



T1900189958

**INVESTIGATION INTO THE CHARACTERISTICS
OF CHILDREN WITH MOTOR DIFFICULTIES:
AN HOLISTIC APPROACH**

John Hammond

Dip.T. (Western Australian Secondary Teachers College)
B.P.E. (University of Western Australia)
Grad. Dip. P.E. (Western Australian College of Advanced Education)
MEdStuds (Monash University)

December 1995

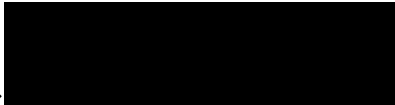
A thesis submitted for the degree of Doctor of Philosophy
at the
University of New England

In loving memory of my mother

CERTIFICATE OF ORIGINALITY

I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree or qualification.

I certify that to the best of my knowledge any help in preparing this thesis and all of the sources used, have been acknowledged in the thesis.

Signed.....
John Hammond (11th December 1995)

ACKNOWLEDGMENTS

This investigation and thesis could not have been undertaken without a great deal of assistance from a variety of people in a myriad of ways. I would like to formally acknowledge and thank my family, friends and colleagues for their assistance over the years, it is deeply appreciated.

Firstly, thank you to my supervisor Associate Professor John Pegg, whose patient and thoughtful guidance has focussed my thoughts throughout the process, and to whom I am greatly indebted. John's skills as a supervisor have not only been of great value for this project but have also been an exemplary model on which I have based my own approach to supervision.

To Dr. Ken Vine, who provided expert advice and assistance in the statistical analysis and interpretations of the findings that occurred throughout, I am extremely grateful for the enormous amount of time he has dedicated to my project.

To Dr Dawne Larkin and Dr Graham Allen, who read my thesis at one of the early draft stages and offered constructive suggestions for improvement and modifications, I owe a debt of gratitude for the way in which they offered their time and considerable expertise.

To my friends and colleagues at UNE, particularly those in the Department of Science, Technology and Mathematics Education, who have given advice, commiserated, encouraged and just listened, I am very grateful.

To my closest colleagues at UNE, Scott Dickson and Judy Sprinkle, for their direct assistance, encouragement, 'holding the fort' and old-fashioned camaraderie.

In addition, I would like to thank the children who participated in both the testing and the Gymstart program, as well as their parents and teachers. Without them this project would not have been possible.

Lastly, but by no means the least, to Joan, Leanne and Susan a special thank you for their love, patience and tolerance over the years of study which led up to the completion of this thesis.

TABLE OF CONTENTS

LIST OF TABLES	iii
LIST OF FIGURES	v
ABSTRACT	vii
INTRODUCTION	1
Chapter 1 REVIEW OF LITERATURE	5
SCOPE AND EXTENT	5
ADOPTING STRATEGIES	23
EVALUATION OF SKILLED PERFORMANCE	28
CONCLUSION	34
Chapter 2 EXPERIMENTAL DESIGN	37
CONTEXT	37
PLANNING FOR RESEARCH	39
DESIGN OF STUDY	44
PARTICIPANTS AND INSTRUMENTATION	49
DATA ANALYSIS PLAN	58
Chapter 3 DESCRIBING THE SAMPLE	62
ANTHROPOMETRIC MEASURES	63
FITNESS PARAMETERS	68
NEUROMUSCULAR DEVELOPMENT ASSESSMENT	71
PSYCHOSOCIAL BACKGROUND	75
RESPONSES TO THE REMEDIAL PROGRAM	79
SUMMARY	85
Chapter 4 ANALYSIS OF THE SCREENING TEST	88
BACKGROUND	89
DESIGN OF THE SUPPLEMENTARY STUDY	91
RESULTS OF THE SUPPLEMENTARY STUDY	95
DISCUSSION AND INTERPRETATIONS	98
Chapter 5 CLUSTERING VARIABLES AND SUBJECTS	100
CLUSTER ANALYSIS	100
CLUSTERING THE VARIABLES	103
GROUPING THE CHILDREN	108
DISCUSSION	125

Chapter 6 THREE CASE PROFILES128
 CASE ONE : ANN130
 CASE TWO : LANCE144
 CASE THREE : GRAHAM155
 CONCLUSIONS166

Chapter 7 SUMMARY, DISCUSSION AND CONCLUSIONS170
 THE FOCUS OF THE RESEARCH171
 SYNOPSIS OF THE FINDINGS172
 IMPLICATIONS179
 EPILOGUE184

REFERENCES185

APPENDICES199

LIST OF TABLES

Table 1.1 : Phases of Motor Development	7
Table 2.1 : Chronological Phases of the Study	46
Table 2.2 : Measures Taken to Establish Children's Physical Capacities	53
Table 2.3 : Sources of Information Available for Analysis	59
Table 2.4 : Plan for Answering Research Questions	61
Table 3.1 : Percentile Rankings of Anthropometric Measures	63
Table 3.2 : Percentile Rankings of Fitness Parameters	68
Table 3.3 : Comparative Scores from the MAND Test	72
Table 3.4 : Motor Factor Scores from the MAND Test	73
Table 3.5 : Percentile Rankings on Self-Concept Scales	77
Table 3.6 : Screening Test Results and Analysis	82
Table 4.1 : Correlation Matrix for the Screening Pre Test	89
Table 4.2 : Partial Correlation Matrix for the Screening Pre Test	89
Table 4.3 : Correlation Matrix for the Screening Post Test	90
Table 4.4 : Partial Correlation Matrix for the Screening Post Test	90
Table 4.5 : Screening Test Results and Analysis Comparing Normal and Clumsy Group	97
Table 4.6 : Correlation Matrix for the Screening Test with the Sample Population of Normal Children	97
Table 4.7 : Partial Correlation Matrix for the Screening Test with the Sample Population of Normal Children	98
Table 5.1 : Clusters of Variables from Analysis at Step Twelve	105
Table 5.2 : Clusters of Variables from Analysis at Step Thirteen	105
Table 5.3 : Clusters of Variables from Analysis at Step Fourteen	105
Table 5.4 : Clusters of Variables from Analysis at Step Fifteen	106
Table 5.5 : A Description of Step One in the Cluster Analysis for Cases	109
Table 5.6 : A Description of Step Two in the Cluster Analysis for Cases	110
Table 5.7 : A Description of Step Three in the Cluster Analysis for Cases	111
Table 5.8 : A Description of Step Four in the Cluster Analysis for Cases	112
Table 5.9 : A Description of Step Five in the Cluster Analysis for Cases	113
Table 5.10 : A Description of Step Six in the Cluster Analysis for Cases	114
Table 5.11 : A Description of Step Seven in the Cluster Analysis for Cases	115
Table 5.12 : A Description of Step Eight in the Cluster Analysis for Cases	116
Table 5.13 : A Description of Step Nine in the Cluster Analysis for Cases	117
Table 5.14 : A Description of Step Ten in the Cluster Analysis for Cases	118
Table 5.15 : A Description of Step Eleven in the Cluster Analysis for Cases	119
Table 5.16 : A Description of Step Twelve in the Cluster Analysis for Cases	120
Table 5.17 : A Description of Step Thirteen in the Cluster Analysis for Cases	121

Table 5.18 : Cluster of Subjects from Analysis at Step Thirteen	122
Table 5.19 : Cluster of Subjects from Analysis at Step Fourteen and Fifteen	123
Table 5.20 : Cluster of Subjects from the Analysis at Step Twelve	124
Table 7.1 : Features of the Clustering of Cases	175

LIST OF FIGURES

Figure 1.1 : The Relationship Between the Causes and Consequences of Clumsiness in Children	16
Figure 2.1 : Overview of the Categories for Assessment	44
Figure 2.2 : Relationship of Primary Study to Subsidiary Studies	45
Figure 3.1 : Height and Weight Characteristics	64
Figure 3.2 : Levels of Body Fat	65
Figure 3.3 : Proportionality Measures	66
Figure 3.4 : Stamina, Speed and Flexibility	69
Figure 3.5 : Strength and Power Indicators	70
Figure 3.6 : Neuromuscular Development Index Scores from the MAND Test	74
Figure 3.7 : Fine and Gross Motor Composite Scores from the MAND Test	74
Figure 3.8 : Demographic Information	76
Figure 3.9 : Self-Concept Dimensions	78
Figure 3.10 : Attendance and Homework Task Completion	80
Figure 3.11 : Parent Perceptions of the Effects of the Remedial Program	81
Figure 3.12 : Pre and Post Test Comparisons of Mean Scores	83
Figure 3.13 : Dominance of Eye and Hand in a Group of Clumsy Children	84
Figure 4.1 : Comparison of Normal Group with Gymstart Group on the Screening Test	95
Figure 5.1 : Relative Distances Between Clusters at each Step in the Procedure (variables)	104
Figure 5.2 : Relative Distances Between Clusters at each Step in the Procedure (subjects)	123
Figure 6.1 : Anthropometric Profile for Ann	131
Figure 6.2 : Fitness Profile for Ann	132
Figure 6.3 : MAND Test Factors Profile for Ann	133
Figure 6.4 : Individual Profile of Neuromuscular Development for Ann on the MAND Test	134
Figure 6.5 : Self-Description Questionnaire Factor Scores for Ann	138
Figure 6.6 : Performance on Pre and Post Screening Tests - Ann	139
Figure 6.7 : Anthropometric Profile for Lance	145
Figure 6.8 : Fitness Profile for Lance	145
Figure 6.9 : MAND Test Factors Profile for Lance	146
Figure 6.10 : Individual Profile of Neuromuscular Development for Lance on the MAND Test	147
Figure 6.11 : Self-Description Questionnaire Factor Scores for Lance	150
Figure 6.12 : Performance on Pre and Post Screening Tests - Lance	151
Figure 6.13 : Anthropometric Profile for Graham	156

Figure 6.14 : Fitness Profile for Graham	156
Figure 6.15 : MAND Test Factors Profile for Graham	157
Figure 6.16 : Individual Profile of Neuromuscular Development for Graham on the MAND Test	158
Figure 6.17 : Self-Description Questionnaire Factor Scores for Graham	161
Figure 6.18 : Performance on Pre and Post Screening Tests - Graham	162
Figure 7.1 : The Relationship Between Causes and Consequences of Clumsiness in Children (modified)	181

ABSTRACT

This study was undertaken to examine a number of issues related to motor clumsiness in children. An approach which accommodated both a humanistic attitude to dealing with children and an holistic approach to dealing with research, was taken. The review of literature established the heterogeneous nature of clumsiness and that this relatively new field of study was characterised by diverse opinion. In order to gain a greater comprehension of the nature of the condition, it seemed reasonable to research more aspects of clumsiness than had been attempted before in a single study. This was adopted as the theme which formulated the basis of the research and upon which a number of research questions were generated.

Seventeen children were assessed across a large range of characteristics and the data explored using qualitative and quantitative methods of analysis. An analysis, which reflected and reported both of these aspects, and would maximise the use of the data in answering the research questions, was seen as appropriate. To facilitate this, three methods of data analysis were employed. They were: a descriptive analysis that provided profiles of the children on various parameters; a cluster analysis of seventeen variables that identified important features of clumsy children and possible homogeneous groupings; and, three case studies which provided more detailed descriptions.

The descriptive analysis showed the children in the study to be larger than their peers, with high levels of body fat and some mechanical disadvantages in their structure. In addition, the neuromuscular ability and fitness levels of the group were low, such that efficient control of movement would be hampered. The family environments of the children were not seen as likely to have caused limitations to normal motor development. However, hereditary factors and the high incidence of birth trauma were regarded as likely to have contributed to their movement difficulties. Associated with the movement difficulties, was evidence of other learning difficulties in some of the children, but the majority were essentially normal on ratings of self-worth. The descriptive analysis suggested also that clumsy children may not possess easily transferable motor attributes. As a consequence of this, a comparison of the study group with a normal population was made, to complement the main study. This supplementary study employed a second quantitative analysis of the relevant data from the study group and the 'post-investigation' data collected on a normal population. The results of the additional investigation suggested that clumsy children were different from normal children, in that they lacked ability to transfer skills across some tasks which were regarded as having a similar skill basis.

It was expected that variables measuring similar characteristics would cluster together and the results of the first cluster analysis grouped like parameters together. However, combined with

evidence from the clustering of cases and the descriptive analysis, the importance of some of the variables as possible descriptors of clumsiness was established. They were flexibility, brachial index, and the motor quotient produced as a consequence of testing using the McCarron Assessment of Neuromuscular Development (MAND). These three factors emerged as strong distinguishing features in recognising the clumsy child. In grouping clumsy children into possible sub-types, the cluster analysis used those and other variables to group the children into three categories. Firstly, a grouping based on homogeneity around the motor quotient and brachial index, with some secondary importance given to skinfold rating sorted the largest cluster. Secondly, a grouping based on homogeneity around brachial index, flexibility and the self-concept rating of general self was established. Thirdly, a category of aberrant cases showing strong independence from those more homogeneous groups was evident.

Individual profiles were established using information gleaned from the descriptive analysis of the group as well as further data gathered on the children selected for the case studies. At least one other person in the families of the three children in the case studies, showed signs of clumsiness. All three children experienced some kind of birth trauma and, coupled with indicators of mild to severe motor disability from the MAND test results, this suggested the possibility of soft neurological damage. The three children came from reasonably stable home environments, however, in all three cases there was a history of difficulties in the early childhood years, which may have affected normal motor development. Characteristics of body build, stature and proportionality in the cases examined showed both diversity and commonality on differing factors. There was diversity in height, weight, levels of body fat and the proportionality indicators across the three children. However, commonality existed in that each had a biomechanical disadvantage and all had a low brachial index. A good deal of homogeneity was found in the fitness levels in each case, characterised by levels of stamina, strength and power seen to be detrimental to efficient physical performance. Analysis of the children's performance during physical activity sessions, through video and instructor observations, also revealed similarities and differences. The three children all have difficulties with balance and coordination involving ball skills but extent of problems encountered and the combinations of coordination difficulties were diverse.

The multi-dimensional nature of clumsiness was confirmed by the findings of this study. However, the findings suggested a so that clumsy children may be sorted into more homogeneous groups, and variables used to identify those groups can be reduced into a manageable and practicable set of characteristic descriptors. In addressing the research theme and questions associated with issues raised in the study, three important conclusions were determined. Firstly, clumsy children can be identified, in general, as possessing combinations of characteristics which can be derived from a limited set of dimensions. Secondly, clumsy children can be characterised more specifically and definitively as: presenting with low

neuromuscular ability and motor control; lacking the ability to transfer associated skills; showing a level of hyperflexibility in combination with weak musculature, as to be detrimental to efficient movement; and exhibiting some biomechanical disadvantage, probably of the upper limb. Thirdly, that there is a possibility of sub-types of clumsy children, who can be identified on the basis of neuromuscular control determinants or on certain physical capacities, with the causes of clumsiness remaining multi-dimensional.