, b) characterised it by describing difficulties of sensory integration and the ability to plan and execute motor skills. This view, that the difficulty is substantially one with impairment at a sensory level, does not explain sufficiently why some children who exhibit perceptual abilities within a normal range cannot exhibit movement ability within a similar normal range.

In summary, clumsiness cannot be categorised as a single phenomenon because the causes, manifestations and treatment of the disorder are multi-dimensional in nature and intensity. Furthermore, a clumsy child is one whose difficulty with movement tasks cannot be ascribed necessarily to any overt impairment in function. For the purposes of this study, the myriad of terms used to describe the condition are seen to be synonymous, in particular, clumsiness and dyspraxia are seen to be terms which "are confounded in the published data and cannot be separated" (Sugden & Keogh 1990).

## INCIDENCE

There are two main issues with regard to the incidence of clumsiness in children. First, with regard to the proportion of clumsy children in the population, i.e., the magnitude of the problem. Second, the differences in reported incidence between boys and girls, i.e., the gender issue. This sub-section addresses these issues in an integrated fashion.

A variation in incidence figures should be expected because of the variety of methods used to assess the problem and the differing approaches used by researchers and clinicians. The reported incidence of clumsiness varies, both Gubbay (1975) and Johnston et al. (1987) estimated that six percent of Australian children are clumsy. Other estimates go as high as three-in-ten children from mainstream English schools "suffer some impairment in their motor development" (Stewart 1990, p. ix). According to Larkin and Hoare (1991), the incidence of the clumsy child syndrome is between five and twenty percent of the normal school population, depending on the research read or the definition used. Often the definition of clumsiness is not specific and could include mentally retarded, physically handicapped or cerebral palsied children. Estimates of the number of children whose motor learning and movement quality is below the norm, vary depending on the source. Short, Crawford and Johnston (1984) suggested the middle ground in their estimate, that seven to ten percent of children are clumsy. The upper limit of this range is consistent with Hoare and Larkin (1991b), who asserted one-in-ten Australians experience a problem with clumsiness. Revie

and Larkin (1993a) stated that Australian estimates of clumsiness, based on motor performance tests, range from five to fifteen percent. They attributed reported incidence variations to differences in the test batteries used, the ages of the subjects and the identification criteria.

Henderson and Stott (1977) suggested that boys are more likely to be afflicted with coordination problems than are girls. Laszlo, Bairstow, Bartrip and Rolfe (1988), using teacher referral as the initial screening device, regarded ten percent of children to be clumsy, of which 80 percent were boys. Sovik and Maeland (1986) confirmed this ratio when screening 331 children with a more reliable diagnostic instrument (Gubbay Test of Motor Proficiency). Although Johnston et al. (1987) also reported teachers referring clumsiness at about a 5:1 boys to girls ratio, there is a distinct difference between the rate at which boys are referred and actual gender differences in the incidence of the problem. Johnston, Short and Crawford (1987) reported around seven percent of five year olds to be poorly coordinated, with boys outnumbering girls at around two to one. Yet, they found that in the seven percent of seven year olds regarded as clumsy, the incidence was distributed equally in gender terms. Research by Hoare and Larkin (1990) and Short, Crawford and Johnston (1984) has shown a more equal gender distribution of children with coordination problems than would otherwise be expected.

In Australian remedial programs, more boys are referred than are girls and it has been suggested that this higher incidence in males may be due to a cultural bias (Larkin & Hoare 1991). Stephenson, McKay and Chesson (1990) stated that boys in general are more likely to experience learning difficulties but they (the researchers) are concerned that the disproportionate referral of boys with motor difficulties may be due to cultural and social factors. This clouds the issue when trying to ascertain any gender differences, as does the fact that girls are generally more skeletally mature than boys at any chronological age prior to the onset of puberty, i.e., girls are approximately two years ahead of boys skeletally before pubertal changes (Mader 1992). Given that there may be some socio-cultural bias favouring referral of boys (Cratty 1994), it may well be that the incidence of clumsiness between the genders is equal or closer to equal than it would seem to be on the surface (Revie & Larkin 1993a). Therefore, it would be reasonable to state that the incidence of clumsiness may not be particularly gender specific at any given developmental level but the resulting aberration is a consequence of boys being referred more often to remedial programs than girls. However, Larkin and Hoare (1991) put forward what seems the most useful rule-of-thumb for practitioners, that boys and girls with movement impairment may be found in every classroom.

## POSSIBLE CAUSES

The causes of motor clumsiness are varied, confirming that the nature of the condition is multi-faceted, and the population more heterogeneous than a single classification of clumsiness would suggest (Henderson & Hall 1982). These causes can be viewed in the model presented in Figure 1.1. The model structure is one based upon two frameworks suggested by Israel and Schurman (1991), who were describing health-behaviour (p. 192) and the stress process (p. 202). Although the content of the model presented here differs from Israel and Schurman's, the adaptation of their framework provides a structure in which to view the possible causes of clumsiness reflected in the research literature.

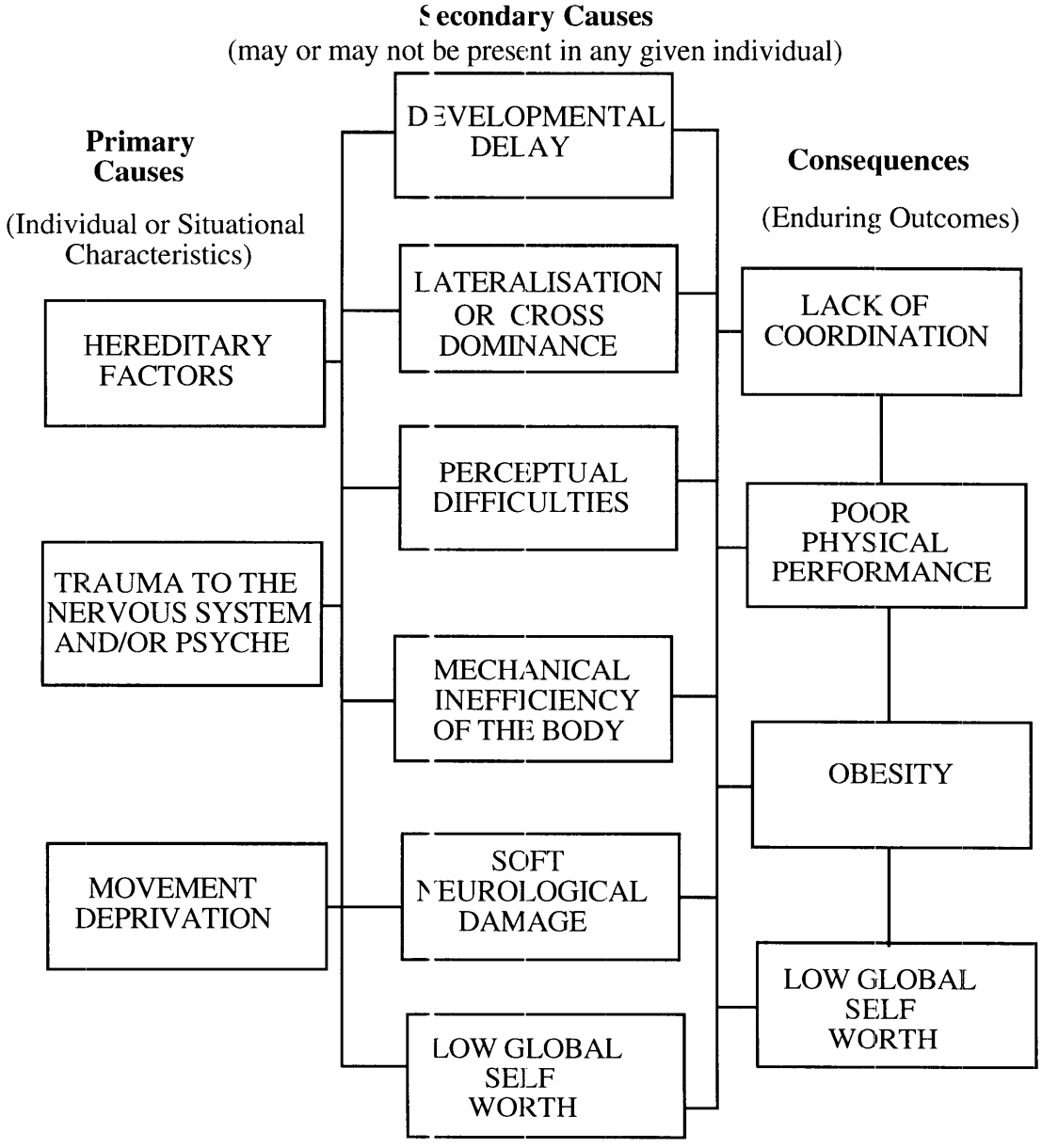


**Figure 1.1 : The Relationship Between the Causes and Consequences of Clumsiness in Children**

In this model of the causes of clumsiness, the view is taken that all causes stem from the nature of the individuals and/or their reactions with the environment. This is a fairly liberal philosophical standpoint in relation to the traditional theories of human development, i.e., those that argue either nature or nurture having the principal effect on development (Newell & Scully 1987). However, it is a standpoint which is consistent with the holistic view of the clumsy child, which considers the heterogeneity of the condition and in accord with much of the literature espousing an integrative multi-disciplinary approach (Lockman & Thelen 1993).

Presenting a model such as this confirms the notion of the heterogeneity of clumsiness. The relatively large number of causes and possible computations point to a condition which is not simple to delineate. The picture that this model (or any other diagrammatic representation of the condition) cannot depict, is one that shows the interrelationships between causes, layers of causality and consequence. To do so would be so complex as to render any diagram ineffectual from the point of view of providing an overview. However, the model does provide an opportunity to distinguish between primary and secondary causes and the difference between cause and consequence (or symptoms).

**Primary Causes**

In presenting the antecedents (primary causes) of clumsiness in Figure 1.1, three major groupings of causality emerged, from which subsequent causes (secondary) are seen to flow. In the absence of any extensive empirical study on the incidence of clumsiness in the families of clumsy children, hereditary factors can only be surmised to be a predisposing cause. However, it can be argued that hereditary factors would have as much of an effect on the movement ability of children as they would on other characteristics (Magill 1993; Walkley et al. 1993). Therefore, it would seem reasonable to assume that movement inability could be predetermined in some cases and conclude that clumsiness can be genetically inherited at least for some individuals (Arnheim & Sinclair 1979; Cratty 1994). In addition, Hoare (1991) reported that family predisposition to clumsiness could be as high as 30 percent. This predisposition may in turn, result in a negative attitude toward physical activity and as a consequence the children may be deprived of participating in movement experiences which could improve their motor skills.

Damage through overt physical or psychological trauma to the growing child could result in serious and identifiable impairment. In most cases, one of the consequences of this would be a movement difficulty of one kind or another. However, children afflicted in this manner would not meet the criteria used to define the clumsy child in this study. Therefore, the discussion is limited to the more covert, less obvious traumatic causes of movement difficulties to the otherwise normal child.

The most reported single traumatic event given as a cause of clumsiness is difficulty at birth. There is evidence to suggest a high incidence of difficulties with the birth process in clumsy children (Johnston, Short & Crawford 1987). This assertion is endorsed by Stephenson, McKay and Chesson (1990), who found a high incidence of perinatal abnormality in children with motor learning difficulties, supporting Gubbay's (1978) findings. In describing the causes of dyspraxia, Cermak (1985) connected the condition with prenatal, perinatal and neonatal complications. Furthermore, over half of the clumsy children in Hoare's (1991) study had a history that was characterised by birth difficulties. These difficulties could be linked to neural dysfunction and a consequent contribution to movement problems.

Henderson, May and Umney (1989) suggested an absence of a substantial body of knowledge with regard to the affective domain of children with movement difficulty. Most literature linking psychological problems with coordination problems, regard any psychological difficulties as a consequence of poor coordination (Johnston et al. 1984; Kalverboer, de Vries & van Dellen 1990). Although associations between clumsiness and self-esteem are often reported, none has established that the psychological difficulties are a primary cause of the clumsiness, rather that most studies infer the causal link to be that clumsiness is the cause of the psychological or social problems Therefore, the lack of global self-worth exhibited in clumsy children is depicted in the model as a secondary cause and/or a consequence of clumsy behaviour.

Movement deprivation occurs when the child's opportunity for movement has been limited by environmental factors, illness or injury. This would seem to be an obvious primary cause of movement difficulties, given that lack of opportunity limits the scope for normal development. Attainment of a mature form of fundamental movement patterns may not eventuate unless sufficient practice takes place (O'Brien 1991a) and movement deprivation denies this practice, according to Hoare and Larkin (1991b). Children who have experienced a lack of opportunity for movement development are under-achievers rather than true clumsy children, and they respond well to remedial programs. However, the deprivation is sometimes severe and without proper attention there is a danger that their full potential will not be attained if early intervention is not forthcoming.

**Secondary Causes**

Having established that clumsiness can be seen to be based primarily upon some hereditary or environmental causes, the restricted abilities of any single clumsy child can be seen as a direct consequence of those primary causes. The direct consequences or secondary causes may be manifest or present in one or any combinations of a number of restricted abilities. Furthermore, secondary causes are multi-dimensional in type and operate at varying degrees

of severity. The secondary causes represented by six categories in Figure 1.1 are those which have been reported most frequently in the literature.

Motor planning disorders may manifest themselves in the following ways: clumsiness, poor tactile perception, inadequate body scheme, difficulty in learning activities of daily living, problems in gross motor skills, problems in fine motor skills, articulation difficulties and personality problems (Cermak 1985). Although acknowledging the multiplicity of causes for clumsiness, Short, Crawford & Johnston (1984) gave examples including both slow maturation and developmental delay Other causes proposed are developmental delays in reflexes, the vestibular system, the visual system, and in tactile receptors (Pyfer 1988). If the problem is one of delay then as the child matures, the clumsiness would disappear with intervention accelerating the process. However, the simple explanations, such as, clumsy or poorly coordinated children will grow out of their problems, implied by the term developmental delay, has a basic flaw (Schoemaker, Hijlkema & Kalverboer 1994). According to Hoare and Larkin (1991b), coordination problems continue into adolescence and many adults still report difficulty in executing coordinated movements. Developmental delay or maturation lag does not explain those who never catch up. Therefore, there is a need to look at the explanation for clumsiness emanating from a wider consideration of the causes. Children have usually established their dominance in handedness by the age of seven years (Whittington & Richards 1987), and therefore, it is appropriate to consider aspects of excessive dominance or cross dominance with eyedness when considering perceptual motor abilities of clumsy children at this age. The significance of the effect that excessive lateralisation and/or cross dominance has on motor proficiency is uncertain. Walton, Ellis and Court (1962) found cross lateralisation in four out of five clumsy children in their case study and cite it as a feature which is frequently linked to motor difficulties. Hulme and Lord (1986) reported that crossed laterality is often associated with developmental clumsiness, although it is not necessarily a core feature. Denckla (1974) mentioned excessive asymmetry being a difficulty for proper movement development, particularly in right preferring children. However, Larkin and Hoare (1991) claimed there is no conclusive evidence that cross lateralisation is a major cause of clumsiness. Clearly, in situations requiring a choice in performing a unilateral skill, children with an excessive dominance may have a disadvantage. Being cross dominant in terms of eye to hand or eye to foot is an issue requiring more substantial evidence. Fisher and Carmenzuli (1987) concluded that difficulties in bilateral symmetry are due more to perceptual problems than with the anatomical structures of the nervous system responsible for encoding the reaction to a stimulus. Therefore, it may be more appropriate to categorise cross dominance or difficulties with lateralisation, in the causes included under perceptual difficulties.

Perceptual difficulties, including visual (Lord & Hulme 1988; Murray, Cermak & O'Brien 1990), visuo-spatial (Lord & Hulme 1987), and kinaesthetic (French & Horvat 1986), may

account for a proportion of clumsiness in children (Hoare & Larkin 1991b). Comparing normal children with clumsy children, Hulme, Biggerstaff, Moran and McKinlay (1982) reported a clear association between impaired visual perception and clumsiness. Perceptual problems occur in a percentage of clumsy children with variation in performance occurring in both perceptual and motor tasks. Laszlo et al. (1988) advocated kinaesthetic training regimes for the alleviation of difficulties experienced by clumsy children. Using only clumsy children in experimental (n=20) and control groups (n=20), they found kinaesthetic training to be more effective than traditional remedial teaching. This view is disputed by Hoare and Larkin (1991a) who compared 80 clumsy children and 80 children of normal development in a similar age range using seven kinaesthetic tests. They argued that kinaesthetic training may not be appropriate for all children experiencing difficulty in performing movement tasks.

In any movement skill, no matter how efficient the control mechanisms are, the action can be limited by the biomechanical constraints put on it by the anatomical structures which effect the movement pattern (Rosenbaum 1985; Phillips, Muller & Stelmach 1989; Hauert, Zanone & Mounoud 1990). The link between body dimensions and physical performance has been established in relation to elite performers (Bloomfield 1980). There are two particular areas of body dimensions which may influence the poor physical performance of clumsy children. These are obesity, or having an endomorphic body type (Holopainen 1985), and/or minor musculoskeletal abnormalities (O'Brien 1991b). The mechanical disadvantage of obesity to physical performance is well established (Craig 1991; Hills 1991a). The only conjecture with its application to the clumsy child is in its level of causality and/or consequence. Obesity can be seen as both cause and consequence which are cyclic in nature. Therefore, it is included under mechanical disadvantages categorised within secondary causes as well as being considered an enduring outcome which may in fact have some causality as a discrete entity.

The second mechanical disadvantage to be considered is less clear. In an anatomical sense, minor musculoskeletal abnormalities are limiting (Wood 1990), but not necessarily debilitating. However, considering that some aspects of body proportions have a distinct mechanical advantage for physical performance (Wilmore 1988), it is not illogical to assume that the reverse of these proportions may be a disadvantage. Specifically, elite performers in jumping events have shown particular trends in the proportionality of lower limb segments (i.e., a high crural index) and of the length of their lower limb to trunk length (Ackland & Bloomfield 1992). Given that clumsy children have exhibited poor jumping patterns (Lockwood & Larkin 1987), it may well be that some clumsy children are characterised by adverse proportionality in body segments vital to efficient movement patterns.

The causes of clumsiness are complex (Goodgold-Edwards & Cermak 1990) as it may occur for a variety of reasons. This can be attributed to the fact that efficient motor performance is the end product of the combination of many different neurological functions (Cermak 1985).

Soft neurological damage can be interpreted as a direct consequence of birth trauma, established previously as a primary cause of clumsiness. This does not lessen the likelihood of other causes of damage to the neurological structures but rather exemplifies the link between levels of causality. Cermak (1985) reported that many children diagnosed as developmentally dyspraxic show several soft neurological signs and proposed a number of hypotheses that attempt to explain why praxis may not develop normally, including:

- impairment of innate cerebral mechanisms,
- under-stimulation of an otherwise intact network due to faulty input pathways,
- failure of integration of different parts of the brain,
- delay or incomplete development of cerebellar functions,
- parietal disorder,
- failure of inter-neuron development due to poor nutrition, anoxia, hypoxia or deprivation,
- sensory integrative dysfunction.

Numerous authors associate Minimal Brain Dysfunction (MBD) with motor inefficiencies (Silva & Ross 1980; Knuckey & Gubbay 1983; Gillberg 1985; Cole & Chan 1990; Sugden & Keogh 1990). However, the use of MBD (and to a certain extent soft neurological signs as an indeterminate indicator) as the all encompassing term for a myriad of conditions which are difficult to explain has been challenged recently (Kalverboer 1993). On the other hand, Gubbay (1975) indicated abnormal clumsiness may arise from virtually any disturbance of the nervous system and not exclusively when there is a disruption to the motor system. To date, researchers have been unable to localise possible sites of damage to the nervous system, resulting in explanations for motor dysfunction of this type (Hulme & Lord 1986; Phillips, Muller & Stelmach 1989). This further reinforces the heterogeneity of the condition, even within a single cause.

The association between clumsiness and aspects of global self-worth has been reported frequently (Gordon & McKinlay 1980; Cermak 1985; Holopainen 1985; Gordon 1991; Schoemaker & Kalverboer 1994). Low global self-worth is used here in a generic sense that encompasses all the different ways individuals can value themselves and includes self-concept, self- esteem, etc. (Harter 1983; Rose 1994). Lockwood, Watt and Homewood (1986) concluded that there was a significant difference in the level of self-esteem between motor impaired and normal children. In agreeing with this conclusion in a more general sense, Rose (1994, p. ix) found "that children who are poorly coordinated differ from their peers in psycho-social aspects of their lives". The nexus between global self-worth and motor proficiency is open to interpretation, in that the direction or level of causality may be a point of contention. Whether cause or consequence, links are established and these may be cyclic in nature. Thereby, justifying the placement of low global self-worth in Figure 1.1 at two levels, which illustrates this cyclic nature. For example, inadequate feelings may lead to inadequate performance, leading to further feelings of inadequacy and so on.

**Consequences**

The observable manifestations of clumsiness can be identified as 'enduring outcomes' or for some observers the 'consequences' of the previous two levels of causality. In Figure 1.1 these manifestations are also suggested as further 'causes', because the affects do not end there. Although using cause and consequence interchangeably would seem illogical, as the terms are contradictory, the assertion that consequences can further exacerbate the condition is sufficient reason for defying logic to illustrate the point.

As already mentioned in the previous section, obesity and low global self-worth can be both cause and consequence, and interact with other causes in cyclic fashion. So too can the resultant lack of coordination and poor physical performance lead to an impediment in the normal development and specifically in the acquisition of motor skills. The circular nature of the difficulties can continue to feedback on themselves, unless the feedback loop is broken with skilled and timely intervention. These overt and often measurable outcomes, brought about by the underlying causes of clumsiness, are obvious signs of the condition. Teachers and parents can identify behaviours or clues that indicate the likelihood of:

- coordination difficulties - such as, frequency in dropping things or difficulty in tying laces;
- poor physical performance - such as, always last in a race, low scores on fitness tests;
- obesity - aesthetically rotund in appearance or exhibiting low levels of stamina;
- low global self-worth - such as, isolation from peers or abnormally quiet.

**SUMMARY**

Studies reviewed in this section have indicated the heterogeneous nature and multiplicity of causes that characterise clumsiness. Indicators evident in the literature suggested that clumsy children do not exhibit normal patterns of motor development and may experience other associated difficulties. Although the true nature of the condition is clouded by different interpretations and definitions, it is possible to identify a number of causes and consequences of clumsiness. Larkin and Hoare (1991) suggested that environmental factors interact with many other casual factors and as a result a circular effect can take over. Difficulty in learning to move, with its concomitant lack of success, leads to withdrawal from demanding situations which in turn leads to a deprived environment. It must be noted, however, that a deprived environment is responsive to intervention.

Whether the vast array and different levels of causality can be merged into more useful core descriptors for identification and intervention purposes has not yet been fully investigated in a single study. Other more specific characteristics of the clumsy child, e.g., physical capacities and/or biomechanical attributes, have seen little investigation. The key aspect identified above is the need to take a broader perspective of the clumsy child in order to fully understand the complexities of the condition.

## ADOPTING STRATEGIES

This section is concerned with strategies that may be adopted to deal with the problem of clumsiness. In the main, those strategies can be grouped into two categories, these are: aspects of intervention; and, the nature of programs designed to remedy motor difficulties. However, in order to provide background, it is pertinent to precede the discussion of the literature in those two areas with a brief commentary on the literature concerning prognostic aspects of the condition.

## PROGNOSIS

What does the future hold for clumsy children? Left unchecked, there are serious long-term consequences for the clumsy child (Laszlo et al. 1988). Children who experience difficulty in movement need specialised attention at an early age to alleviate their problems. According to Larkin and Hoare (1991), this early intervention often avoids the attendant pitfalls and stigma that can arise as a result of awkward behaviour. They stated that children with poor coordination often turn into clumsy adults who seek occupations that do not reveal their condition. Hoare and Larkin (1991b) claimed that for the truly clumsy child, who in a clinical sense presents with significant medical or developmental indicators, the prognosis may not be as positive. This implies that clumsy children do not grow out of the condition necessarily (Henderson 1993; Geuze & Borger 1993). However, in general, children respond positively to intervention (Schoemaker & Kalverboer 1994), although the degree of modification in performance or behaviour is variable.

Although there are longitudinal studies which have investigated problems of motor development in children (e.g., Losse, Henderson, Elliman, Hall, Knight & Jongmans 1990; Geuze & Borger 1993; Kalverboer, Hopkins & Geuze 1993), no substantial research has taken the investigation through to adulthood. It is likely that the clumsy adults of today have not had the opportunity of participating in remedial programs. Given this, and despite the few longitudinal studies on this issue with evidence to the contrary, the literature indicates that children who are clumsy can improve. For instance, Knuckey and Gubbay (1983) predicted that although the prognosis for a clumsy child is unclear they regard it as favourable. In contrast to Larkin and Hoare (1991), they reported that children with mild or moderate clumsiness improve as they enter adolescence and early adulthood and only those with severe degrees of clumsiness do not improve with maturation. The literature gives an impression that the improvement can be achieved if a remedial program is used. If intervention is early enough and the child is motivated, with remedial assistance maintained throughout childhood then the prospects are more positive (Larkin & Hoare 1991). Motivation of the children seems to be tied to their emotional state at school as well as at home. If the classroom situation is stable and the remedial program has the same personnel, then stability is created.

If the child's motivation is strong then improvement can be expected (Short, Crawford & Johnston 1984).

## INTERVENTION AND IDENTIFICATION

The first indication that a problem may exist is if the movement pattern of the child appears immature, i.e., below the standard expected for a child of that age (Cole & Chan 1990). Hulme and Lord (1986) identified four signs to be aware of, "Impaired motor performance ... Absence or paucity of neurological signs ... Normal or near normal intellectual capacity ... Discrepancies in motor capacities" (p. 260), providing a reminder of the heterogeneous nature of the condition. If children with movement problems are not identified correctly, they cannot be given the educational and social support necessary to alleviate the direct and associated problems of clumsiness. Identification needs to occur in pre-school, or at the latest, in the first years of primary school, so that the child has the chance to develop more efficient movement patterns. School-based information and background about the child's developmental and medical history could aid in the decision on intervention (Hoare & Larkin 1991b). The earlier in the first years of school that intervention can occur and the remedial program be instituted, the greater the prospects for improvement.

In order to better facilitate intervention, those involved in the process have to be aware that a child has a problem. Teachers seem to differ considerably in their awareness of the phenomenon of clumsiness in their classes. Identification and subsequent intervention at an early stage can be limited by a lack of background in teachers' training for observing motor development (Revie & Larkin 1993a) According to Sovik and Maeland (1986), pre-primary and primary school teachers have a limited knowledge of motor development and movement. Furthermore, teacher identification of clumsy children does not equate always with tests of motor proficiency. Larkin and Hoare (1991) cited many studies which have shown teachers have difficulty in identifying clumsiness among students in their classrooms. They are unaware of the incidence of poor coordination among their children. Teachers in the early years of schooling tend to underestimate the importance of movement and many adopt the approach that movement problems are due to developmental delay or maturational lag. The identification of the clumsy child can be enhanced if a specialist in the area of movement, such as specialist physical education teacher, is present in the school (Revie & Larkin 1993a).

Typically, physical education programs in upper primary and lower secondary level falter because the programs do not allow for children with motor dysfunction. The assumption often is, that because children are of a certain age, they should be participating in more specific and more complex physical activity. This is where clumsiness manifests itself as a serious social problem for the child with their peers (Cermak 1985). Many clumsy children go through school with their problems, in the main, unrecognised or trivialised. The literature

suggests that failure to recognise correctly, and attend to the problems of the clumsy child appropriately, may lead to missed opportunity, low self perception, ostracism, lack of confidence and learning disadvantages (Rose 1994). It is evident that the clumsy child pays a high price for this lack of attention.

## REMEDIAL PROGRAMS

Once children with coordination problems have been identified, it is important to develop a remedial program for them. A number of diagnostic and remedial procedures have been implemented in both clinical and educational settings over the years (Lockwood & Larkin 1987). Until recently, only a handful of these procedures has been evaluated properly and still there remains a dearth of empirical evidence to support or refute many of the assertions underlying these practices. There have been many programs which have attempted to remedy children's movement problems, with varying degrees of success. The following paragraphs review some of the programs established to remedy motor difficulties.

The UNIGYM program (Lockwood & Waters 1984) at the University of Western Australia has been one of the most successful remedial physical education programs in Australia. Based on extensive experience and constant evaluation of the methods (reports of which have been cited extensively in this literature review through the publications of Larkin, Hoare and colleagues), the program provides an individual and progressive program of motor activities for children with movement problems. The approach taken in providing this program is described as functional and multi-dimensional, including all facets of physical education from movement to music through to aquatic activities (Smith & Larkin 1988).

Following the early successes of UNIGYM, Lockwood, Watt and Homewood (1986) undertook a study in a school setting, using a similar remedial motor coordination program. Their research was undertaken in two primary schools from similar sized West Australian rural towns. Thirteen children were selected from the pre-primary grade of one school to act as the experimental group. Ten children, selected from various pre-school centres feeding the other school, acted as the control group. The children were selected on the basis that they failed two or more of the items in the Stott-Moyes-Henderson Test of Motor Impairment. Affective variables were measured with standardised instruments for testing self-concept/esteem. Measurement of academic achievement was not as standardised, as teachers were asked to rank-order children in the groups on the basis of their academic achievement before and after the twelve-month program. The physical education program was designed to emphasise various aspects of coordination, most particularly motor sequencing, hand-eye coordination and balance. The program was tailored to suit each child's performance profile as determined by scores on the Stott-Moyes-Henderson test. Significant improvements were made in both groups for physical achievement but the experimental group had a far greater

change in performance levels. In addition, it was found that a significant difference existed in the level of self-esteem between motor impaired and normal children, but there were no significant changes in these measures as a consequence of the remedial program. Teachers' estimates of children's achievement showed a significant improvement in ratings of children who were involved in the program. Only tentative conclusions can be drawn because of the small sample size, the failure to randomly allocate treatment and control groups, and the wide ranging effects of motor therapy programs. The changes observed in the children, however, do warrant further investigation with a tighter control on these variables accommodated in the methodology.

Other studies report improvements in motor skill after physical education programs. Johnson and Fretz (1967) concluded there were improvements in the perceptual-motor skills of children who participated in their clinic, reporting a significant change in the children from the pre-clinic testing due to a physical development program. However, the failure of Johnson and Fretz to report the sample size might lead the reader to assume there may have been a small number of children involved, as a large sample size would have increased the study's credibility. Working with a small number of subjects, Mauser and Reynolds (1977) found that there were significant increases in body coordination due to an eight-week developmental physical activity program. In addition, they reported little change in affective characteristics, concluding that while body coordination might be improved by participating in activity of short duration, the improvements may not be accompanied necessarily by increases in self-concept.

Using a larger sample of children (n = 76), Arnheim and Sinclair (1974) found significant changes brought about by a motor development program. The changes observed were not just in motor ability but also in personality and self-awareness. Jenkins and Sells (1984) showed concern also for the effect on other learning domains of physical therapy for gross motor problems. Although this was not the main aim of their research, they were able to comment that the treatment had no effect on academic, communication and social/self-help skills. This seems to support Mauser and Reynolds' findings but contradicts those of Arnheim and Sinclair (1974). However, what Jenkins and Sells did find, with the 45 children in their study, was the frequency of treatment (per week) made no difference to the outcome. They reported no significant difference in improvement levels of gross motor skills for children who received physical therapy three times per week than for those children who participated only once per week. The improvements they reported for all the children were in both fine and gross motor skills. The evidence obtained supported the notion that their physical therapy treatment made marginal changes to fine motor skill and substantial changes to gross motor skill.

Short, Crawford and Johnston (1984), identified 717 poorly coordinated five year-olds in Adelaide schools. One of their aims was to determine the effect on coordination of three twenty-minute gross motor developmental activity sessions per week for 22 weeks. The 717 children were broken into two groups, 369 of the children from twelve schools became the treatment group. This group, already involved or interested in a gross motor activity program, were given such a program as an intervention. The other 348 children were drawn randomly from 18 selected schools and became the control group. The control group continued with their usual physical education program at their school for the 22-week duration of the research project. Results showed that there was an improvement in motor skills for both groups at the completion of the program. However, the treatment group showed a higher level of improvement over the control group. There was no change in either group's self-concept and these five year-olds showed no evidence of having a poor self-concept either prior to, or after the program. The classroom teachers from the treatment-group schools, commented that most of the children had improved in their gross motor skill development. They noted improvement also in the areas of following directions, attending to and completing tasks, being accepted and chosen by others as friends, being happier at school and having more confidence in play activities.

A concurrent study was undertaken by the same team of researchers (Johnston, Short, Crawford and Harmstorf 1984), involving seven year-olds in the Adelaide area. Results here showed that there was a far greater improvement in the fine and gross motor scores of the treatment group and only a minor improvement in the control group. Poor self concept was almost twice as prevalent in both the treatment and control groups compared with U.S. norms for seven year-olds. Surprisingly, this prevalence decreased more in the control group than in the treatment group, following the latter group's involvement in a fine and gross motor program. Behavioural problems were far more prevalent in the treatment group, both before and after participating in the program. After six months these behavioural difficulties had decreased in both groups, decreasing less in the control group. These two Adelaide studies show that the fine and gross motor skills of a seven year-old improves at a greater rate than that of a five year-old, as a consequence of participating in a remedial program.

## SUMMARY

The studies reviewed in this section indicate some support for the notion that a structured and correctly evaluated program of physical activity, can cause a change in the level of motor skill of children with movement problems. Furthermore, due to a lifting of skill levels in these children, consequent changes in global self-worth may be brought about. Evidence from this and the previous section indicates early identification of these children is of paramount importance to the success of any intervention program. However, the specific effect of the program is very much dependent on the identification processes as well as the nature of the

program itself. The number of approaches to remedy the problem is surpassed only by the multi-dimensionality of the condition. There can be no 'cure-all' for the condition until the characteristics of the clumsy child are understood fully and remedial programs evaluated extensively using the same criteria. Suffice to say that most remedial programs for clumsy children seem to bring about some positive changes, depending on the child and the program itself. Exactly what the long term ramifications of those initial changes are is as yet unknown.

## EVALUATION OF SKILLED PERFORMANCE

This section reviews the literature pertaining to the evaluation of factors affecting skilled performance under three headings. First, how physical capacities can be assessed and the relevance of these capacities to motor proficiency, are discussed. How motor proficiency itself is both screened and evaluated, as a tool for diagnostic recommendations in intervention programs, formulates the second and more substantive section. Third, an overview of assessment in the psychosocial domain is provided.

### PHYSICAL CAPACITIES

Malina, Meleski and Shoup (1982) suggested that anthropometric, compositional and maturational indicators, interacting with other parameters, form the determinants for performance in children. Establishing a physical capacities profile, which include these parameters, has been advocated as a necessary aid to the diagnosis of areas of weakness in athletic performance (Bloomfield 1992; Magill 1993). Given that "motor ability is based upon such components as muscular strength, muscular endurance, cardiovascular endurance, speed, balance, agility, power and coordination" (Battinelli 1984, p. 109), it would seem appropriate also to use such profiles for those at the lower end of the physical ability scale. Physical capacity indicators which may assist in understanding the performance of the clumsy child can be categorised under two main headings, these are: indicators of physical fitness, e.g., speed, stamina, flexibility; and, anthropometric data, e.g., measures of body proportions and composition, height and weight. The inclusion of this type of assessment, advocated by O'Beirne, Larkin and Cable (1994), would broaden the view of the clumsy child, moving away from the previous narrow focus in assessment which dealt mainly with neurodevelopmental mechanisms (Henderson 1993) into the more multi-disciplinary perspective of movement analysis which has emerged in the more recent literature (Lockman & Thelen 1993).

### SCREENING AND TESTING MOTOR PROFICIENCY

According to Sovik and Maeland (1986), we do not have established assessment procedures to identify clumsy children. It would appear that the inability to describe and understand motor impairment is parallelled by our limited understanding of the nature of motor

development (Hopkins, Kalverboer &. Geuze 1993). Often formal assessment is inadequate due to the limitations of current knowledge in neural control and organisation of movement. Vaessen and Kalverboer (1993) suggested that conventional neurological examination may not reveal poor coordination in children. As a result of these limitations, there is a need to think flexibly when assessing movement (Larkin & Hoare 1991).

Specialist physical educators may aid in the recognition of clumsy children and appropriate assessment can ensue. A physical education teacher may be better suited to identify and assess for movement problems than the generalist primary school teacher (Revie & Larkin 1993a). The assumption is that the physical education teacher, with knowledge of motor development and motor observation, is more capable of the task without further specialist training. However, this assumption could be flawed, as the physical education specialist is usually a secondary teacher, with little working knowledge of the younger child. It could be that the junior primary teacher with specialist training is best suited to identify motor difficulties. To date there have been no substantive studies which have investigated this issue. Whoever completes the assessments, there will be two distinct phases in the assessment of motor proficiency in children. First, the screening phase which may use a rough and ready guide to possible motor dysfunction. Second, a more valid and reliable diagnostic assessment using a more standardised instrument.

**The Screening Process**

Henderson and Hall (1982) advocated a greater role for teachers in the initial identification of clumsy children. The early recognition of motor dysfunction and subsequent remedial programs are placed more appropriately as early as possible after entering school (Hosking 1982). Screening needs to be conducted during the early years of schooling and those more likely to use the tests are teachers who may not have any specialist physical education training. There have been many tests developed over the years to help identify motor dysfunction. However, most tests available are often expensive and time consuming and only able to be administered by specially trained professionals. Johnston et al. (1987) found that there were no Australian standardised motor screening tests for five year-old children. They recommended that screening tests should be simple to administer, time efficient, inexpensive, valid and reliable. Their research developed a ten-item screening procedure and a five-item screening procedure (a sub-test of the ten items) for use by teachers. The latter of these takes only five minutes per child to administer, with items assessing functioning in both the gross and fine motor domains.

A screening test for use by primary school teachers in the field was developed by Revie and Larkin (1993a). This test involved teachers observing the children performing nine movement skills and rating their performance on a movement behaviour characteristic checklist. The

checklist was designed for children, perceived by teachers as poorly coordinated. The test results showed that many children, in particular girls with coordination problems, missed identification by their teachers. In attempting to provide a practical screening procedure which avoided the possibility of miss ng children with problems, Hoare (1992) developed a field test which screens for gross motc r coordination problems. The test battery is expeditious and relatively easy to administer, pro viding a movement analysis checklist for the untrained person to use with all primary school children. Consisting of five gross motor tasks: stationary hop; static balance; 50 mc tre run; catching and throwing; and a standing broad jump, it avoids the necessity of untrai ied observers selecting children at risk from subjective judgement. Although the information gathered from this type of test is limited, it can be useful in the remedial process. However, it is essential to analyse the child's movement for each task in order to identify areas tha may contribute to a breakdown in skill development.

Sugden and Sugden (1991, p. 331) have suggested that "intervention programmes should be matched to the problems the child is experiencing" and have developed a screening and diagnostic procedure for teachers catering for this purpose. Their Motor Competence Checklist (MCC) follows a numbe of principles and is organised into a five-section framework. The guiding principles are :

> a system of assessment and management of movement skill problems needs to be based firmly on the developmental progressions of children, the interaction with the task to be completed and the context in which it is being performed ... activities with the movement skill domain ought to be organised into a framework so that a class of activities can be identified, with remediation aimed at that class ... any guidelines for remediation should follow modern theories of skill acquisition, and particularly how they relate to the developing child.
>
> (p. 332)

The framework which forms a teacher's checklist is organised into sections where movement assessments are conducted with: the child stationary and the environment stable; the child moving and the environment stable; the child stationary and the environment changing; the child moving and the environment changing. A fifth section comprising a list of associated behaviours which may be signals for movement difficulty is included also. The process would take longer than the screening procedures described previously, with 55 items to be considered and teachers would require training in administering the instrument. However, the duration of teacher training programs and time spent in screening all children using this procedure would be productive in the longer term. Teachers can identify, diagnose and plan remedial programs using this procedure.

### Tests of Motor Proficiency

Numerous tests of motor proficiency or motor dysfunction have been validated and documented (Henderson & Stott 1977; Henderson 1987; Lam & Henderson 1987;

Schoemaker & Kalverboer 1990). There may be some which may also be of practical value in judging motor skill but have not been assessed appropriately in an empirical sense. Different professions bring with them differences in philosophy and background which appear to influence task construction. For example, a comparison between the tests devised by: Gubbay (1975) - a paediatric neurologist; Calder (1979) and Arnheim and Sinclair (1979) - physical educators; Stott, Moyes and Henderson (1984) - working in the child development field, would reveal many differences between the required tasks (Larkin & Hoare 1991). As a result, many movement assessment batteries have been devised within different professional fields, often purporting to measure the same abilities but having an emphasis on different aspects.

Assessment can serve a number of purposes: screening for normality; as a profile of performance; and for judgement of movement breakdown (Hoare 1992). However, due to the heterogeneous nature of clumsiness, the most useful methods of evaluation are probably those which concentrate on the individual. Assessment procedures that assist individuals most are those which are dynamic and associated with teaching in a supportive environment (Larkin & Hoare 1991). Dynamic assessment methods are used as tools for change, as a guide to intervention and should not be used to label children. While norm-referenced tests are standardised and give valuable information regarding an individual's performance compared to the norm, the majority of these tests do not focus on movement problems.

Product-oriented tests, focusing on student outcomes, are satisfactory for identifying children's standing in relation to their peers (Larkin & Hoare 1991). However, tests that simply look at the final score and not the performance provide no information to deal with the movement problem. As a consequence, product-oriented tests do not achieve necessarily the aim of screening for co-ordination problems because some children have coordination problems that are subtle enough to allow them to achieve an acceptable result on a test in an awkward manner. The specific movement problem is, therefore, not identified. These tests only focus on the product and not the process and are of little diagnostic value (Hardin & Garcia 1985). In contrast, process-oriented tests have attempted to isolate dysfunctions in processes underlying the organisation of the movement. This is very difficult to do, because the motor system can be disrupted in so many ways. The process-oriented approach is hampered by the multiple strategies available to the subject to organise actions (Larkin & Hoare 1991). The McCarron Assessment of Neuromuscular Development (MAND), the Test of Motor Impairment (TOMI) and the Movement Assessment Battery for Children (Movement ABC) have attempted to overcome problems of product and process oriented tests, by including an observational check list, with a qualitative and quantitative score combined (McCarron 1982; Stott, Moyes & Henderson 1984; Sugden & Wann 1987; Hoare 1991; Wright, Sugden, Ng & Tan 1994).

What needs to be evaluated is the dynamic patterning or structure of the movement, in particular segmental interactions. Larkin and Hoare (1991) suggested the use of criterion - referenced tests to identify initially current levels of performance on selected tasks, combined with continual teaching to a desired performance level. These tests are useful particularly for goal setting and for deciding if a child is ready to move back into a regular physical education class. Criterion-referenced tests look at how a skill is performed, e.g., the quality of a jump as well as distance achieved. In addition, continual assessment by skilled observation (Mielke & Morrison 1985) or through cinematographic analysis (Marchiori, Wall & Bedingfield 1987), is advocated as a supplement to traditional forms of testing.

## ASSESSING THE PSYCHOSOCIAL DOMAIN

The psychosocial domain in its broadest sense, including all aspects of the child's environment and emotional well-being is much more difficult to assess, certainly in quantitative or comparative terms. As stated earlier, one of the possible outcomes of a lack of movement ability is that clumsy children have a lower global self-worth than their normal peers (Rose 1994). The evaluation of self-worth is based on four domains of the Harter (1978) revision of the White (1959) model. They are: athletic, academic, social and physical competence. Within each of these domains a self-esteem or evaluation of competence is produced. This is an important facet of the child's psyche, as a child may have high self-esteem in the academic domain and low self-esteem in the physical domain, which impacts on the social domain. Clumsy children have a lower athletic and physical self-esteem (Mittleman 1954; White 1971; Kielhofner 1985). Self-concept and self-esteem are frequently used interchangeably because evaluation and affect appear to be natural consequences of self-description (Shavelson, Hubner, & Stanton, 1976).

There have been a number of instruments developed for the assessment of self-esteem and self-concept. Harter (1978) has modified the White (1979) construct of self-esteem into a multi-dimensional model of competence which is influenced by: the notion of domain-specific mastery attempts; the consequences of both success and failure experiences; perceived competence and control; influence of significant others; affective outcomes of mastery attempts; success based on optimal challenges; and, intrinsic/extrinsic motivational orientation. Harter has developed the 'Self-Perception Profile for Children' (1985a) for children in grades three to six and the 'Social Support Scale' (1985b) for children from eight to fifteen years of age (Rose 1994).

In turn, other scales assessing the psychosocial domain have been developed specifically for a sport or physical activity orientation. The 'Motivational Orientation in Sport Scale' (Weiss, Bredemeier & Shewchuk 1985) was developed as a modification of Harter's work and consists of five sub-scales: challenge; curiosity/interest; mastery; judgement; and, criteria (Rose 1994). There are multi-dimensional physical self-concept instruments based at least in

part on the Marsh and Shavelson self-concept models (Marsh, Byrne & Shavelson). For example, the 'Physical Self Perception Profile' (Fox & Corbin, 1989) instrument measures five scales: physical condition; physical strength; body attractiveness; competence; and, physical self worth. Similarly, the 'Physical Self Concept' instrument has been used extensively in relation to outward bound programs and measures seven scales: activity; appearance; health; competence; strength; body build; and, general satisfaction (Marsh, Richards & Barnes 1986). Extending the scope of items Marsh (1993) has recently developed the 'Physical Self Description Questionnaire' which measures eleven scales: strength; body fat; activity; endurance; sports competence; coordination; health; appearance; flexibility; general physical self concept; and, self-esteem. The latter three instruments all consider the effect of the other attributes, both physical and in terms of skill level, on and with the psychosocial attributes.

## SUMMARY

In the main, extensive evaluation of physical capacities, through anthropometric measures, has been aimed at assisting the skilled performer. The methods of assessment used to evaluate these physical capacities have been well developed as a consequence and modified into valid and reliable field orientated procedures. However, there have been no substantial studies which have included the assessment of physical capacities in conjunction with other areas evaluating aspects of the clumsy child. In particular, there is little evidence reported which provides a simple biomechanical profile of the clumsy child in the same way as these profiles are emerging for particular groups of athletes.

The systematic screening and subsequent testing of motor proficiency has been questioned, pointing to a lack of expertise on the part of teachers and some inconsistent views about the purpose of the testing. Assessment batteries which focus on a very narrow or specific aspect of clumsiness cannot provide the holistic view required when evaluating this most heterogeneous of conditions. Tests of motor proficiency or dysfunction should provide both a qualitative and a quantitative component, accommodating the process as well as the product.

The assessment of psychosocial aspects of the clumsy child is perhaps even more difficult and has been attempted less often. The standardised tests of self-evaluation (self worth, concept or esteem) can be criticised from a number of viewpoints, not the least being the sample upon which the normative standards are derived. In addition, evaluation of the characteristics of the clumsy child's family environment and the like, is not necessarily generalisable to the population as a whole. However, this type of information is vital in gaining the holistic view of the child, as often apparent physiological difficulties have a psych-social dimension. Apart from the self-evaluation inventories, the data collection in this domain adopts inevitably a more phenomenological approach.

Ostensibly the assessment of the clumsy child at the various levels is inconsistent, often too narrow and not reflective of the characteristics of the condition. It is important to note that how the assessment is carried out can often determine the number and type of difficulties observed. Any assessment should include the broad categories of physical capacity, motor proficiency and psychosocial background and take the holistic view and include both qualitative and quantitative assessment. Evaluation of physical capacity consists of the mapping of the dimensions of the body and assessment of its various systems under the stress of exercise. Motor proficiency tests can be used at two stages: firstly, in a simple or modified form to provide initial screening for further scrutiny; secondly, to confirm or contradict that screening process and provide a diagnostic tool. The psychosocial domain can be evaluated for the child through tests of self-worth and more qualitative assessments of a variety of social dimensions, such as family environment, health history or school achievement.

## CONCLUSION

This review of literature has established that there is a small, but significant, number of children who have movement problems. Without help, clumsy children may suffer from a range of emotional, social and learning problems that they carry into adulthood. Although some clumsy children appear to outgrow their movement problems, once under stress these problems may re-appear (Knuckey and Gubbay 1983). Left untreated, the effects of the condition may restrict the individual to certain ranges of occupation and may influence attitudes to physical activity and positive health practices. In general, it has become the teacher's task to identify and rectify the situation as its effect can be wider than movement difficulties. Some instruments for identification are available and prognosis for clumsy children, although unclear, appears positive if appropriate assessment schedules and remedial programs are instituted. However, often there is a lack of importance assigned to movement skills by many teachers, coupled with an inability to recognise and plan a program for the clumsy child. In the main, this is attributed to inadequacies in teacher training. If useful descriptors of the characteristics of clumsiness can be developed for teacher identification purposes, early recognition may ensue.

Professions dealing with clumsy children recognise that treatment should take into account and reflect the causes of the clumsiness. The literature indicates that there are many causes which may result in a child being defined as clumsy. These causes cannot be reduced into a single entity used to remedy the particular problem, as the nature of clumsiness is multi-faceted, as indicated earlier in this chapter. However, it may be possible to reduce the myriad of causes, consequences and symptoms into more manageable and identifiable descriptors. In recommending that the cause should be identified prior to treatment, Cermak (1985) claimed that, even though therapists, educators and neurologists are trying still to determine which type of child responds to specific treatment regimes, a number of therapeutic approaches need

to be considered. The best type of approach required may well depend on sound knowledge of the characteristics of the particular child and the degree to which the underlying causes may contribute to movement difficulty.

Test batteries which have been designed to assess the extent of a child's clumsiness have some difficulties associated with their effectiveness. These difficulties are related to the limited knowledge of the nature of motor abilities and that the batteries often produce assessment only of the motor domain. Despite the fact that it is difficult to diagnose the exact cause of an individual's clumsiness, considering a broader range of assessment parameters and providing programs to assist them with the problem has obvious benefits. This is especially so if the help given is related, as closely as can be determined by appropriate testing, to the particular cause of the problem. It is important that as much as possible is done to identify these children and establish remedial programs, aimed at improving their movement skill.

Every child should be given the opportunity to reach his or her full potential both in and out of the classroom. If clumsy children are not given support and opportunity to participate in identification and remedial programs, then the system is not fulfilling its role of equality for all. The affect on the child with motor difficulties is more far reaching than just a lack of success in physical activity. The self-esteem of the child is affected negatively by lack of physical prowess and children who have participated in remedial programs have shown considerable improvement in measures of global self-worth. The carry over from this into socialisation and emotional well-being is obvious, in that it has a positive affect on these parameters of development. The affect that improvement in motor ability has on academic performance is less clear, as the variables are much more complex. Therefore, no definitive statement can be made, although some writers have postulated a link (Sorochan & Bender 1979).

The approach to the difficulties encountered by the clumsy child should embrace both the theoretical base in Cermak's explanations for dyspraxia and the view provided by Hoare and Larkin (1991b) in their definition, both of which were cited earlier in this review. The amalgamation these two views of motor clumsiness is taken as a working definition for this particular study. This is an approach which acknowledges motor planning deficit as a major underlying difficulty for most clumsy children, coupled with a myriad of exacerbating multi-dimensional causes and consequences of the condition. From the literature in general, the heterogeneity of the nature of clumsiness was reported consistently as a major characteristic. Where the literature was shown to be deficient, was in findings and theories which related the multi-dimensional nature of the condition to research and practice in identifying and dealing with clumsy children. In order to better understand clumsy child, it would seem appropriate to investigate many more parameters of the condition than has been attempted previously in

one study. This was taken as the general theme of the research, upon which the following research questions are based.

**RESEARCH QUESTIONS**

Given the issues arising, and conclusions reached, from the literature, a series of questions arose which seemed worthy of empirical investigation within the scope of this study. They are as follows :

**(A) Is there a set of identifiable features which are common to clumsy children?**

It is expected that the answer to this research question will reveal a wide range of characteristics, confirming the notion of heterogeneity in the condition. Although useful in understanding the problem, the resultant information may be of little value diagnostically.

Therefore, in anticipation of these findings, subsequent research questions were set which are of a more specific nature:

**(B) How do the identified features group together in terms of the capacities and competencies of clumsy children?**

**(C) Do clumsy children group together in more discrete sub-types based upon these identifiable features?**
**- If so, what are the characteristics of these groupings and/or which features show prominence in formulating the groups?**

**(D) How do these features manifest themselves and affect the individual child with motor difficulties?**

**AND**

as a corresponding and complementary theme resulting from questions (A) to (D) and the anticipated conduct of the research, the model presented as Figure 1.1, which summarises the coverage of causes and consequences of clumsiness in the literature, will be verified against the findings of this research. As an outcome of this process the model may be modified to more accurately reflect the conclusions in tandem with previous research findings. This will be used as a collective aim of the research which synthesises the general and specific findings of this study and tests the model's legitimacy.

A study which focuses on an holistic view of clumsiness and attempts to document as many parameters of clumsy children as possible, would seem the most appropriate given the review of literature and postulated model. In addition, it is hoped that the information gathered, through addressing these research questions, will provide useful information for teachers and others who are dealing with these children. Consequently, it is important the research design approximates conditions and uses testing procedures which are as close to the normal educational environment of the children as possible. Therefore, the use of replicable field tests rather than laboratory tests, in appropriate circumstances, would seem appropriate. Moreover, both qualitative and quantitative data is needed to address issues raised in the literature review. The following chapter considers the design aspects in detail.

## Chapter 2

# EXPERIMENTAL DESIGN

*Random selection and assignment of large homogeneous groups for research purposes are rarely feasible in natural settings. In addition, predicting generalisability of findings from group studies also assumes that the particular client or clients to whom findings are to be generalised will respond in the same manner.*

(Berryman & Cooper 1982, p. 207)

### Introduction to Chapter

In the previous chapter, important research issues were identified in the review of literature. In particular, three questions were developed that would provide information relevant to the general theme, namely, features which identify clumsy children and the categorisation of these features. Using principles of investigation consistent with the spirit of Berryman and Cooper, above, the study is to be carried out in as natural a setting as possible within certain constraints. This chapter outlines how the research was conducted by describing the following: the context of the investigation; factors considered in the planning of the study; the research design; major participants and instrumentation ; and, the data analysis plan.

### CONTEXT

This section provides an overview of the contextual setting for the research. Its purpose is to describe the university, the course and units of study which were linked closely to the investigation and the school catchment area for children who might be suitable for the special program, set up to accommodate the research.

The city of Armidale is set in the New England region of north-western New South Wales (NSW) and has a population of approximately 20,000. The population comprises mainly of rural and academic elements, with infrastructure support for these endeavours. Armidale is considered to be a provincial education centre with the location of University of New England (UNE) and a concentration of both state and private schools within its boundaries. UNE has a student population of around 10,000, with a large proportion of these undertaking study in the external mode. One of the avenues for the training of primary school teachers at UNE is through its Diploma of Teaching (Dip.Teach) award.

Students in the Dip.Teach are required to complete three years of on-campus study to complete the award. The Dip.Teach is recognised by the NSW Department of School Education as appropriate training for Infants/Primary school teachers. In addition to compulsory study of all curriculum areas and education foundation subjects, Dip.Teach students may select a major elective study option from : Mathematics, Science, Music, Art, Media Studies, Environmental Science, Religion, Multi-Cultural Studies and Movement Studies. The major elective sequence entails four units of study across the final four semesters of their course. Movement Studies attracts a high enrolment rate and provides students with a greater insight into the study of human performance than that provided in the compulsory core units in health and physical education curriculum. The Movement Studies sequence is a pre-requisite for entry to a fourth year of study specialising in physical education and leading to the Bachelor of Education (Physical Education) award.

The Movement Studies elective sequence is offered by the Department of Science, Technology and Mathematics Education, which has responsibility for the teaching of Physical Education and associated subject areas within the Faculty of Education, Nursing and Professional Studies. The indoor facilities for physical education teaching are a small gymnasium at the UNE Newling Campus with limited large equipment and adequate small equipment. The outdoor facilities are extensive but not located centrally in terms of easy access to the gymnasium.

The first three units of the Movement Studies elective sequence provide a traditional approach to the study of human movement with topics covering: functional anatomy, biomechanics, exercise physiology, skill acquisition, psychosocial aspects of sport and a variety of practical or laboratory experiences. The fourth unit aims to bring those studies together in an integrated approach to understanding children who experience movement difficulties. The main focus in the theoretical component of the fourth unit is on principles and planning for adapted/special physical education. The practical or applied experience in the unit takes the form of instruction in the UNE Gymstart program (explained below). Students are monitored and assessed on their planning and demonstrated teaching skills within the Gymstart program.

A remedial physical education program for clumsy children (Gymstart) was set up at the University of New England, in the Armidale area, to provide assistance to children experiencing movement difficulties. There are nine primary schools within reach of UNE, only one within safe walking distance for young children. Gymstart was conducted on a twice weekly basis in second semester. Children attended the UNE Newling Gymnasium for an eleven-week program. The program commenced in 1993.

## PLANNING FOR RESEARCH

The purpose of this section is to provide an explanation of the initial considerations required to establish an overall plan for the research project. It covers in detail the major limitations and constraints that the plan of action needed to consider, as well as the outline of the profile, necessary to evaluate the children involved in the project and the reasons for selecting the items to be measured.

### LIMITATIONS AND CONSTRAINTS

The limitations and constraints fell into four major categories, namely: those imposed as a consequence of the instructors' university requirements and current expertise; those imposed by the schools in the screening process; the ethical consideration of the children involved in the remedial program; and the decision to focus on a more ecological view of the child.

#### University Requirements and Instructor Expertise

It was felt that only students in their final semester of teacher training and with the necessary background in Physical Education/Movement Studies were capable of undertaking the duties of an instructor in the program. Individual instruction on a one-to-one basis was required to conduct this type of program and this meant that the number of students enrolled in Movement Studies 4 (n=40) determined the number of children taken into the remedial program. Therefore, on this basis the number of children in the study was decided.

Timetabling requirements of the university determined the availability of students to instruct in the program. In the context of their studies, it was considered reasonable to allocate only one of their two hours of class time to this part of the unit requirements, as other content needed to be covered in addition to this applied task. In order to accommodate two hours per week for the children, it was necessary to allocate pairs of instructors, one from each pair attending on different days. Although it would seem advantageous to have the same instructor throughout the program for each child to provide consistency and cement a relationship, there were advantages with this split. Firstly, given the child had two different instructors, in the event of friction between the instructor and the child, the situation was alleviated for at least half the time. Secondly, the instructors were able to cooperate and support each other in the planning undertaken outside the program sessions. Regardless of the timetable constraints, the physical environment of the gymnasium (in terms of size) and availability of equipment would not have allowed 40 instructors and 40 children to operate at the same time. Therefore, the number of children was fixed at an optimum of twenty. The duration of the program was set at eleven weeks which accommodated both the university semester dates, allowing for one week's preparation for the program, and the school holidays.

**Schools' Requirements and Teacher Cooperation**

In implementing stage one of the screening process, teachers in the selected schools were relied upon to apply the criteria outlined in a checklist developed for the purpose (see Appendix 1). The teachers were supplied with the checklist in week one of the second school term. Explanations were given to the teachers as to how the criteria would be applied and they were left to carry out observations in the normal course of conducting their classes. Some teachers were more expedient than others but all had a list of children they wanted to refer by the middle of that school term.

Access to the children, for screening in stage two, was limited by the availability of classes to be observed by the research and program directors. Schools asked for as little disruption as possible to the normal program and generally teachers were reluctant to be observed too often whilst teaching in an area in which they may have felt less than confident. This meant that schools could make only one timeslot available for all children to be seen during normal physical education lessons. The two observers were able to see each of the six classes for thirty to forty minutes, where both carried out observations as a team, systematically working through the children in each class. Each observer made independent decisions about the children, then comparisons and consultation took place during and after the lesson. Teachers were consulted, in order to clarify various points about the children after the lesson.

Stage three involved withdrawal of the children from normal class to test them individually on the more objective screening mechanism developed for the purpose (see Appendix 2 for details). Again the research and program directors administered the test items with minimal disruption to the school routine by complying with each school's request in its organisation. Some schools required this stage to be administered following the lesson observed for stage two. They felt a second visit would be more intrusive and parental permission would have to be sought only on the one occasion if the same morning was used for both. This determined the step between stage two and three of the screening process. In some cases it was instantaneous, in others it occurred within two weeks. Consequently, the observers erred on the side of caution, carrying forward to the third stage of screening some children who, under normal circumstances, may not have continued.

**Consideration of the Children**

The decision to have the children attend only twice weekly was based on past experience of similar programs where parents had indicated this as the maximum commitment they could guarantee. Parental cooperation is required in transport and collection of their children, due to the ages of the children. Other activities in the children's lives and those of their families have restrictions on time available out of school hours. The wisdom of this decision was confirmed at the initial parent meeting upon discussion of these issues. The advantage for the children,

in not having too much commitment of time and/or visits to the program, was to maintain as much of a normal pattern of life as possible.

Once children had accepted the invitation to join the program it was felt that the testing required for research purposes should be as unintrusive on their program as possible. In the introductory briefing for parents, this undertaking was made to allay any fears that the children were being used as 'guinea pigs'. The research and its purpose was outlined to the parent gathering, with assurances about the commitment to the instructional aspects of the program having greater priority than the testing given. This dictated that an absolute maximum of two whole sessions, to be given over to testing was set, being the pre and post test sessions. In addition, a principle of planning very short periods of withdrawal from individual instruction time, for the purpose of testing, was adopted. This meant that the tests and measurements would be carried out as unobtrusively as possible, to maximise the children's cooperation and enjoyment during the program. Consequently, the children would be tested rarely during group work, which occurred at the beginning and end of each session. Only the self-concept inventory contravened this principle, as it required a more extensive single timeslot. This self imposed constraint would be instrumental in creating a fun-like atmosphere, which motivated the children to work at the set tasks more readily and to maintain regular attendance patterns.

**Comprehensive Approach to the Research**

A decision was made to reverse the trend of the more traditional approach to research, where a smaller number of measures, within discrete areas of interest, are taken over a larger population. In this study, a relatively small sample of children was to be measured over as large a range of parameters as possible within the limitations of the study, giving a comprehensive profile of characteristics which may lead to a better understanding of difficulties encountered by clumsy children. This established by necessity and design, an approach to analysis which was exploratory and mixed both qualitative and quantitative methods of research. This dictated that the qualitative approach would have a greater significance for the study, owing to both the small number of children in the program and to the philosophical standpoint of the researcher. However, the final number of children was determined also by reasons already outlined.

The extent of the tests and measurements taken on the children would be constrained by the time available and the availability of appropriate instruments and equipment. The great advantage of having a smaller group of children was that the group became much more manageable, both in terms of instruction and research, allowing the larger number of measures to be blended into the program in a less obvious fashion. These measures fell into the broad categories of physical capacity, motor proficiency and psychosocial background which emerged from the review of literature. These broad categories provided a basis upon

which more specific parameters could be selected for assessment of the children, within the stated limitations and constraints under which the research was conducted. The diversity of the three broad categories ensured also that the assessment was multi-dimensional and in conjunction with the blend of qualitative and quantitative analyses provided the desired holistic view. The items for assessment are described in the following section and the methodological considerations subsequent to those.

## ITEMS FOR THE CHILDREN'S PROFILES

The items for the profiles of all the children could be categorised under three headings, namely: physical capacities; motor proficiency; and, psychosocial indicators. This sub-section discusses the selection of those items under those category headings.

### Physical Capacities Profile

The physical capacities profile was made up of two sub-categories, these are: body dimensions and proportions; and, fitness indicators. There is initial evidence to support the notion that some clumsy children may have a biomechanical disadvantage for performing normal movement patterns (Larkin, Hoare & Kerr 1989). Physical capacity measures can point to body proportionality indicators which may be disadvantageous. Numerous authors (cited in the literature review) in the Human Movement field of study have recommended a physical capacities profile as a useful tool in understanding the requirements of human physical performance. Furthermore, items in such a test battery are linked closely with health-related fitness tests, giving an additional window through which to view the child.

It was felt that a physical capacities profile was essential if a comprehensive approach to the assessment of the children was to be maintained. Leaving the parameters of analysis to just the motor control and the socio-psychological aspects would not seem to cover the desired all-round approach. The items in this category were selected with consideration given to two broad categories which guided selection. Firstly, the items were selected for their usefulness in indicating the following areas: growth and development status; indicators to performance; mechanical efficiency of various body segments; and, health-related levels of fitness. Secondly, the items were selected in terms of: their practicality of administration; the availability of equipment; and, the suitability of the normative tables to the characteristics of the children, e.g., relevant age group.

### Motor Proficiency

Motor proficiency was assessed also in two ways: through pre and post test procedures which were regarded as indicators of performance in the program; and, a standardised test - the McCarron Assessment of Neuromuscular Dysfunction (MAND).

The children's performance in the program was considered important to the overall evaluation and not just to gauge the effectiveness of the program itself. In addition and perhaps more importantly for this study, monitoring the individual's response to the program, particularly in terms of any sub-types which may be identified during the study, was seen as valuable to the overall assessment. The evaluation of performance in the program in motor proficiency was conducted using a battery of items for a pre and post test.

- The battery of items, considered to be reasonable diagnostic indicators for design of the remedial program, provided the instructors with a skill profile. The selection of the items in the test battery gave a good overview of the children's skills base, in that they covered aspects of balance, hand-eye coordination (fine and gross), speed and agility. The test items were selected with three criteria in mind:
  1) those which appeared consistently in standardised tests of motor proficiency, e.g., standing broad jump (which appears in: Bruininks-Oseretsky Test of Motor Proficiency - Bruininks 1978; McCarron Assessment of Neuromuscular Dysfunction - McCarron 1982; Stott-Moyes-Henderson Test of Motor Impairment - Stott, Moyes & Henderson 1984).
  2) those items recommended as having considerable single predictive power, e.g., hopping in a limited square (Hoare 1992) were included.
  3) that the tests were relatively simple and a reasonable number of items able to be administered for the children in a single session.

These two tests served not only as evaluation tools but provided also the opportunity for the instructors to observe various characteristics of individual children and their responses to tasks and/or different approaches to instructions.

The MAND test is a standardised test of motor proficiency with separate items in the battery. The test is recommended by Rose (1994) and it has superior power than other standardised tests of motor deficit. The literature review included a discussion of the efficiency of tests of this kind. The MAND test battery is able to be adapted to allow administration of single test items on separate occasions. The treatment of the items on the MAND test, as a separate entity, enabled the principle of minimal disruption of the program to be preserved. The test was conducted only once as a tool for profiling the children rather than evaluating the program which was facilitated by the procedures described immediately above.

**Psychosocial Indicators**

In order to ascertain some indications of the children's psychological and social characteristics, three areas were evaluated: the children's self-worth; aspects of performance in the program other than motor proficiency indicators; and, a family and personal history. Owing to the established link between movement deficit and a lack of self worth, the inclusion of the evaluation of children's perceptions of themselves was considered mandatory

in a holistic approach to assessment. An instrument was selected which met the following criteria: was accessible within the resources of the project, i.e, available on the campus; normed for Austrlaian children; and had sections on the characteristics important to the study.

An examination of whether regular attendance and/or completion of homework tasks makes a difference to overall performance in the program would be a useful indicator of some success or otherwise in the psychosocial domain. Observations by supervisors, instructors and parents during the program were considered to be pertinent sources of information contributing to the psychosocial profile. Previous and current health status was seen as an important factor in determining reasons for a lack of movement proficiency. Also important was the family structure, status of the child within the family and possible hereditary factors. A structured interview with parents was planned to establish a personal and family background for each child.

**Overview**

An overview of the items for assessing and profiling the children involved in the study is represented diagrammatically in Figure 2.1 below.

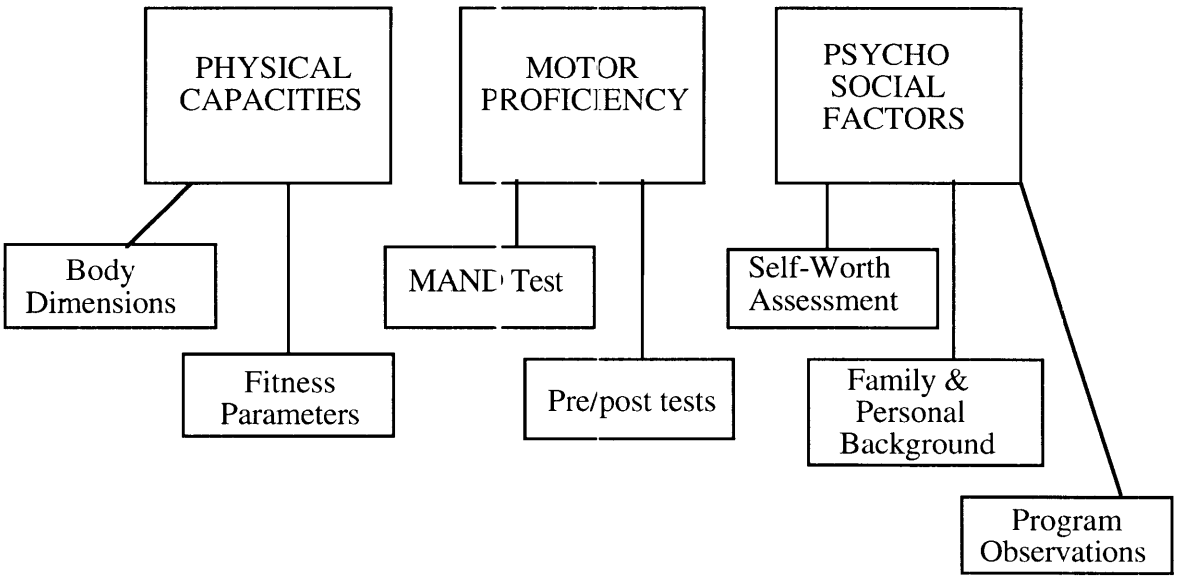


**Figure 2.1 : Overview of the Categories for Assessment**

## DESIGN OF STUDY

This section outlines the research design developed to investigate the questions identified in Chapter 1. The design took into account the limitations and constraints described previously, as well as issues which emerged from the literature. Essentially, a case study approach was adopted, with a plan to report some issues based on group trends and some in a single case format. Although there are many interpretations and definitions for case study (Kenny and

Grotelueschen 1984), the interpretation used for reporting here adopts as broad and flexible a definition as possible, with this study utilising such research designs as ethnographic studies, field studies or multiple case studies.

These single and multiple case analyses were to be supported by some exploratory statistical analysis where the nature of the data indicated it was appropriate. This provided a triangulation of the data, comprising: descriptive group analysis; statistical analysis; and in-depth single case analysis, which further contributed to the holistic approach in that the analysis was also multi-dimensional. The aim was to document as much information on the nature of the clumsy child as possible. Specifically the analysis was undertaken for three purposes. Firstly, to describe and compare children for the identification of features common to the clumsy child. Secondly, to extract and portray those elements which underpin clusters in this diverse category of children. Thirdly, to identify individuals who typify these clusters of children, in order to further detail their characteristics and responses to various situations.

## OVERVIEW

In essence the investigation comprised of a main study of children who were identified as being clumsy. This study generated a number of smaller or subsidiary studies. These subsidiary studies were in the form of more selective studies or case studies, used to identify specific aspects relevant to the research. Figure 2.2 shows the organisation and relationship of the main study with the subsidiary studies.

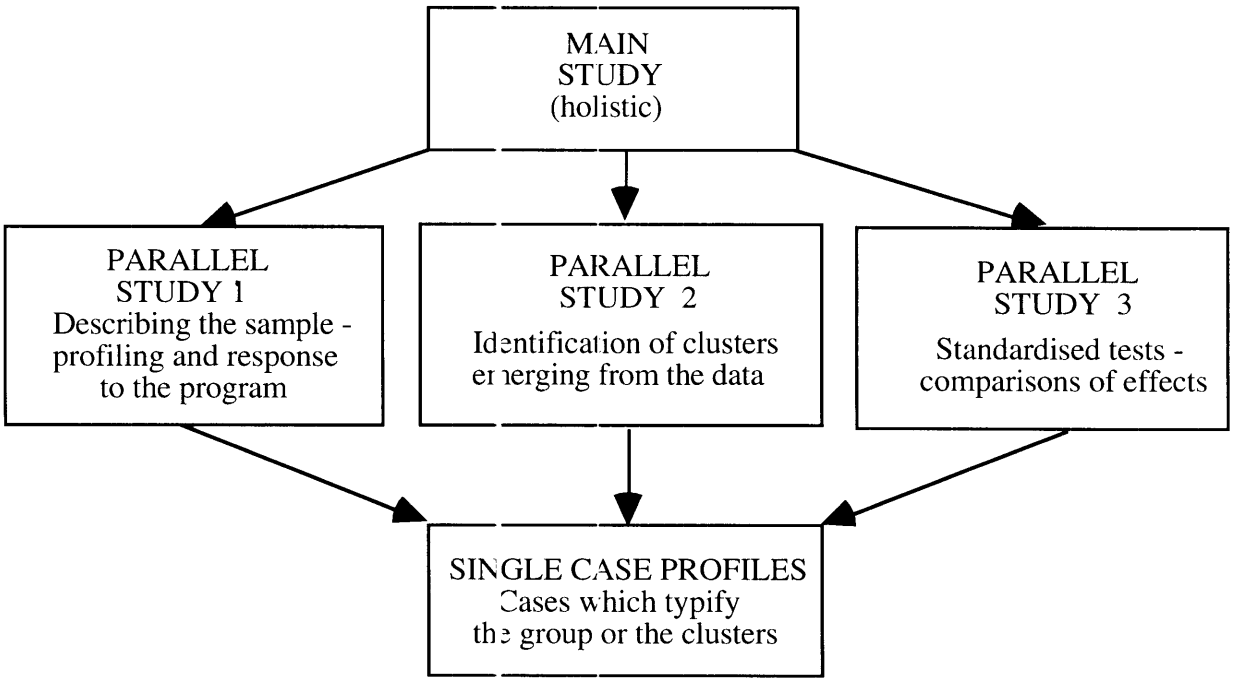


**Figure 2.2 : Relationship of Primary Study to Subsidiary Studies**

Each of the subsidiary studies were intended to draw information which would attempt to answer the research questions. The study was conducted over three main phases during a period of 12 months. Table 2.1 outlines these phases chronologically and divisions within each phase.

**Table 2.1 : Chronological Phases of the Study**

| Week | Phase | Action | Comment |
|---|---|---|---|
| 1-8 | (1) Preparatory Phase | ◦ Initial letters to schools<br>◦ Follow up telephone calls<br>◦ Request to teachers for referrals from screening stage one<br>◦ Submission of referrals from teachers - screening stage one<br>◦ Organisation of observation and testing days at the selected schools<br>◦ Observation of children during PE lesson by program and research directors - screening stage two<br>◦ Testing the observed children on motor proficiency - screening stage three | • Appendix 3<br>• see below under section headed '**The Children**'<br>• As above<br>• see letter to parents - Appendix 4<br>• see below under section headed '**The Children**'<br>• As above |
| 9-13 | (2) Selection Phase | ◦ Resources to undertake the remedial program assessed<br>◦ Children tested were ranked in order of need for a remedial program<br>◦ Parents contacted and 26 children invited to participate<br>◦ 19 acceptances | • e.g., personnel, time, equipment, space<br>• see below under section headed '**The Children**' |
| 14-26 | (3) Implementation Phase | ◦ 11 week remedial PE program<br>◦ Week 1 Diagnostic Screening & Parent information session<br>◦ Weeks 2-10 Individual and Group Instruction<br>◦ Week 11 Post Testing | |
| 27-45 | (4 ) Follow up and Evaluation | ◦ Instructor's Reports<br>◦ Parent Interviews<br>◦ Comprehensive reports to parents and schools | |

**PHASE 1**

After the participating schools were selected, an initial letter was sent to each principal, to request permission to screen children for the program in their school (see Appendix 3). Once permission was granted, guidelines for teachers on selecting children for referral was provided (see Appendix 1). Teachers then submitted the names of children they thought may fit the criteria. This was regarded as stage one of the screening process.

Many teachers, across all three schools, expressed concern that their ability to recognise clumsy children may have been flawed. In addition, the guidelines provided, by way of the simple checklist, had not been validated. Therefore, it was decided that the program director and the research director (described later) would observe all target-age children during a physical education lesson. In consultation with each school, this was arranged to coincide with the administration of the more objective field screening test for referred children (see Appendix 2). Letters informing parents of these procedures and seeking their permission to test children, were distributed through each school principal (see Appendix 4). This was regarded as stage two of the screening process.

After observation of children during a physical education lesson, a list of those thought to need further screening was compiled. These children were tested shortly after the observed lesson. The field screening test, previously mentioned, was used to establish a ready approximation of each child's motor proficiency. This was regarded as stage three of the screening process. Hence, the screening of the children considered three forms of input, these are: that of the classroom teacher; that of the UNE staff; and, subsequent to the first two inputs, the field screening procedures.

**PHASE 2**

The resources, facilities and personnel were assessed, to determine the number of children to be offered a place in the program. On the basis of this assessment the number of children was established. The children who participated in stage three of the screening process were ranked in order of need, based on either a low overall score on the field test and/or a skill profile which indicated major difficulties with isolated aspects of motor skill. The parents of the selected children were contacted directly and the children were invited into the remedial program (see Appendix 5).

**PHASE 3**

This phase consisted of an eleven week, twice weekly remedial physical education program. The program was interrupted with a break for two weeks, because of school holidays. There were 21 sessions in all, as one session was cancelled due to a public holiday. The organisation of the overall program could be described under three headings: aspects

concerning the parents; organisation of the assessment procedures; and, the instructional program itself.

**Parent Liaison**

Parents were invited to an information meeting during the first session of week one. This well-attended meeting provided the research director with an opportunity to outline the intentions of the program. Each aspect of the program was explained and parents took the opportunity to ask many questions. Parents were invited to stay and observe any of the sessions they wished and to view their children from a comparatively concealed vantage point. This provided a more informal opportunity for the program and/or research director to discuss with parents their child's progress.

**Assessment Procedures**

The assessment procedures (measures on the children) were conducted using two forms of organisation. Firstly, the diagnostic or pre/post testing was conducted as a whole test battery during session two of week one and session two of week eleven. The pre-test provided information to the instructors for planning their programs. Secondly, the extensive profiling carried out on the children was administered continuously throughout weeks two to ten.

A briefing took place immediately prior to week one, to train the movement studies students in administering test items and assisting the children to the correct station at the test venue. After explanation of the various tasks, the students were given the opportunity to practice their tasks on each other in a mock set-up of the testing session. A copy of the protocol for individual test items was given to those administering that item (Appendix 7 contains each protocol). The children were divided into two groups, designated blue or red, for the pre and post tests, to facilitate movement around the test sites. All instructors were required to attend the testing sessions and were assigned either as a tester or as a helper to one child. Helpers were assigned to the child for which they were to be the instructor. The tests were organised in circuit fashion, a plan of the gymnasium and surrounding areas was drawn up to facilitate movement around the circuit (see Appendix 8).

**The Instructional Program**

The instructional program was modified from the UNIGYM program at the University of Western Australia (Smith & Larkin 1988). Modifications were made to suit the different environment and circumstances at UNE. A pair of instructors was assigned to a child in the program. It was their task to develop the overall program as a team, giving instruction at their allotted session each week. Individual lesson planning was the responsibility of the individual instructor within an overall framework established by the team. Background information and skills which assisted planning of instruction was facilitated through: a skill profile drawn

from the pre-test (an example can be seen as Appendix 10); a briefing on planning as part of Movement Studies 4 classes; previously described background in teacher training of the instructors; and a lesson pro forma (see Appendix 11). In addition to the two weekly sessions, instructors set homework tasks (Bishop & Horvat 1984) which supported the Gymstart program, which were to be completed over the weekends.

Monitoring of both the written planning and the teaching performance took place under the auspices of the program director. Overall plans were submitted by week 3 and lesson plans were submitted at the time of the lesson. The program director conducted a systematic observation of teaching technique during sessions and across the whole program. Continuous assessment and feedback on these processes were provided on a regular basis. A post session debriefing occurred on each day of the program.

**PHASE 4**

Instructors were to submit a joint evaluation report on the child, which would be suitable to send to parents and, with parental permission, to schools. A guide to the type of observations required by the instructors and writing of the report was distributed and explained during tutorial classes. The report was an assessment item for Movement studies 4. These reports, after review and amendment for style and format, were included in a larger report showing the performance and movement status of the child overall. The larger report was to be available for parents.

A follow up interview, conducted with parents approximately three months after the conclusion of the program, was to ascertain background on the child not otherwise gathered in the previous assessment procedures. The time gap between the program's end and the interview was placed deliberately with the intention of determining any longer term effect of the program on the child's motor development, i.e., from the parents' point of view.

Evaluation of the program took place through the analysis of all of the information gathered during the program. This analysis is detailed in subsequent chapters of this thesis.

## PARTICIPANTS AND INSTRUMENTATION

The purpose of this section is to examine in some detail the people involved in the program and the instruments of measurement which were employed to evaluate the program or assess the children. The three major groups of participants are described in the first sub-section and the various methods for measuring and selecting the items for profiling of the children, are described in the second sub-section.

## PARTICIPANTS

There were three major groups participating in the program: the children; the instructors (student teachers); and those directing and organising the program. Although there are other groups who had some influence on the success of the program, e.g., the parents, the three groups described below are those who were involved most directly.

### The Children

Dictated by the number of instructors that were available, an optimum number of children to be catered for in the program was set at twenty. Twenty-six Year One and Year Two children were identified and ranked as being most in need of a remedial physical education program, as a consequence of the three-step screening process. Allowance was made for some parents declining our offer of a place, as some did, and nineteen children accepted the offer to participate in the program. Two of the nineteen children dropped out during the first half of the program, leaving seventeen children who attended regularly.

Three schools cooperated in the screening process. Two of the schools already had a link with UNE, as participants in the 'Aussie Sport Teaching Program'. These two were State government administered schools. The third was selected as the only independent school (Catholic primary) to show a keen interest in the program. The school years (or grades) chosen were on the basis of early intervention being the most effective and that the age range selected was regarded as the most receptive to a remedial program. This meant that the age of most children when they entered the program was between six and seven years. Kindergarten children were not screened as they were thought to be too young to show essential differences between a lack of skill and a lack of maturation in the stage of screening by teachers. This notion was confirmed when kindergarten children were referred inadvertently by one school and the trained observers noted a distinct difference between identifying them and identifying children in the target-age groups.

Screening took place in three stages:

- **stage one** involved classroom teachers checking their classes using subjective observational criteria and nominating children suspected of being in need. A criteria checklist was supplied to the teachers, explaining some simple observations which can be made in the normal course of teaching duties. A copy of the criteria can be seen in Appendix 1. This stage involved seven teachers and approximately one-hundred-and-eighty children, the teachers identified twenty-seven children they thought were suitable for referral. As the checklists and the teachers' judgements could be seen as somewhat arbitary in nature, stage two provided a double-check of the children to increase the reliability of the process.

- **stage two** involved the Gymstart research director and program director (trained observers) observing all of the children during a physical education lesson. This acted as a check on the teachers' opinions and added any children missed by the untrained eye. The lessons were structured to emphasise the skills which would more easily indicate motor difficulty, e.g., hopping was included as an activity. This stage involved the same number of children as stage one, with particular focus on the twenty-seven children referred in the initial part of the lesson. Stage two expanded the number of children who may have some motor difficulties to fifty-three, which were added by the trained observers.
- **stage three** consisted of a more structured screening procedure, designed specifically for the purpose of ranking the children on motor proficiency and providing a further check on the reliability and validity of the previous two stages. Thereby, providing identification of those most in need of help for invitation to participate in the Gymstart program. This stage involved only the fifty-three children identified from stage two. These children were ranked on need using a composite score from the test battery which reduced the number eligible for the program to twenty-six (this produced a prevalence rate of 14% from the original 180 children, which is consistent with reported rates in the literature - see Chapter 1). A description of the test battery can be seen in Appendix 2.

**The Instructors**

The instructors were third-year Diploma of Teaching (Primary) students in their final semester. They were completing a major elective study sequence in movement studies. Relevant previous studies in their teaching course included: school experience; general teaching methodology and planning; specific physical education teaching methodology; three units of movement studies (which included motor learning); and special education. Instructing in the Gymstart program was a requirement of their fourth unit of movement studies (Movement Studies 4), which has special or adapted physical education as its major focus. There were forty students enrolled in Movement Studies 4.

The instructors were prepared in a theoretical and practical sense by their previous studies, mentioned above. In the first week of the semester, prior to the Gymstart program, they were briefed specifically about the teaching task and trained for relevant testing procedures. Much of the preparation at this stage consisted of revision and/or application of previously learned skills and knowledge. Fresh materials or new skills were not required and, therefore, only logistical considerations needed emphasis in order for the program to run effectively. Concurrent tutorial classes were run as part of the movement studies unit, hence any matters of concern within the program were addressed there and at the regular debriefings which followed each Gymstart session.

The instructors worked in collaborative pairs, one allocated to session one in the week and the other to session two. Therefore, each child was allocated two instructors who were responsible for instruction on a different day of the week. Each pair of instructors met on a regular basis, with planning taking place in the short term across the two weekly sessions, rather than planned as two discrete sessions. Planning for the long-term was based upon the diagnostic testing which occurred in the first week of the program. The instructors were monitored and assessed as a part of their studies. This had two main advantages. Firstly, motivation for quality in their written planning and practical teaching was maintained. Secondly, regular attendance occurred as the program was designated as part of their university schedule. Twenty places were originally available for children and nineteen took up the offer of a place. This left two spare instructors (one on each day) and they were assigned tasks as standby instructors, in case of emergency, or as assistants in the testing procedures. As a consequence of the two children dropping out of the program, a further four instructors were left spare, providing more 'cover' personnel at each session. However, the busy testing schedule and occasional absent instructors provided appropriate responsibilities for these students.

**Program and Research Directors**

The program director was a qualified physical education teacher, with both primary and secondary school teaching experience. Her current position was as lecturer in Health and Physical Education at UNE and in this role she coordinated the unit of movement studies in which the program was contained. Within the Gymstart program, this director monitored the quality of instruction on site and checked written planning with systematic weekly feedback. The program director recorded children's attendance and provided one of two liaison points for parents.

The research director was a qualified physical education teacher, with secondary teaching experience and previous involvement in similar programs. His current position was as lecturer in Health and Physical Education at UNE and in this role was responsible for the coordination of the whole movement studies sequence within the Diploma of Teaching. The research director coordinated all testing, evaluation and screening procedures which are detailed in subsequent chapters. Assisting the research director in some of the testing were two female graduate physical education students, required to be present for 'hands-on' measures (e.g., skinfold measurements were taken by a male assessor) with female children and/or testing which needed an isolated room (e.g., self-esteem inventory). The research director provided a second liaison point for parents.

**INSTRUMENTATION**

There was a number of instruments used to provide data for the study. They fell into four broad categories:

**Fitness/Physical Capacities Measures**

The physical capacities and fitness parameters which were measured/calculated for the children are summarised in Table 2.2. The procedures followed in administering all items except one, were straightforward and require no further elaboration.

**Table 2.2 : Measures Taken to Establish Children's Physical Capacities**

| **Dimension** | **Procedure** | **Instrument** | **Reference** (Protocol & Norm Table) |
|---|---|---|---|
| Height | Bare Feet, Post-Vertebral Stretch | • Wall Mounted Height Gauge | • Procedure - Bloomfield et al. (1986)<br>• Normative Table - CAHPER (1980) |
| Body Weight | Swim wear only | • Hospital Scales | • Procedure - Bloomfield et al. (1986)<br>• Normative Table - CAHPER (1980) |
| Percent Body Fat | By: Subscapular Bicep, Suprailiac & Tricep Skinfolds | • Skinfold Callipers (skilled & experienced assessor used) | • Procedure/Interpretation % Body fat - Hills (1991b)<br>• Normative Table - AAHPERD (1980) |
| Aerobic Capacity | 800 metre run | • 400 metre track<br>• Stopwatch | Procedure & Normative Table - CAPHER (1980) |
| Flexibility | Capacity to reach toes with finger tips - straight knee | • Sit & Reach Apparatus | Procedure & Normative Table - CAPHER (1980) |
| Leg Strength /Power | Vertical Jump | • Blackboard<br>• Chalk<br>• Metre Rule | • Procedure - Bloomfield et al. (1986)<br>• Normative Table - Blanksby et al. (1994) |
| Upper Body Strength | Flexed Arm Hang | • Horizontal Bar<br>• Stopwatch | Procedure & Normative Table - CAPHER (1980) |
| Abdominal Strength/ Local Endurance | Number of sit-ups in 60 seconds | • Stopwatch | Procedure & Normative Table - CAPHER (1980) |
| Running Speed | 50 metre sprint | • Grassed Track<br>• Stopwatch | Procedure & Normative Table - CAPHER (1980) |
| Proportionality | Length of upper & lower limb segments, sitting & standing heights. Calculation of Crural, Brachial Indices & Relative Sitting Height | • Anthropometer<br>• Height Gauge | • Procedure - Bloomfield et al. (1986)<br>• Normative Table - Blanksby et al. (1994) |

In conducting the 800 metre run, the test of aerobic capacity, the instructors ran alongside the children who seemed not to understand the purpose or strategy required due to their age, to assist with uniformity of pacing and motivation. This was the only test item which adopted a variation in the protocols described in the various test manuals.

With regard to selection of the test items and/or the methods of interpreting data, some explanatory comment is required. The adoption of the CAPHER (based on a Canadian population) procedures and normative tables rather than the ACHPER (1992) fitness test battery (based on an Australian population) was due to the Canadian normative tables showing standards for the ages of the children in this study. In addition, one item on the ACHPER battery was considered unsuitable for younger children due to its reliance on higher perceptual-motor processes to complete the task, i.e., the sit up test requires fairly skilled judgement to keep pace with a cadence sound. In any event, the Canadian population and its ethnic derivations could be considered close enough to the Australian population (Upshall 1990) for genuine comparisons to be made. In general the criteria for selection of procedures and normative tables were as follows, in priority order:

- Age appropriateness - tests that could be normed for all the ages of children in the study.
- Sample appropriateness 1 - Australian norms could be applied to interpreting the tests (unfortunately the first criterion excluded many of the test items/batteries developed in Australia).
- Sample appropriateness 2 - failing the second criterion, Canada was selected as a similar population. USA was used as the third source, as it was a ready source of normative data.
- Consistency - where higher criteria were satisfied, as many test items were selected from the same source as possible (e.g., CAHPER was used for 7 items), as well as protocols and norms from the same source.

Percentage body fat was predicted through the recording and interpreting of skinfold measures according to Hills (1991b). The difficulty with reliability of skinfold measurements, sometimes found, was addressed by using a single, experienced and skilled assesssor. Other methods of determining body composition were not adopted due to the absence of sophisticated and costly equipment needed for their administration. For similar reasons, height and weight were used to indicate maturation or level of physical development rather than using skeletal age determined through radiological analysis. The assessment of sexual development, through classification of genitalia and/or menarcheal determinants, did not seem appropriate to this age group or to the sociological setting. In adopting less invasive methods of maturity assessment, the psychosocial environment was kept closer to the desired natural atmosphere.

Leg strength or power was assessed by the vertical (Sergeant) jump test, as the more traditional test, i.e., the standing broad jump, had been used on two other test batteries in this study (the MAND test and the screening procedures). Therefore, it was decided that another indicator may have been of value, in adding an alternative form of assessment. The flexed arm hang was used as an indicator of upper body strength in preference to a modified push-up test. Whereas, there is considerable variation in scoring for push-ups, the objectivity of the flexed arm hang allows for much better control of the test procedure. This adds further support for the adoption of the CAPHER test rather than the ACHPER Test, as the latter contains a modified push-up item.

Proportionality measures used for establishing crural index, brachial index and relative sitting height were taken. These indices point to the mechanical efficiency (Bloomfield, Ackland & Elliott 1994) of the levers in the musculoskeletal system. Some of the literature reviewed in Chapter 1 provided an indication that the length and proportions of body levers used in the performance of movement tasks are factors in determining the success or otherwise of that performance. However, although procedures for the measurement of these parameters are well established, the only available norms tables are based on limited or biased samples and do not report rankings for children younger than eight years. In addition, published norms for all of these indices have become available only since concluding the data collection of this study (Blanksby, Bloomfield, Ackland, Elliott & Morton 1994; Bloomfield, Ackland & Elliott 1994) and show that distributions are not dissimilar for each age group or gender. As a consequence of the embryonic nature of investigations in this field, the standards can be taken only as a guide to the relative proportionality indices of the sample used in this study.

## Motor Proficiency Measures

• Field Screening Procedure

The initial screening procedure used to select children in the schools consisted of the following items: a stationary hop test; judgement of throw and catch; a timed static balance; a dynamic balance; standing broad jump; a timed and observed agility run; hand-eye dominance determination; and two fine motor tasks - name writing and copying a shape. An arbitrary scoring system was set up to determine an overall 'functional' score, which was used to rank the children screened.

The items were selected as a consequence of discussions between the research and program directors and based upon items which met one or more of the following criteria:

i) Consistently appeared in standardised tests, e.g., standing broad jump (MAND[2.1], BOTMP[2.2], TGMD[2.3]);
ii) Have been identified by researchers as good single predictors, e.g., stationary hop (Hoare 1992);
iii) Were of importance in the judgement of the observers, e.g., hand-eye dominance.

Appendix 9 contains a description of the score sheet for the screening test and the protocols for the test items can be seen in Appendices 2 and 7.

• Pre/Post Diagnostic Test Procedure

The field screening procedure formed the basis for developing an expedient diagnostic tool which could be used both for pre and post test analysis in the program and as a source of information for the children's instructors. The test battery consisted of the following items: a stationary hop test; judgement of throw and catch; a timed static balance; dynamic balance; standing broad jump; running speed and agility - shuttle run; hand-eye dominance determination; and fine motor hand-eye coordination - placing dots in circles in a specified time. The scoring system was more controlled in this test battery, as protocols derived for the items from standardised tests were used. An interpretation of the results for profiles given to instructors was developed to give comparative standards by which to plan the program for the children.

The items were selected as a consequence of: discussion between the research and program directors; the practicality shown in implementing the field screening test; and, the original reasons for selection in the field test. A copy of the score sheet for the screening test can be seen in Appendix 9 and an example of a profile established from the pre-test results in Appendix 10.

• The McCarron Assessment of Neuromuscular Development (MAND)

A brief explanation of the MAND test and its scoring system precedes the group results for the test in Chapter 3. This explanation is placed at that juncture, rather than at this point, as it aids the flow and interpretation of the MAND test results. A two page summary description of the MAND test can be found in Appendix 14.

**Questionnaires**

• Self Concept Inventory

The Self-Description Questionnaire (SDQ-1, Marsh 1990) was used as a basis for a structured interview, as some of the children were too young to be able to read all of the words.

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2.1 The McCarron Assessment of Neuromuscular Development (McCarron 1982)

2.2 The Bruininks-Oseretsky Test of Motor Proficiency (Bruininks 1978)

2.3 Test of Gross Motor Development (Ulrich 1985)

Consistency was established by using the same interview technique for all of the children in the group, regardless of reading level, and by the use of the same interviewer throughout. The structured interview was piloted and amended as a consequence of trials with three children outside the study group. The validity of the instrument for the population of interest was strong, as the instrument was developed using Australian children. No additional questions, other than those on the SDQ Scales, were asked.

The Marsh Self-Description Questionnaire is a standardised testing procedure using eight scales of self-concept, each scale requiring responses to eight "simple declarative sentences" (Marsh 1990, p. 1). The SDQ-1 was intended initially for use with children of eight to twelve years. However, the analysis of age effects undertaken on the SDQ-1 suggests the tests suitability for children two years younger than originally intended, with appropriate modifications (Marsh 1990). The scales can be used independently and four of the scales were selected for this study: physical ability scale; physical appearance scale; peer relations scale; general self scale. The use of a limited number of scales was decided in order to reduce interview time, lessening intrusion on the program activities. The selection of scales was made on the basis of suitability to the purpose of the study.

• Parent Questionnaire - Family/Personal History

A follow-up parent questionnaire was used to establish information about: family demographics; health status and history; response to and since the program; referral to other professionals for any aspects of development: history of birth trauma; heredity factors; and, general family environment. The questionnaire (see Appendix 17) was designed specifically for the purposes of the study, administered in the child's home by an independent interviewer and, where possible, with both parents present.

One family moved away from the district between the conclusion of the program and the timing of the questionnaires, they were surveyed by mail and a telephone interview. To maintain consistency, the same interviewer was used for all questionnaires and the interview procedures were trialed with two families outside the study group. The three children selected for case profiles had additional interviews conducted with their parents, as a further follow up to the routine interviews. Interviews were audio-taped and transcriptions checked to maintain some reliability of the information gathered.

**Other Indicators of Performance in the Program**

• Report by Program Instructor

As part of an individual report to parents, along with other information collected, each pair of program instructors was required to submit a report about a child's progress. The instructor's reports were utilised in the study, mainly as additional information for the case profiles presented in Chapter 5. Guidelines for report writing, given to each instructor can be seen in Appendix 6.

• Record of Attendance

A simple attendance register of sessions attended during the program was kept by the program director.

• Completion of Homework Tasks

A simple record of the number of set homework tasks that were completed by the children was kept by the instructors.

• Video Recordings

Five selected children were video-recorded for two sessions each during the program. The same camera operator was used throughout, to provide for consistency, with practice sessions set up on site during the early stages of the program. The video tapes were analysed by the research director and the camera operator independently. The video analyses utilised in the study were used only as additional information for the case profiles presented in Chapter 5. The method for selection of the children and the video analysis categories are described in that chapter.

## DATA ANALYSIS PLAN

There were seventeen children (cases) who had been evaluated on a large range of characteristics (possible variables), from both a qualitative and quantitative aspect. It was decided that an analysis of these data, reflecting and reporting on both of those aspects in such a way as to provide explanatory links across different sources of information, would maximise the use of the data to answer the research questions. In order to facilitate this, three broad categories of data analysis were seen as appropriate for the task. Firstly, a description of the sample was regarded as vital to understanding the characteristics of the children in the study. Secondly, some form of statistical analysis of the relevant quantitative data would enhance the profile provided by the descriptive analysis and point more explicitly to answering the research questions. Thirdly, in order to gain a more detailed focus, in a manner not available through broad descriptive and statistical analysis, three case profiles facilitated a deeper understanding of the clumsy child. This triangulated combination of approaches to the analysis of the data was seen as consistent with the holistic approach, reinforcing the philosophical approach adopted in the research.

### DESCRIPTIVE ANALYSIS OF THE SAMPLE

The descriptive analysis was undertaken to provide profiles of the children on the various characteristics assessed during the study. Table 2.3 shows the sources of information required to be analysed and presented in accommodating these profiles.

**Table 2.3 : Sources of Information Available for Analysis**

| Method/Parameter Assessed | Type of Data |
|---|---|
| Anthropometric measures | Quantitative |
| Fitness measures | Quantitative |
| Neurodevelopmental indices | Quantitative |
| Self-concept ratings | Quantitative |
| Parent questionnaires | Combination |
| Pre and post tests | Quantitative |
| Instructor reports | Qualitative |
| Attendance and homework records | Quantitative |
| Other incidental comment (anecdotal) | Qualitative |

The quantitative data were recorded on a computer generated spread sheet, with the facility to graph and tabulate information. The raw scores from the quantitative measures were converted to a percentile rank or standardised score using the norms tables associated with the test protocols, in order to provide some means of comparison to the general population. Where possible, the information from the questionnaires was quantified and recorded accordingly but could not be similarly converted for comparison. The remaining qualitative information was examined, transcribed and summarised for both describing the group and the selected individuals for case profiles. A simple statistical presentation of the first four sets of measures was best presented in graphical and tabulated form, indicating some measure of central tendency. The median score was selected as the measure of central tendency where percentile rankings were used, due to the ordinal nature of the converted data. The mean was used as the central indicator where raw scores were utilised.

Most measures regarding aspects of participation in the Gymstart program were of a descriptive nature, e.g., attendance record, instructors' reports. Therefore, the pre and post test results of the diagnostic screening test were placed more appropriately with those descriptive measures, as they combined to determine the response to the program overall. However, because of the repeated nature of the pre and post test measures, they were considered appropriate for a more sophisticated analysis of the results, to support the descriptive presentation. A repeated measures multivariate analysis of variance (MANOVA) was used to test differences in the means across pre and post tests. The Super ANOVA statistical software package was used to produce the required analysis. Although using a MANOVA for these data contravened some of the assumptions of the statistical procedure because of the small sample size, the analysis was used only to confirm or reject the degree of significance, rather than suggest change due to the Gymstart program. Hence, if there were differences in the means across the two sets of measures evident after examination of

graphical comparisons, the MANOVA could provide confirmation of this descriptive interpretation in an exploratory fashion.

This description of the children and their responses to the program follows in Chapter 3.

## PRINCIPAL STATISTICAL TREATMENT OF THE DATA

In order to address the research questions regarding characteristics of the clumsy child and possible sub-groupings, the descriptive analysis needed to be supported with a more rigorous treatment of the data. Therefore, a cluster analysis of seventeen variables, taken from the collected data, was conducted to identify important characteristics and possible homogeneous groupings. The seventeen measures were selected on the basis of a number of criteria. Firstly, that the measures were able to be compared to the general population, as an indication of normality or lack of it. Those with a standardised score or percentile rank derived from normative tables, being the most appropriate here. Secondly, measures which reduced the number of variables, rendering the statistical procedure more robust were selected. Unfortunately, only the Neuromuscular Development Index (NDI) from the MAND test was able to reduce the data by four variables, as it was the only aggregate score encompassing the four sub-indicators in the test. Otherwise, all the anthropometric, fitness and self-concept scores were utilised, as they met the first criterion.

A description and the reasons for selection of the cluster analysis precedes the results of that procedure. This explanation is placed at that juncture, rather than at this point, as it aids the flow and interpretation of the findings, being in close proximity to the results of the cluster analysis. These results, interpretations and associated explanatory comment are contained in the chapter entitled 'Clustering Variables and Subjects'.

## CASE PROFILES

Inevitably in group analysis, some individual detail is lost in the attempt to give an overall picture of group trends. In some situations this inability to report individual details, as exemplifiers or representatives of typical characteristics, is disadvantageous to the description. Therefore, it was decided to select three children for whom a more detailed analysis or case profile could be reported. These case profiles are contained in the 'Three Case Profiles' chapter.

## ADDRESSING THE RESEARCH QUESTIONS

In order to address the research questions, the results chapters have been organised to answer systematically the questions and discuss the issues surrounding them. A schematic view of this organisation can be seen in Table 2.4 following iteration of the questions, as follows:

**A) Is there a set of identifiable features which are common to clumsy children?**

**(B) How do the identified features group together in terms of the capacities and competencies of clumsy children?**

**C) Do clumsy children group together in more discrete sub-types based upon these identifiable features?**
**- If so, what are the characteristics of these groupings and/or which features show prominence in formulating the groups?**

**D) How do these features manifest themselves and affect the individual child with motor difficulties?**

**AND**

as a 'corresponding and complementary theme' resulting from questions (A) to (D) and the anticipated conduct of the research, the model presented as Figure 1.1, which summarises the coverage of causes and consequences of clumsiness in the literature, will be verified against the findings of this research. As an outcome of this process the model may be modified to reflect more accurately the conclusions in tandem with previous research findings. This will be used as a collective aim of the research synthesising the general and specific findings of this study and testing the model's legitimacy.

**Table 2.4 : Plan for Answering Research Questions**

| Phase/ Research Question | Purpose | Methodology | Chapter |
|---|---|---|---|
| 1 (A) | Identifying features of the clumsy child | Descriptive Analysis of the study group | 'Describing the Sample' |
| 2 (B) & (C) | Identifying features which group together and/or identifying groupings of children | Cluster Analysis of the variables and the subjects | 'Cluster Analysis' |
| 3 (D) | Examination of those features or groupings in individuals | Case Study | 'Three Case Profiles' |
| 4 'research themes' | Synthesis | Drawing together of the conclusions from each method of analysis | 'Summary, Discussion and Conclusions' |

## SYNOPSIS

This section has described the plan to analyse the data, collected in various forms which have been outlined in this chapter. The data analysis plan utilises a triangulation of methods to explore the data more fully. Subsequent chapters present the analysis of these data, following the sequence of sub-sections contained in the data analysis plan. The first of those chapters (Chapter 3) provides a mainly descriptive view of the children, illustrating the characteristics of the group and providing important background information about the sample.