YUNIBESITI YA BOKONE-BOPHIRIMA
NORTH-WEST UNIVERSITY
NOORDWES-UNIVERSITEIT

A COMPARISON OF DIFFERENT INTERVENTIONS FOR CHILDREN WITH DEVELOPMENTAL COORDINATION DISORDER

Anquanette Peens
M.A.

Thesis submitted for the degree Doctor of Philosophy in Human Movement Science at the North-West University

Promoter: Prof. A.E. Pienaar
Assistant Promoter: Dr. A.W. Nienaber

November 2005
Potchefstroom Campus

YUNIBESITI YA BOKONE-BOPHIRIMA
NORTH-WEST UNIVERSITY
NOORDWES-UNIVERSITEIT

DECLARATION

The co-authors of the articles which form part of this thesis, hereby give permission that the candidate, may include the articles as part of a thesis. The contribution (advisory and supportive) of these co-authors was kept within reasonable limits, thereby enabling the candidate to submit this thesis for examination purposes. This thesis, therefore, serves as partial fulfilment of the requirements for the Ph.D degree in Human Movement Science within the School of Biokinetics, Recreation and Sport Science in the Faculty of Health Sciences at the North-West University.

Candidate:

Anquanette Peens

Qualification:

MA-degree

Title of Thesis:

A comparison of different interventions for children with Developmental Coordination Disorder

Signature of promoter: _____

Date: 15/5/2006

Signature of assistant promoter: _____

Date: 15/5/2006

POTCHEFSTROOMKAMPUS
Privaatsak X6001, Potchefstroom, Suid-Afrika, 2520
Tel: (018) 299-1111 • Faks: (018) 299-2799
Internet: http://www.nwu.ac.za

FOREWORD

I would hereby like to thank the following persons, without whom it would not have been possible to complete my studies successfully:

- First of all my Heavenly Father for the talent to come so far, Your loving Guidance and the gift of Goodwill that You gave me through all my life but especially through this period. "Lord without You carrying me all this way I would never have gone so far. I Thank You so much. With all my love, Your daughter. Anquanette."

- Christo (my husband) for all your love, support, inspiration, patience and motivation. And for all the tears I shed on your shoulder. I really love you. Thank you very much.

- My promoter, prof. A.E. Pienaar, for all her time and support as well as motivation during this period.

- My assistant promoter, dr. A.W. Nienaber, for her help in the psychological parts of the study.

- Mrs. C. Van Der Walt (Tel. no. 018 – 290 7367) for the language editing of the thesis.

- Mrs. L. Wolmarans for translation of two chapters of the thesis.

- The National Research Foundation and the North-West University for financial support for this study.

- My whole family for their support and love during the study period. I love you all and I really appreciate all you have done for me.

I DEDICATE THIS THESIS TO MY HUSBAND, CHRISTO. THANK YOU SO MUCH FOR BEING SUCH A CARING AND SUPPORTIVE HUSBAND. THIS IS MY PRAYER FOR YOU:

"MAY THE LORD BLESS YOU AND KEEP YOU. MAY THE LORD MAKE HIS FACE SHINE UPON YOU, AND GIVE YOU PEACE FOR EVER (NUM. 6:24-26)."

WITH ALL MY LOVE

GOGGA

A comparison of different interventions for children with Developmental Coordination Disorder

Research indicates that Developmental Coordination Disorder (DCD) is associated with a poor self-concept and high levels of anxiety (Peens *et al.*, 2004; Piek *et al.*, 2000; Skinner & Piek, 2001). Research also substantiates that participation in a well planned motor intervention programme can enhance the self-concept of a child with DCD (Colchico *et al.*, 2005). Literature further indicates that DCD is associated with neuro-motor problems which may vary in severity (Sigmundsson & Hopkins, 2005). It is further indicated that more boys than girls are diagnosed with DCD and also that, in general, boys have a higher self-concept than girls (Maldonado-Duran, 2002; Stein *et al.*, 1998).

The aim of this study was firstly, to determine the influence of DCD on the self-concept and anxiety of 7-9 year old children in the Potchefstroom district. Secondly, the study aimed to determine whether gender and the ethnic group of DCD children have an effect on the success of different intervention programmes. A third aim was to determine whether a motor based intervention programme, a self-concept enhancing programme or a combination of the two (psycho-motor intervention programme) would have the best effect on enhancing children's self-concept and motor proficiency. Lastly, the study attempted to determine whether neuro-motor problems could have a negative influence on an intervention programme for DCD children.

The Movement Assessment Battery for Children (MABC), Bruininks-Oseretsky Test for Motor Proficiency (BOTMP-SF), Sensory Input Measurement Instrument (SIM) and Quick Neurological Screening Test II (QNST) were used to determine children's motor proficiency as well as possible neuro-motor problems. The Tennessee Self-Concept Scale (Child Form) (TSCS-CF) and Child Anxiety Scale (CAS) were used to determine the children's self-concept and anxiety respectively.

One way variance of analysis, repeated measures analysis, independent t-testing, co-variance of analysis as well as correlational coefficients (r) were conducted, using the Statistica computer package in order to analyze the data according to the above-mentioned aims. A p-value of smaller than or equal to 0.05 was accepted as a significant difference.

From the results of the study it seemed that the self-concept and anxiety of randomly selected 7-9 year old children (N=58) diagnosed with DCD are negatively influenced and that girls are more vulnerable to these influences. Repeated measure analyses over a period of one year showed that of the three programmes the motor intervention programme showed the best results at improving the children's motor proficiency while, on the other hand, the psycho-motor intervention programme improved their self-concept most. Ethnic group and gender did not have a significant effect on the success of intervention programmes. Lastly, it was found that underlying neuro-motor problems could influence the effect of an intervention programme negatively. It is clear from this study that DCD has a negative effect on children, but that participation in a well planned intervention programme will have positive effects on both their motor proficiency and self-concept.

Key words: DCD, self-concept, gender, ethnic group, neuro-motor

'n Vergelyking van verskillende intervensies by kinders met ontwikkelingskoördinasieversteuring

Navorsing dui daarop dat ontwikkelingskoördinasieversteuring ("Developmental Coordination Disorder"-DCD) gepaard gaan met 'n lae selfkonsep en hoër angstigheid (Peens *et al.*, 2004; Piek *et al.*, 2000; Skinner & Piek, 2001). Daar is ook aanduidings dat die deelname aan 'n gerigte motoriese intervensieprogram die selfkonsep van kinders met DCD kan verhoog (Colchico *et al.*, 2005). Die literatuur dui ook verder daarop dat DCD gepaard gaan met neuro-motoriese probleme wat in grade van ernstigheid kan wissel (Sigmundsson & Hopkins, 2005). Verder word aangedui dat meer seuns as dogters met DCD gediagnoseer word en ook dat seuns in die algemeen 'n hoër selfkonsep toon as dogters (Maldonado-Duran, 2002; Stein *et al.*, 1998).

Die doel van hierdie studie was eerstens om te bepaal wat die invloed van DCD op die selfkonsep en angstigheid van 7- tot 9-jarige kinders in die Potchefstroom-distrik is. Tweedens was dit nodig om te bepaal of die geslag en ras van DCD-kinders nie dalk 'n effek op die sukses van verskillende intervensieprogramme kan hê nie. 'n Verdere doel was om te bepaal watter van 'n motories gebaseerde intervensieprogram, 'n selfkonsepverrykingsprogram of 'n kombinasie van die twee (psigo-motoriese intervensieprogram) die beste effek sal hê op die verbetering van die selfkonsep en motoriese vaardighede van kinders met DCD. Laastens het die studie gepoog om die effek van neuro-motoriese probleme op die sukses van 'n intervensieprogram vir DCD-kinders te bepaal.

Die "Movement Assessment Battery for Children" (MABC), "Bruininks-Oseretsky Test for Motor Proficiency" (BOTMP), "Sensory Input Measurement Instrument" (SIM) en "Quick Neurological Screening Test II" (QNST) is gebruik om die kinders se motoriese vaardighede sowel as moontlike neuro-motoriese probleme te bepaal. Die "Tennessee Self-Concept Scale (Child Form)" (TSCS-CF) en "Child Anxiety Scale" (CAS) is gebruik om die kinders se selfkonsep en angstigheid onderskeidelik te bepaal.

Daar is met behulp van die Statistica-rekenaarprogram onderskeidelik van eenrigtingvariansie-analises, herhaalde metingsanalises, onafhanklike t-toetsings, ko-variansie-analises sowel as korrelasiekoëffisiënte (r) gebruik gemaak om die data met

betrekking tot bogenoemde doelwitte te ontleed. 'n P-waarde kleiner as of gelyk aan 0.05 is as betekenisvol aanvaar.

Uit die resultate van die studie het dit geblyk dat die selfkonsep en angstigheid van die ewekansig geselekteerde 7- tot 9-jarige kinders (N=58) wat met behulp van die MABC met DCD gediagnoseer is, negatief beïnvloed word en dat dogters meer vatbaar vir hierdie invloede is. Herhaalde metingsanalises oor 'n tydperk van een jaar het getoon dat die motoriese intervensieprogram die kinders se motoriese vaardighede die beste verbeter, terwyl die psigo-motoriese program die kinders se selfkonsep die meeste verbeter het. Ras en geslag het geen betekenisvolle effek op die sukses van intervensieprogramme uitgeoefen nie. Laastens is gevind dat onderliggende neuro-motoriese probleme die sukses van intervensieprogramme negatief kan beïnvloed. Uit die studie is dit duidelik dat DCD 'n negatiewe effek op kinders het, maar ook dat blootstelling aan gerigte intervensieprogramme 'n positiewe effek op hul motoriese vaardighede en selfkonsep kan uitoefen.

Sleutelwoorde: DCD, selfkonsep, geslag, ras, neuro-motories

INDEX

CHAPTER 1:

PROBLEM AND AIM OF STUDY 1

1.1 Introduction 2

1.2 Problem statement 3

1.3 Aims 6

1.4 Hypotheses 6

1.5 Structure of thesis 7

CHAPTER 2:

A LITERATURE OVERVIEW OF MOTOR IMPAIRMENT AND SELF-CONCEPT RELATED PROBLEMS, AND INTERVENTION METHODS FOR CHILDREN WITH DEVELOPMENTAL COORDINATION DISORDER 10

2.1 Introduction 11

2.2 Self-concept 12

2.2.1 Self-concept and gender 13

2.3 Anxiety 13

2.3.1 Anxiety and gender 13

2.4 Motor development 14

2.4.1 Developmental Coordination Disorder 14

INDEX (continue)

2.4.2 Nature of problems associated with DCD 15

2.4.3 Ethnic and gender differences and DCD 16

2.5 Association between motor problems, self-concept and anxiety 16

2.6 Motor intervention methods for DCD 20

2.6.1 Intervention by means of parent leadership 21

2.6.2 Le Bon Départ (LBD) 22

2.6.3 Sensory integration (SI) 23

2.6.4 Specific skills approach (SSA) 24

2.6.5 Motor skill intervention 25

2.6.6 Cognitive Orientation to daily Occupational Performance (CO-OP) 25

2.6.7 Cognitive motor intervention 27

2.6.7.1 Visual 27

2.6.7.2 Kinaesthetic 28

2.6.8 Perceptual motor approach (PMA) 29

2.6.9 Neuro-development treatment 29

2.6.10 Combined treatment approach 29

2.6.11 Success of intervention 30

2.7 Self-concept improvement activities 32

2.7.1 Challenging educational activities 32

2.7.2 Initiative 32

2.7.3 Line route activities 33

2.7.4 Briefing and Debriefing 33

2.7.5 Feeling of belonging 33

2.7.6 Feelings of worth 34

2.7.7 Recognition of uniqueness 34

2.7.8 Moral exercise 34

2.7.9 Expected ability 35

2.7.10 Encouragement in the acceptance of the self 35

2.7.11 Challenging activities for students with special needs 36

INDEX (continue)

2.8 Chapter summary 36

2.9 Bibliography 38

CHAPTER 3:

THE INFLUENCE OF DCD ON THE SELF-CONCEPT AND ANXIETY OF 7-9 YEAR OLD CHILDREN 53

CHAPTER 4:

THE EFFECT OF DIFFERENT INTERVENTION PROGRAMMES ON THE SELF-CONCEPT AND MOTOR PROFICIENCY 0F 7-9 YEAR OLD DCD CHILDREN 70

CHAPTER 5:

THE EFFECT OF GENDER AND ETHNIC DIFFERENCES ON THE SUCCESS OF INTERVENTION PROGRAMMES FOR THE MOTOR PROFICIENCY AND SELF-CONCEPT OF 7-9 YEAR OLD DCD CHILDREN 102

INDEX (continue)

CHAPTER 6:

EFFECT OF VARIOUS NEURO-MOTOR DIFFICULTIES ON THE SUCCESS OF MOTOR INTERVENTION FOR 7 – 9 YEAR OLD DCD CHILDREN 133

CHAPTER 7:

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS OF THE STUDY 165

7.1 Summary 166

7.2 Conclusions 169

7.2.1 Conclusion 1 169

7.2.2 Conclusion 2 170

7.2.3 Conclusion 3 170

7.2.4 Conclusion 4 170

7.3 Recommendations 171

7.3.1 Recommendation 1 172

7.3.2 Recommendation 2 172

7.3.3 Recommendation 3 172

7.3.4 Recommendation 4 173

7.3.5 Recommendation 5 173

7.3.6 Recommendation 6 173

INDEX (continue)

APPENDIXES 174

APPENDIX A

Guidelines for authors for the African Journal for Physical, Health Education, Recreation and Dance 175

APPENDIX B

Guidelines for authors for the Child: Care, Health and Development 182

APPENDIX C

Guidelines for authors for the Child: Care, Health and Development 187

APPENDIX D

Guidelines for authors for the Adapted Physical Activity Quarterly 189

APPENDIX E

Information letter to the headmasters about the study (Because all the headmasters home language were Afrikaans the letter is only presented in Afrikaans 196

APPENDIX F

Guidelines for teachers to identify possible DCD candidates (Afrikaans and English versions) 198

INDEX (continue)

APPENDIX G

Informed consent documents

(Afrikaans and English versions) 204

APPENDIX H

Motor intervention programme 209

APPENDIX I

Letter stating that article 1 (Chapter 3) is in the review process of the African Journal for Physical, Health Education, Recreation and Dance 226

APPENDIX J

Letter stating that article 3 (Chapter 4) is in the review process of the Child: Care, Health and Development 228

APPENDIX K

Letter stating that article 3 (Chapter 5) is in the review process of the Child: Care, Health and Development 230

APPENDIX L

Letter stating that article 4 (Chapter 6) is in the review process of the Adapted Physical Activity Quarterly 232

LIST OF TABLES

CHAPTER 3:

Table 1:	Number of participants in each group	67
Table 2:	Normal score range of CAS, TSCS-total and subscales	67
Table 3:	Significant interrelationships between the different subcomponents, $p<0.05$	67
Table 4:	Significance of differences between moderate and severe DCD groups for the CAS, TSCS and subscales	68
Table 5:	Significance of differences between girls with moderate and severe DCD with regard to CAS, TSCS and subscales	69

CHAPTER 4:

Table 1:	Age, gender and number of children in each group	94
Table 2:	Descriptive statistics for all the tests and subtests (MABC, TSCS and CAS)	95

CHAPTER 5:

Table 1:	Number of children in each gender and ethnic group in each intervention group	126
Table 2:	Significance of differences between boys and girls for the different tests	127

Table 3: Significance of differences between boys and girls for the TSCS subscales in group 2 128

Table 4: Significance of differences between the different ethnic groups for each specific intervention group 129

Table 5: Significance of differences between the different ethnic groups for the MABC subscales in group 1 132

CHAPTER 6:

Table 1: Number and percentage of children showing improvement and no improvement after a motor intervention programme 157

Table 2: Significance of differences between the experimental and control group for the MABC-total 158

Table 3: Co-variance of analysis of the MABC-total corrected for the SIM and QNST total 159

Table 4: Significance of differences between the improvement and non-improvement group for the neuro-motor test totals 160

Table 5: Significance of differences between scores of the improvement and non-improvement groups for the neuro-motor subtests 161

Table 6: Percentages of children in the different groups with or without problems in neuro-motor subtests 162

Table 7: Factorial ANOVA to determine differences between groups for reaction speed and reflex total 164

LIST OF FIGURES

CHAPTER 4:

Figure 1: Within-group differences between different testing sessions for MABC (a), MD (b), BS (c) and BAS (d) 98

Figure 2: Within-group differences of CAS between different testing sessions 99

Figure 3: The differences between the different testing opportunities for each of the groups on the TSCS-CF (3a), PHY (3b), MOR (3c), PER (3d), FAM (3e), SOC (3f) and ACA (3g) 100

CHAPTER 1

PROBLEM STATEMENT AND AIM OF STUDY

1.1 Introduction

Developmental Coordination Disorder (DCD) is a diagnosis that indicates motor coordination problems, while the child has normal intelligence with no neurological condition or physical disturbance. The DCD-related problems which the child experiences interfere with his/her routine of daily activities, as well as his/her academic achievements (American Psychological Association - APA, 1994:53). Research by Wright and Sugden (1996:358) indicates that 16% of a random population has DCD. In Australia the occurrence of DCD is reported to be between 6.1% and 15% (Hoare & Larkin, 1991a:2), while in South Africa (in the North-West province) Pienaar (2004:79) indicated an incidence of 61.2%. Dussart (1994:84) and Fox, A.M. (2000:1) state that in primary school at least one child in every classroom has DCD.

Problems associated with DCD are the development of a poor self-concept (Henderson *et al.*, 1989:9; Skinner & Piek, 2001:84), poor physical self-concept (Piek *et al.*, 2000:268; Schoemaker & Kalverboer, 1994:134; Skinner & Piek, 2001:88), socialization problems (Geuze & Börger, 1993:10; Schoemaker & Kalverboer, 1994:135), academic related problems (Dussart, 1994:81; Losse *et al.*, 1991:55; Maeland, 1994:128) and anxiety, especially when taking part in motor activities (Gallahue & Ozmun, 1989:353; Rose *et al.*, 1999:1; Schoemaker & Kalverboer, 1994:130). Other problems linked to DCD are a lower performance IQ (Piek & Coleman-Carman, 1995:981), slower movement times (Henderson *et al.*, 1992:901; Huh *et al.*, 1998:483; Maruff *et al.*, 1999:1317) and problems when working under pressure of time (Rodger *et al.*, 2003:463).

Researchers also linked DCD to certain neuro-motor problems such as kinaesthetic perception problems (Coleman *et al.*, 2001:95, Hoare & Larkin, 1991b:676; Lord & Hulme, 1987b:722; Piek & Coleman-Carman, 1995:981), vision problems (Hulme *et al.*, 1982:469; Lord & Hulme, 1987a:255; Mon-Williams *et al.*, 1996:179; Sigmundsson & Hopkins, 2005:158; Van Waalvelde *et al.*, 2004:666), reflex problems (Cheatum & Hammond, 2000:60) and vestibular problems (Cheatum & Hammond, 2000:149).

1.2 Problem statement

It is apparent that sufficient physical activity, exercise and sport have a positive influence on a variety of developmental aspects in children (Leupker, 1999:12). Notwithstanding the noted health advantages (Baranowski *et al.*,1999:237; Leupker, 1999:12), researchers have indicated that exercise also contributes to a positive self-concept (Colchico *et al.*, 2000:978; Dekel *et al.*, 1996:193; Goni & Zulaika, 2000:248; MacMahon, 1990:344; Salokun, 1994:754) in children 10 years and older. Theories (Chia & Wang, 2002:65) that pose a relationship between physical activity and self-concept suggest that time away from daily routine and spent on acute physical activity have an anti-depressant effect. Furthermore, the self-efficacy theory states that self-effectiveness is the continuation of moderate activity and predicts the participation in intense activity (Chia & Wang, 2002:65). As exercise is a challenging task for sedentary people, participation in regular physical activity can improve their emotional state, enhance self-confidence and possibly improve their ability to handle tasks that would normally threaten their emotional well-being (Chia & Wang, 2002:65). Furthermore, the mastery theory states that mastering a challenging activity such as exercise can have a feeling of success and confidence (Chia & Wang, 2002:65). It is furthermore believed that a feeling of achievement over the body or being skilful in a physical activity flows over into one's daily life where it can be used to improve mental health (Chia & Wang, 2002:65). The theory of social interaction states that the social support that is received from other exercisers contributes to the positive effect of exercise on mental health to a large degree (Chia & Wang, 2002:65).

In terms of an association between motor proficiency and self-concept, some researchers indicate that motor proficiency is associated with a good self-concept and that children 5–13 years old with motor problems develop a poor self-concept (Bluechardt *et al.*, 1995:62; Henderson *et al.*, 1989:9; Losse *et al.*, 1991:55; Skinner & Piek, 2001:82). Peens *et al.* (2004:52) further indicate that DCD has a negative effect on the total self-concept as well as physical self-concept of 10–12 year old children in the North West Province of South Africa. This finding supports the results of Losse *et al.* (1991:55) and Skinner and Piek (2001:88). Furthermore, Peens *et al.* (2004:60) found that behaviour, anxiety, intellect, popularity and happiness are influenced by DCD as early as at the age of 10 to 12 years. This negative effect of DCD on children's general well-being could possibly explain why they regularly

motor problems of children is emphasised. Research by Faul (1994:23) further reveals that a self-concept improvement programme is advantageous to adolescents, but no information can, however, be found where such programmes are applied to younger children or in combination with a motor enhancement programme. However, some research indicated that expected physical ability (Goodway & Rudisill, 1996:297) and own expected ability (Pless *et al.*, 2001:536) of 4–6 year old children were improved by means of a motor intervention programme.

Various intervention methods, of which the success is still being debated in the literature, are used in the intervention for DCD (Hamilton *et al.*, 1999:423; Leemrijse *et al.*, 2000:252; Mandich, Polatajko, Missiuna & Miller, 2001:139; Miller *et al.*, 2001:204; Missiuna, 2001:4; Pless & Carlsson, 2000:394; Pless *et al.*, 2001:536; Revie & Larkin, 1993:34). Emmanouel *et al.* (1992:1154) report that physical education that is taught through various methods is associated with a positive change in the self-concept of primary school children. With regard to DCD and self-concept, no results of intervention programmes have been documented that show a correlation between motor problems and changes in self-concept in young children. The above-mentioned literature emphasises the importance of research on the effect of a combination of motor and psychological intervention programmes on DCD and self-concept in younger children.

From this literature review it is clear that studies regarding the influence of motor skill intervention on self-concept of especially younger children are lacking. Contradictory results also exist with regard to gender differences, while no information is available regarding ethnic differences. Having extensively studied the literature in this regard, various questions arose that will be addressed in this study. The first research question to be addressed is: What is the influence of DCD on the self-concept and anxiety of 7-9 year old children? If the above show a negative association a further question arises: What is the effect of different intervention programmes on the self-concept, anxiety and motor proficiency of 7-9 year old DCD children. A further question to be answered is whether ethnic and gender differences have an influence on different intervention programmes that are aimed at improving the motor proficiency and self-concept of 7-9 year old DCD children. The final question that needs to be answered is: What is the effect of various neuro-motor difficulties on the success of motor intervention for 7-9 year old DCD children?

motor problems of children is emphasised. Research by Faul (1994:23) further reveals that a self-concept improvement programme is advantageous to adolescents, but no information can, however, be found where such programmes are applied to younger children or in combination with a motor enhancement programme. However, some research indicated that expected physical ability (Goodway & Rudisill, 1996:297) and own expected ability (Pless *et al.*, 2001:536) of 4–6 year old children were improved by means of a motor intervention programme.

Various intervention methods, of which the success is still being debated in the literature, are used in the intervention for DCD (Hamilton *et al.*, 1999:423; Leemrijse *et al.*, 2000:252; Mandich, Polatajko, Missiuna & Miller, 2001:139; Miller *et al.*, 2001:204; Missiuna, 2001:4; Pless & Carlsson, 2000:394; Pless *et al.*, 2001:536; Revie & Larkin, 1993:34). Emmanouel *et al.* (1992:1154) report that physical education that is taught through various methods is associated with a positive change in the self-concept of primary school children. With regard to DCD and self-concept, no results of intervention programmes have been documented that show a correlation between motor problems and changes in self-concept in young children. The above-mentioned literature emphasises the importance of research on the effect of a combination of motor and psychological intervention programmes on DCD and self-concept in younger children.

From this literature review it is clear that studies regarding the influence of motor skill intervention on self-concept of especially younger children are lacking. Contradictory results also exist with regard to gender differences, while no information is available regarding ethnic differences. Having extensively studied the literature in this regard, various questions arose that will be addressed in this study. The first research question to be addressed is: What is the influence of DCD on the self-concept and anxiety of 7-9 year old children? If the above show a negative association a further question arises: What is the effect of different intervention programmes on the self-concept, anxiety and motor proficiency of 7-9 year old DCD children. A further question to be answered is whether ethnic and gender differences have an influence on different intervention programmes that are aimed at improving the motor proficiency and self-concept of 7-9 year old DCD children. The final question that needs to be answered is: What is the effect of various neuro-motor difficulties on the success of motor intervention for 7-9 year old DCD children?

By answering the above-mentioned questions, teachers, kinderkineticists and therapists who work with children will be enabled to handle the problems of DCD children in an informed manner. Furthermore, the knowledge gained, can assist kinderkineticists and psychologists in aiding DCD children of different genders and ethnic groups more effectively. The results of the study could also assist the specialists in the various fields in planning interventions that are developed and tested in this study more efficiently. If the intervention programmes prove to be successful, it may be implemented in schools in order to deal with children with specific needs in motor development and self-concept areas effectively and professionally.

1.3 Aims

The aims of this research are:

1.3.1 to determine whether DCD has an influence on the self-concept and anxiety of 7-9 year old children in the Potchefstroom district;

1.3.2 to determine the effect of various intervention programmes on the self-concept, anxiety and motor proficiency of 7–9 year old DCD children in the Potchefstroom district;

1.3.3 to determine whether ethnic and gender differences have an influence on different intervention programmes that are aimed at improving the motor proficiency, self-concept and anxiety of 7–9 year old DCD children in the Potchefstroom district; and

1.3.4 to determine the effect of various neuro-motor difficulties on the success of motor intervention for 7-9 year old DCD children in the Potchefstroom district.

1.4 Hypotheses

The hypotheses of this research are as follows:

1.4.1 DCD has a negative influence on the self-concept and anxiety of 7–9 year old children in the Potchefstroom district.

1.4.2 An intervention programme based on psycho-motor intervention will have the best effect on the self-concept, anxiety and motor proficiency of 7–9 year old DCD children in the Potchefstroom district.

1.4.3 Gender and ethnic differences will have no influence on different intervention programmes that are aimed at improving motor proficiency, self-concept and anxiety of 7–9 year old DCD children in the Potchefstroom district.

1.4.4 Underlying neuro-motor problems will have a negative effect on the success of motor intervention for 7-9 year old DCD children in the Potchefstroom district.

1.5 Structure of thesis

This thesis is offered in article format. The structure of the thesis is as follows:

1.5.1 Chapter 1 contains the problem, aims, hypotheses and structure of the study.

1.5.2 Chapter 2 offers a literature review on the possible relations between Developmental Coordination Disorder (DCD), self-concept and anxiety. This chapter also discuss literature regarding the effect of various intervention methods on motor deficiencies as well as self-concept.

The bibliographies of Chapters 1 and 2 follow directly after Chapter 2 and are cited according to the Harvard requirements as requested by the North-West University for a thesis.

1.5.3 The method of research is set out as part of Chapters 3, 4, 5 and 6 which contain the 4 articles regarding the aims of the study. These articles are presented according to the guidelines of the specific journals to which the specific article was submitted. These guidelines are attached as appendixes (A-D) at the end of the thesis.

All the chapters of the thesis will have the same margins, while line spacing will vary between one and a half and double spacing.

Chapter 3: The influence of DCD on the self-concept and anxiety of 7-9 year old children.
Journal: African Journal for Physical, Health Education, Recreation and Dance.
Guidelines for authors: Appendix A.

Chapter 4: The effect of different intervention programmes on the self-concept and motor proficiency of 7-9 year old DCD children.
Journal: Child: Care, Health and Development.
Guidelines for authors: Appendix B.

Chapter 5: The role of gender and ethnic differences on the effect of various intervention programmes for 7-9 year old DCD children.
Journal: Child: Care, Health and Development.
Guidelines for authors: Appendix C.

Chapter 6: The effect of various neuro-motor difficulties on the success of motor intervention for 7-9 year old DCD children.
Journal: Adapted Physical Activity Quarterly.
Guidelines for authors: Appendix D.

1.5.4 Chapter 7 contains the summary, conclusions and recommendations of the study.

1.5.5 Appendixes. Appendixes follow at the end of the thesis which include the following:
Appendix A: Guidelines for authors for the African Journal for Physical, Health Education, Recreation and Dance.
Appendix B: Guidelines for authors for the Child: Care, Health & Development.
Appendix C: Guidelines for authors for the Child: Care, Health & Development.
Appendix D: Guidelines for authors for the Adapted Physical Activity Quarterly.
Appendix E: Information letter to the headmasters concerning the study. (On account of the fact that the home language of all the headmasters was Afrikaans, the letter is only presented in Afrikaans).

Appendix F: Guidelines for teachers to identify possible DCD candidates (Afrikaans and English versions).

Appendix G: Informed consent documents that had to be signed by the parents (Afrikaans and English versions).

Appendix H: Motor intervention programme that the children were subjected to.

Appendix I: Letter stating that article 1 (Chapter 3) is in the review process of the African Journal for Physical, Health Education, Recreation and Dance.

Appendix J: Letter stating that article 2 (Chapter 4) is in the review process of the Child: Care, Health and Development.

Appendix K: Letter stating that article 3 (Chapter 5) is in the review process of the Child: Care, Health and Development.

Appendix L: Letter stating that article 4 (Chapter 6) is in the review process of the Adapted Physical Activity Quarterly.

Due to copy right protection the instructions of the Movement Assessment Battery for Children, Tennessee Self-Concept Scale (Child Form), Child Anxiety Scale, Bruininks Oseretsky Test of Motor Impairment — Short Form, Quick Neurological Screening Test and Sensory input measurement instrument are not included in the thesis. All the guidelines for authors were typed over to suit the format of the thesis.

The self-concept enhancing programme can be found in the Master's Dissertation of Hugo (2005:19) with the title: "The development and evaluation of a self-concept enrichment programme for children aged 7-9 years" as she developed and conducted this programme for this specific study.

The literature review of the study will subsequently follow in Chapter 2.

CHAPTER 2

A LITERATURE OVERVIEW OF MOTOR IMPAIRMENT AND SELF-CONCEPT RELATED PROBLEMS AND INTERVENTION METHODS FOR CHILDREN WITH DEVELOPMENTAL COORDINATION DISORDER

2.1 Introduction

Research proof exists that the self-concept of children is influenced by motor problems such as Developmental Coordination Disorder (DCD) (Dekel, Tenenbaum & Kudar, 1996:139; Piek *et al.*, 2000:268; Skinner & Piek, 2001:87). Furthermore, it appears that DCD has certain implications with regard to the child's overall well-being (Fox & Lent, 1996:1970). A variety of problems are also associated with DCD that makes the condition difficult to remediate (Cairney *et al.*, 2005:67; Henderson & Sugden, 1992:127). However, research findings exist that proved that motor skill intervention can improve children's motor proficiency (Bunker, 1991:467; Pless & Carlsson, 2000:395) as well as their self-concept (Bunker, 1991:467; Henderson & Sugden, 1992:127). Controversy does, however, still exist concerning the most appropriate method of intervention for children with DCD, and also of improving the self-concept of young children. The question as to whether boys and girls will benefit to the same degree when they are exposed to such programmes, seeing that differences in the development of their self-concept are indicated, also remains.

The first aim of this study is to determine the effect of DCD on the self-concept and the anxiety of 7-9 year old children living in the Potchefstroom district. The effect of various intervention programmes on the self-concept, anxiety and motor proficiency of these children diagnosed with DCD needs to be determined as a second aim. Additionally, it needs to be determined whether ethnic and gender differences have an influence on the success of the different intervention programmes aiming at improving the motor proficiency and self-concept of these DCD children. Lastly, this study intends to determine the effect of various neuro-motor difficulties on the success of the motor intervention for these 7-9 year old DCD children. It is thus important to analyse the literature in this regard in order to explore literature findings regarding these aims.

Literature was firstly studied to gain an overview of the self-concept development, anxiety and possible differences between the genders and different ethnic groups. Motor development are then discussed with specific emphasis on problems such as DCD that children experience. Other problems associated with DCD will also be discussed. Gender and ethnic differences in children with DCD will further be explored and discussed. The association between motor problems, such as DCD, and other problems such as a poor self-concept, anxiety and certain neuro-motor problems will also be studied, and findings in this

regard will be highlighted in this chapter. Different intervention methods for the enhancement of motor proficiency will also be discussed here. These different intervention methods were studied in order to gain insight into the appropriateness of the different intervention programmes. A short discussion on self-concept enhancement activities will also be included at the end of the chapter. In the following section, self-concept development, anxiety and possible differences with regard to gender will be discussed.

2.2 Self-concept

Self-concept can be seen as the umbrella term under which various variations of the self, such as self-image and self-worth, is characterised (Gallahue & Ozmun, 1989:344). Researchers have concluded that the self-concept is multi-dimensional (Marsh & Redmayne, 1994:47; Mboya & Mwamwenda, 1996:1235; Bracken *et al.*, 2000:484) and comprises of a variety of components such as behaviour, intellectual and school competency, physical appearance and athletic abilities, anxiety, popularity, social and moral acceptance, family acceptance, personality, happiness and satisfaction (Bracken *et al.*, 2000:484; Fitts & Warren, 1996:3; Piers, 1984:1).

Furthermore, self-concept can be described as a feeling of self-worth and the acceptance or rejection of the self as a result of self-evaluation (Chow, 2002:47) from observing his/her own behaviour, observing how others act towards him/her and by evaluating him/herself socially (Roux & Malan, 2001:90). The larger the discrepancy between the components that are regarded as important and the children's ability or competency to perform these components, the lower the self-concept will be (Harter, 1993:91). This is offered as a reason why a low self-concept is reported in children who feel that they are not competent in a component in which they expect to be successful (Harter, 1993:91). According to Bunker (1991:467), teachers should therefore offer opportunities to children to become successful, seeing that children develop better self-confidence and self-concept as a result of a successful experience, especially in the motor domain.

2.2.1 Self-concept and gender

Most researchers found that boys have a higher total (Garcia *et al.*, 1995:216; Stein *et al.*, 1998:6) as well as physical self-concept (Crocker *et al.*, 2000:391; Hagger *et al.*, 1998:150; Smith & Croom, 2000:315; Stein *et al.*, 1998:6) than girls.

Watkins *et al.* (1997:374) and Hay *et al.* (1998:464) found that boys showed significantly higher self-perceptions in most non-academic areas, while Hay *et al.* (1998:464) reported higher reading self-concepts among girls. Factors that appear to have a significant influence on peer relations, especially for boys, are physical competence (Evans & Roberts, 1987:23) as well as how they compare in athletics relative to their peers (Kavussanu & Harnish, 2000:236). In this regard, Brutsaert (1990:435) found that the higher boys' sense of mastery over the environment, the higher their self-concept, while girls who feel that they are instrumentally involved in their achievements will develop a higher level of self-concept. Crocker *et al.* (2000:386) stated that, although boys showed significantly higher physical activity, sport and strength competence scores, the relationship between physical activity and physical self-perception was similar in both boys and girls.

2.3 Anxiety

Anxiety can be defined as an increased arousal accompanied by generalized feelings of fear or apprehension (Baron, 1995:559). It is also indicated that some children turn to drugs to temporarily escape the anxiety, while others suffer in silence until at that time that their inner tensions become unbearable, they commit suicide (Gillis, 1980:1).

2.3.1 Anxiety and gender

With regard to anxiety between the two genders, Ohannesian *et al.* (1999:403) and Rose *et al.* (1999:10) stated that girls are significantly more anxious than boys, while Sigurdsson *et al.*

(2003:18) stated that the anxiety of boys is associated with motor impairment, while it is not the case with the anxiety of girls.

A discussion of the motor development and specifically the motor problems that children experience will now follow.

2.4 Motor development

Playing is an important aspect in young children's development, as they need movement to learn more about their world (Bunker, 1991:467). In this regard, Bunker (1991:467) states that they must move to learn and learn to move. Gallahue and Ozmun (1989:344) further state that children's emotions depend on their playing behaviour, both successful and unsuccessful.

2.4.1 Developmental Coordination Disorder

Literature shows that children with motor deficiency or coordination disorders (also known as clumsiness) regularly withdraw from participation in exercise and activities, which in turn can affect their total well-being (Boufford *et al.*, 1996:64; Hay & Missiuna, 1998:68; Schoemaker & Kalverboer, 1994:130; Smyth & Anderson, 2000:407). The literature further shows that at least one out of every ten children in a normal population suffers from a coordination disorder (Dussart, 1994:85), a problem that the DSM-IV refers to as Developmental Coordination Disorder (DCD) (American Psychological Association, 1994:53). This condition is diagnosed as a motor problem, while the child has normal intelligence and no known neurological condition or physical disability. These motor problems interfere with the routine of children's daily living as well as with their academic performance (APA, 1994:53). Researchers indicate that children with DCD experience problems with a variety of tasks and activities on a daily basis. This includes holding crayons, scissors and cutlery, throwing and kicking a ball, tying shoe laces and fastening buttons (Fox & Lent, 1996:1966) and doing activities such as washing, dressing, eating,

walking to school, turning a page in a book, writing an essay, riding roller-skates and undressing (Henderson & Sugden, 1992:127).

Some other problems that are also associated with DCD are: the development of a poor self-concept (Henderson *et al.*, 1989:9; Skinner & Piek, 2001:84); a poor physical self-perception (Piek *et al.*, 2000:268; Skinner & Piek, 2001:88); socialization problems (Dewey *et al.*, 2002:914; Fox & Lent, 1996:1966); academic related problems (Dussart, 1994:81; Fox & Lent, 1996:1966; Fox, A.M., 2000:3); and anxiety in dealing with motor tasks (Ashman & Van Kraayenoord, 1998:399; Rose *et al.*, 1999:10; Schoemaker & Kalverboer, 1994:130; Skinner & Piek, 2001:87).

2.4.2 Nature of problems associated with DCD

Vision problems (Mon-Williams *et al.*, 1996:179; Sigmundsson & Hopkins, 2005:158; Van Waalvelde *et al.*, 2004:666), slow movement times (Henderson *et al.*, 1992:901; Huh *et al.*, 1998:483; Missiuna, 1994:232) and problems when working under pressure of time (Rodger *et al.*, 2003:463) are also documented to be linked to DCD. In this regard, some researchers also stated that DCD children are known to display vision related deficits such as in the use of visual feedback (Lord & Hulme, 1987a:255), visual perception (Lord and Hulme, 1987a:255; Mon-Williams *et al.*, 1996:179), visual motor integration (Van Waalvelde *et al.*, 2004:665), visual discrimination (Van Waalvelde *et al.*, 2004:665) and visual recognition (Sigmundsson & Hopkins, 2005:157). Some of these researchers found that visual perception, visual feedback (Lord & Hulme, 1987a:250) and visual recognition problems (Sigmundsson & Hopkins, 2005:157) contribute to the clumsiness of movements observed in children with DCD. Van Waalvelde *et al.* (2004:665), however, found that the association between visual-perceptual deficits and motor tasks seems to be task specific and that the visual-perceptual impairment of some of the children with DCD is not related to their motor impairment. In agreement with this, a study by Rodger *et al.* (2003:641) claimed that DCD children performed in the average range in a visual motor integration test. Other neuro-motor function problems related to DCD are kinaethesis (Hoare & Larkin, 1991b:676; Lord & Hulme, 1987b:722; Piek & Coleman-Carman, 1995:981), reflexes (Cheatum & Hammond,

2000:60) and vestibular functioning (Cheatum & Hammond, 2000:149). This variety of problems makes intervention of DCD children difficult.

Follow-up studies of children with DCD, 18 months (Barnett & Henderson, 1992:341), 5 years (Geuze & Börger, 1993:19) and 10 years later (Cantell *et al.*, 1994:125; Losse *et al.*, 1991:55) showed that these children still experienced motor coordination problems. Thus the importance of early intervention for these children is clear.

2.4.3 Ethnic and gender differences and DCD

With regard to gender differences, it is generally found that boys are diagnosed with DCD (Fox, A.M., 2000:3; Maldonado-Duran *et al.*, 2002:5; Missiuna, 1994:227; Sugden & Sugden, 1991:329) more frequently than girls, although Dussart (1994:83) indicated no relationship between DCD and gender. Generally, a ratio of 2-3:1 for boys:girls is documented in the literature (Sugden & Sugden, 1991:329). Literature with regard to ethnic differences and DCD could not be found. However, some literature indicates that certain culture groups do differ with regard to the occurrence of DCD (Maldonado-Duran *et al.*, 2002:5).

From the literature it is clear that self-concept and impaired motor development play an important role in the overall development of children. For this reason associations between motor problems and self-concept found in the literature, will subsequently be discussed.

2.5 Association between motor problems, self-concept and anxiety

Motor problems seldom appear in isolation in children and it is emphasised by Hoare and Larkin (1991a:7) that a school career without problems is rather the exception than the rule for these children. Some of the most common problems found to go hand in hand with coordination problems are a poor self-esteem, under achievement at school and loneliness

(Henderson & Sugden, 1992:127). Challenges such as throwing and catching and the movement of the body through space aid in building a child's self-esteem and personal identity (Bunker, 1991:468). It therefore seems that movement activities offer opportunities for children to gain confidence in their abilities, to investigate their abilities and to learn from themselves and their environment (Bunker, 1991:467). Children can also learn who they are and what they are capable of doing through games and playing. Therefore, it is important that children ought to be exposed to a wide variety of activities such as throwing, catching, kicking and running (Bunker, 1991:468). Physical education in schools also offers the opportunity for children to develop their physical abilities and to take part in a wide variety of physical activities that offer them intrinsic motivation (Chow, 2002:49). Children with motor problems can, however, develop low perceptions of their physical abilities which lead them to withdraw or avoid any physical activity situations (Causgrove Dunn & Watkinson, 1994:282; Chen & Cohn, 2003:69).

However, controversial findings with regard to the relationship between motor problems and self-concept still remain. Various researchers indicate that good motor skills can be associated with a good self-concept while children with motor problems had a lower self-concept (Cairney *et al.*, 2005:67; Peens *et al.*, 2004:59; Bluechardt *et al.*, 1995:55; Henderson *et al.*, 1989:9; Losse *et al.*, 1991:55; Skinner & Piek, 2001:84). Studies by Piek *et al.* (2000:268) and Skinner and Piek (2001:87) also found that children with DCD have lower self-perceptions in the athletic domain. Chow (2002:45), however, found that physical ability does not directly affect the self-concept, but that it should be seen to subjectively form a physical self-perception which then influences the self-concept. For this reason, researchers believe that children's feelings about themselves can be improved through exposure to success related experiences in the physical domain (Fox, 1992:35).

In contrast, Dussart (1994:84) and Maeland (1994:128) is of the opinion that the self-concept and specifically the physical domain of the self-concept of 10 year old children, as measured by the Piers-Haris Self-concept Scale for primary school children, and the Harter scale, cannot be linked to DCD. Arnold and Chapman (1992:99) also found that 15 – 17 year old adolescents with physical deficits, when compared with people without physical deficits, did not exhibit different levels of self-concept. Furthermore, Causgrove Dunn and Watkinson (1994:282) believe that the presence of movement problems does not necessarily lead to perceptions of incompetence.

Furthermore, it seems that physical activity is associated in a positive way with emotion (affect), mood and psychological health (Biddle, 2000:83). It is apparent that there is a positive relation between moderate intensity exercise and psychological health (Biddle, 2000:86). Paluska and Schwenk (2000:167) further found that physical activity can play an important role in the treatment of mild to moderate mental conditions, especially depression and anxiety. Although people with depression are inclined to be less active than those who do not suffer from depression, increased aerobic exercise and strength training appears to lessen the symptoms of depression significantly. In contrast, it appeared that everyday activity cannot prevent depression, but anxiety and stress conditions do improve with regular exercise and the positive effects achieved are the same as obtained from meditation and relaxation (Paluska & Schwenk, 2000:177). These researchers do, however, state that people with acute anxiety react better to exercise than those with chronic anxiety. Fox *et al.* (2000:5) also confirmed that an increased participation in exercise can have an important impact on the prevention of sub-clinical levels of mental conditions in people in the general public. Steptoe and Butler (1996:1789) further state that emotional wellness is positively associated with participation in sport and intense recreational activity during adolescence. Furthermore, Taylor (2000:17) found that less active children reported twice the anxiety levels compared to active children. A general relationship could, however, not be found. This could be due to less anxious individuals being more attracted to physical activity and exercise, in comparison to anxious individuals (Taylor, 2000:17). All types of physical activity (aerobic, strength training) are therefore not regarded in the same light by all individuals. Thus the effect of physical activity on mental health appears to be very individual (Biddle, 2000:77).

According to Fox, K.R. (2000b:98), physical self-worth is related to mental health and must be considered as an important outcome of exercise. A positive effect can be experienced by both genders and all age groups. There is, however, proof that children and middle aged adults experience greater positive change after exercise (Fox, K.R., 2000a:235). The positive effects of physical activity on a person's self-worth are inclined to be more marked in individuals with lower self-esteem and although it is difficult to include an individual with low self-esteem in physical activity programmes, the effects are inclined to be greater in them (Fox, K.R., 2000a:235).

A variety of exercises are seen as effective for use in changing self-perceptions, but most evidence supports aerobic and strength exercises, with strength exercise showing the greatest effect in the short term (Fox, K.R., 2000a:235). Children with physical problems, however, withdraw from physical activity, which in turn leads to a lack of physical exercise opportunities. This decreased exercise time inhibits the further development of culturally normative skills which, in turn, increases the participation differences between children and their peer group (Wall *et al.*, 1990:301). Children with physical problems will possess less procedural knowledge than their peers; hence the correctness with which they perform tasks will not be sufficient (Wall *et al.*, 1990:301). Exercise can therefore be used as a medium to increase physical self-worth and other important physical self-perceptions such as self-image. In some situations some of the improvements are accompanied by an increase in self-esteem (Fox, K.R., 2000a:235).

Further important findings were that an improvement in motor proficiency may lead to an improvement in total self-concept (Peens *et al.*, submitted for publication) as well as physical self-concept for both boys and girls (Salokun, 1994:752). Researchers are therefore of opinion that self-concept can be improved by participation in physical activity (Colchico *et al.*, 2000:977; Goni & Zulaika, 2000:246; MacMahon, 1990:344) and that exercise contributes more to the improvement of the physical self-concept than to the total self-concept (Alfermann & Stoll, 2000:53; Fox, K.R., 2000a:239). In this regard, March *et al.* (1997:369) and Welk *et al.* (1995:160) found that non-athletes had a lower physical self-concept than athletes. It therefore is clear that exercise can be associated with the improvement of the self-concept.

Children who perceive themselves to be less skilled than others can react differently to both success and failure. When they are successful, they are worried that it is only a coincidence, but when they fail, they blame themselves (Henderson & Sugden, 1992:134). These reactions usually mean that they are not in a state of experiencing immediate pleasure and when they do not succeed, they are convinced that this is an example of how they disappoint people.

Children with physical problems generally do not know how to approach movement problems, have a poor idea of how to analyse the instructions to do the task and do not possess the planning ability that is necessary for them to learn on their own (Wall *et al.*,

1990:304). It is for this reason that children with movement problems are less able to learn on their own and take the rules and demands of a task into account (Henderson & Sugden, 1992:136).

The manner in which movement tasks are demonstrated to children, the way in which they are encouraged to find a solution and the way in which feedback is given should therefore all be manipulated into ways to help children grow from where they are not aware of what they see and feel, to a state where they can perform specific movement skills with little or no help (Henderson & Sugden, 1992:134). Therefore it is important to use intervention strategies to guide children to a better performance.

The importance of intervention for children with poor motor proficiency as well as different intervention methods that are used will be discussed in the following section.

2.6 Motor intervention methods for DCD

Some people still believe that children with writing, fine and gross motor problems, clumsiness and balance problems do not require intervention (Missiuna, 2001:1). There are teachers that do, however, initiate referrals of such children as a result of the huge influence that these types of problems have on the children's participation in the classroom and on the playground (Missiuna, 2001:1). The advantages of a physical lifestyle are available to all children (Chia & Wang, 2002:64), and intervention can increase the individual's awareness of his/her motor competence (Pless *et al.*, 2001:532). Gurlanick (1991:174) further found that the ability of early intervention programmes to lessen development problems can be seen as significant. Other research in this regard (Pless & Carlsson, 2000:381) recommend specific skill intervention at least three to five times a week.

Henderson and Sugden (1992:127) further give important reasons why intervention should be offered to children with motor problems. Firstly, it is stated by them that by improving the motor ability, the door to complete participation in activities for daily life is opened and it can in turn aid with associated problems such as poor learning strategies and low self-esteem (Henderson & Sugden, 1992:127). These strategies that are adopted by children to perform

movement skills will, to a great extent, determine how successful the action will be. The amount of motor control that the children have will influence the strategy that they adopt. Furthermore, the emotional state of the child also has an influence on his motor skills. Their motor skills will also influence their willingness to participate in movement learning situations as well as their ability to evaluate their abilities realistically (Henderson & Sugden, 1992:127). According to Wall *et al.*, (1990:309), another important aim is the forming of strategies to motivate children with motor problems to exercise on their own effectively or with assistance from others during scheduled instructions and free playtime. They must be taught to learn about the apparatus and the physical layout of the environment (inside and outside), as well as to facilitate their own learning (Wall *et al.*, 1990:309). Mandich, Polatajko, Macnab and Miller (2001:52) also suggest that treatment methods must be based on the principle that skill learning occurs due to the interaction between the child, the task and the environment.

As a result of the diversity of motor problems that children experience, there are various intervention methods described in the literature that could be used for the intervention of motor proficiency (Mandich, Polotajko, Macnab & Miller, 2001:55; Pless & Carlsson, 2000:381). One of the main aims of this study was to determine the effect of different intervention programmes for DCD children. Therefore it is necessary to discuss, in the following section, the different intervention methods used for the enhancement of motor proficiency.

2.6.1 Intervention by means of parent leadership

The parent's primary role in this motor intervention is to present the lesson plan to the child (Hamilton *et al.*, 1999:421). The lesson plan is supplied to the parent by the primary supervisor. To be able to present the lesson plan, the parent must attend a 15-minute session before each lesson. During this time, two skills are explained to the parents that they must teach their children during the lesson. It includes a visual and verbal demonstration by the supervisor. Apparatus and stations are set up in the gymnasium where the activities are facilitated, and parents are given the opportunity for questions and answers after each lesson

and demonstration. A minimum of two skills are taught by the parent to the child, and specific components of the skill are emphasised during each lesson. The primary supervisor is present while the parent presents the lesson, so that feedback can be given on where a skill is not executed correctly or for any other assistance to the parent. The programme consists of movement based songs, activities where both parent and child can participate as well as opportunities for the child to explore various movements (Hamilton *et al.*, 1999:421). These researchers found that the motor skills of children aged 3 to 5 years improved significantly after completing a parent supported intervention. According to Sugden and Chambers (2003:545), the motor abilities of children aged 7 to 9 years who followed a parent supported intervention programme improved to the same degree as those children who followed the same programme that was offered by a teacher. It can therefore be concluded that parent supported intervention is effective for children with motor deficiencies.

2.6.2 Le Bon Départ (LBD)

The rationale behind LBD is that motor performance is positively influenced by the development of rhythm (Leemrijse *et al.*, 2000:251). Treatment using LBD is greatly individualised and can be used to address specific problems experienced by the child, for example writing or ball skills. Various musical instruments such as drums, castanets and flutes are used in the LBD as well as apparatus such as ribbons, balls, bean bags and stationary (Leemrijse *et al.*, 2000:251).

Treatment with LBD is divided into a preparation phase, a main learning phase and a period of variations. In the preparation phase, general rules and methods are taught through simple games. The children listen to sounds and study geometric figures by following them visually and with their hands. In the main learning phase, geometric figures and extra songs are the essential components in a structured set of exercises. The figures are changed into body experiences, which range from walking in a circle to drawing a triangle. External rhythm is supplied by the therapist and the songs are sung by the therapist and/or the child. The rhythm of the music supports the coordination of movement and defines its time. When the child is able to execute the figures in a well coordinated manner, the exercise is made more difficult by changing some of the characteristics of the basic figure and the accompanying music

(Leemrijse *et al.*, 2000:251). According to Leemrijse *et al.* (2000:254), LBD is a valuable method of treatment for children with DCD, and the motor skills of the children who followed this programme improved significantly.

2.6.3 Sensory integration (SI)

SI is a non-cognitive, movement based therapy that was developed by Ayres (1972:8). Ayres defines the aim of SI as increasing the brain's capacity to perceive and organize sensory information for a normal response and in so doing, lays the foundation for mastering of academic tasks (Leemrijse *et al.*, 2000:251; Sigmundsson *et al.*, 1998:102).

Mandich, Polatajko, Macnab and Miller (2001:56) state that the SI approach is further developed to provide the necessary sensory stimulation to children to facilitate motor adaptation and higher cortical learning. Furthermore, Pless and Carlsson (2000:383) state that it is accepted that the development of cognitive, language, academic and motor skills are dependent on sensory integration abilities. It is thus believed that children with sensory-motor problems are inadequate in SI and as a result they need help with making adaptive responses to improve the brain process and organize sensory inputs. Proprioceptive, tactile and vestibular stimulation, which includes complete body movement and training in specific perceptual and motor skills, is needed for this therapy. The possible success of this intervention was investigated in children with a large variety of problems, but no clear improvement was found (Pless & Carlsson; 2000:383).

According to Maldonado-Duran *et al.*, (2002:16), SI treatment comprises of specific inputs for a specific child and the facilitating of lengthened adaptation responses. Examples of internal senses are proprioception, awareness of position of the body in general and limb and body parts seperately. The SI approach makes further allowances for a variety of techniques that can be incorporated at home and in the classroom to improve adaptation functions further (Maldonado-Duran *et al.*, 2002:16). The expectation is that SI-therapy will generalize the increased sensory motor function and in so doing will increase motor skills (Maldonado-Duran *et al.*, 2002:16).

In a study conducted by Polatajko *et al.* (1992:332) SI had no effect on academic skills, but it improved motor abilities as much as a perceptual motor programme and participating in no programme at all. Kaplan *et al.* (1993:346), Leemrijse *et al.* (2000:254), Maldonado-Duran *et al.* (2002:16) and Vargas and Camilli (1999:189) also found that SI is as successful as a variety of alternative treatment methods.

2.6.4 Specific skills approach (SSA)

Methods based on this approach include task specific instructions, the knowledge based approach, the attempt based approach and the cognitive-affective approach (Pless & Carlsson, 2000:383). The SSA is based on the assumption that specific motor control and motor learning processes form the basis of skilled movement. These processes encompass the interaction between genetic and experience factors. The key to successful motor programmes is dependent on the correct training of functional skills, combined with sufficient repetitions and enough leadership and time to facilitate skills, automation and generalization. In this approach, the individual must participate actively in the exercise process (Pless & Carlsson, 2000:383).

Task specific intervention is part of the SSA and focuses on the direct learning of the task that must be learnt. It is based on the assumption that performance is the result of learning and that learning is optimal when the learning process focuses directly on the task (Mandich, Polatajko, Macnab & Miller, 2001:62). During this, learning the task is performed in steps which subdivide the task into smaller units. Each unit is then learned separately after which they are joined together (whole-part method) (Mandich, Polatajko, Macnab & Miller, 2001:62). This strategy is used in the development of a specific skill that needs to be addressed. For example, when a child does not know what the aim of the movement is or how to formulate a plan, this strategy is used. Task specification is also used when the child does not understand the aim and the plan of the movement, or when the child knows the plan, but cannot execute the complete movement. The therapist will then adjust the task so that the child can perform the task. Examples of using this strategy is during the task of folding paper planes, learning to manipulate chopsticks and learning to throw a basket ball (Mandich, Polatajko, Missiuna & Miller, 2001:136; Sigmundsson *et al.*, 1998:104). According to Revie

and Larkin (1993:29), children exhibit significant improvement in motor skills after participating in a task specific programme.

2.6.5 Motor skill intervention

The group based motor skill intervention programme was implemented by Pless, Carlsson, Sundelin and Persson in 2000 as well as in 2001. The group based motor skill intervention programme is organised by a gymnastics organization. The children who participated in this programme for 10 weeks were between ages 5 and 6 years. The maximum number of children in each group was 10. The apparatus that was used in a playful manner, included wall bars, horizontal pipes, gymnastic boxes, mats, frisbees, skipping ropes, balls and a tape recorder. The children exercised on the gymnastic apparatus that was laid out in the shape of an obstacle course. They ran, hopped on one leg, practiced long-jump, balanced on the balance beam, did forward rolls, skipped and caught a bouncing ball. At the end of the session they all played a game together. The intervention reflected school and playground activities. The group motor skill intervention is organized in such a way as to ensure that each child can execute the gross motor skills successfully a few times. The instructions were based on motivation and the child could choose how to execute the skill. The understanding was that an effective motor learning situation could also influence the child's individual awareness of motor competence (Pless *et al.*, 2000:185; Pless *et al.*, 2001:352).

2.6.6 Cognitive Orientation to daily Occupational Performance (CO-OP)

CO-OP is a verbal based approach in which the therapist teaches the child to use self-speech or verbal self-guidance problem solving strategies to solve motor problems (Missiuna *et al.*, 2001:70). In this approach the therapist guides the child in the discovery of the domain specific strategy that is needed for performing the task. Verbalising by both the therapist and the child about the discovered strategies is used to guide performance and emphasize strategy learning. Bridging strategies are used to emphasize transference, where the therapist ties the

child's acquired knowledge and strategies and connects them to situations that might occur. Furthermore, the therapist guides the child in investigating how cognitive strategies can be applied in new situations. Briefly, CO-OP is seen as a cognitive based, child centred intervention which enables the child to reach his functional goals (Missiuna *et al.*, 2001:70).

Missiuna *et al.* (2001:70) further state that, when children participate in CO-OP, it develops their meta-cognitive skills effectively which enables them to reconsider their task performance situations. They are also motivated to work towards reaching the goals that they have set for themselves. Current motor learning theories offer support to approaches that focus on child centred goals. It is expected that motor control can originate as a child works on a task for which he/she is motivated to learn. Goals or tasks must be ecologically acceptable, performed in a realistic environment with exercise opportunities and feedback that focus on the child learning to solve motor problems. The child needs a global problem solving strategy to allow him to select, apply, evaluate, monitor and develop task specific cognitive strategies. To facilitate transference and generalization of learning strategies, the child must be led by questioning and motivation to discover these strategies and to focus on the process of selection and the evaluation of their outcomes (Missiuna *et al.*, 2001:70).

In closing, Polatajko *et al.* (2001:102) stated that this approach does not attempt to cure DCD in children. According to these researchers, there is still no proof that the lack of motor coordination in these children can be cured. The success of this approach, which is founded in the learning paradigm to teach children with DCD to use strategies to improve their chances in performance, indicated that it is not a problem that is looking for a cure. It is rather a problem searching for effective learning strategies that will enable children to perform the activities that they must, want or expect to perform (Polatajko *et al.*, 2001:102).

Martini and Polatajko (1998:157) see verbal self-guidance (VSG) as part of the CO-OP method. VSG appears to have good potential in assisting children with DCD to become more skilled in the movement of their choice (Martini & Polatajko, 1998:157). In the USA, the client with DCD is taught a self-instruction strategy, e.g. the client is taught the Goal, Plan, Do, Check to aid him/herself through the daily problems and to reach the goal that he/she has set (Martini & Polatajko, 1998:159). Researchers (Mandich, Polatajko, Missiuna & Miller; 2001:139; Missiuna *et al.*, 2001:75) have further indicated that cognitive treatment plays an

important role when DCD children must learn new motor behaviour and to improving motor skills (Miller *et al.*, 2001:188).

2.6.7 Cognitive motor intervention

In this approach, the emphasis is not merely on motor performance, but emotional, motivating and cognitive aspects are also addressed. Children are taught how to plan, execute and evaluate the quality of the results of their motor performance (Maldonado-Duran *et al.*, 2002:15; Mandich, Ploatajko, Macnab & Miller, 2001:61; Sigmundsson *et al.*, 1998:103). The cognitive-motor approach ties together the performance of the motor ability as a problem solving exercise, which includes the interaction of cognitive, motor and affective elements (Henderson & Sugden, 1992:129). Firstly, a motor performance must be planned, then the children must focus on performing the task and lastly they have to evaluate the success of the activity performed (Henderson & Sugden, 1992:129). Sensory and perceptual processes also form part of the cognitive strategy where vision and kinaesthetic aspects are seen as the most important (Henderson & Sugden, 1992:130). A discussion of these two aspects follows.

2.6.7.1 Visual

Vision is used to determine where the body is in space, to determine the characteristics and position of people and objects in the environment and also whether they are static or moving. Vision is used to satisfy the temporal demands of a task (for example, to determine whether there is sufficient time to cross the road). It is used in slow movements that need precision such as drawing a line within a specific space or controlling a sewing machine. The eyes use two types of information, namely static and dynamic clues. Without the person being aware, the eyes move constantly in the head and the head rotates to widen the field of vision. Under normal circumstances the eye constantly connects the information that is available in the static part, for example shape of an object, with information obtained from the eye movement, such as whether or not the object is moving (Henderson & Sugden, 1992:130).

It is also an approach that is used by some optometrists or trained occupational therapists to address specific problems with ocular motor functioning. Some visually related problems or

problems with visual motor integration interfere with coordinated motor skills as well as equilibrium. Although vision therapy is a widely used approach, the American Academy of Pediatrics declared the use of visual training by eye movements as ineffective and unacceptable for treatment (Maldonado-Duran *et al.*, 2002:17).

2.6.7.2 Kinaesthetic

The term kinaesthetic refers to the information on the position and movement of the body part that is received from the receptors in the muscles, joints and inner-ear (or vestibular system). This type of sensory information is used in every action that is performed, from the act of speech, where awareness is necessary for the relationship between the facial muscles, the tongue and the palate, to the execution of stepping onto an escalator, where it is necessary to be aware of balance and the position of the larger body parts. It is, therefore, always necessary to know where the body parts are in relation to each other and how they contribute to the task that must be performed — before and during the action (Henderson & Sugden, 1992:130). Children with kinaesthetic problems are described as kinaesthetically blind, because they have a poor body perception and suffer from poor vestibular functioning (Henderson & Sugden, 1992:131).

When the senses capture the information available, the brain must simultaneously convert the perceptual information into a plan of action and specify what the various muscles and joints must do to reach the goal of the action. The process that captures sensory information, the combining thereof as a whole and the processing thereof into a plan of action includes the constant interaction between what is immediately available and that which already is available from previous experience (Henderson & Sugden, 1992:131).

Maldonado-Duran *et al.* (2002:17) and Sigmundsson *et al.* (1998:102) further state that the aim of increasing kinaesthetic sensitivity through kinaesthetic methods in children is to increase their motor control and to lower their perceptual-motor dysfunction. This approach attempts to generate an improvement of the general functioning in terms of perception of movement in children, but does not focus on the learning of specific skills as is the case in other methods. People that practice kinaesthetic methods are of opinion that, when the total perception of movement in space is improved, the motor skills will also improve as a secondary outcome (Maldonado-Duran *et al.*, 2002:17; Sigmundsson *et al.*, 1998:102). There

are, however, conflicting opinions concerning the successes of the kinaesthetic methods that are presented by the authors.

2.6.8 Perceptual motor approach (PMA)

This approach supposes that there is a relationship between motor behaviour and underlying perceptual processes. PMA consists of providing the child with a broad series of sensory and motor experiences. The general improvement in motor skills by using this method is seen as a result of the experience of increased sensory and motor tasks (Mandich, Polatajko, Macnab & Miller, 2001:60; Sigmundsson *et al.*, 1998:102).

2.6.9 Neuro-development treatment

This treatment is specifically used to increase gross motor skills, balance, quality of movement, hand usage, hand-eye coordination, self-care skills and perceptual skills in children with motor disturbances (Royeen & Degangi, 1992:175). According to Maldonado-Duran *et al.* (2002:17), the basic principles of this treatment are inhibiting primitive reflexes and abnormal motor coordination patterns. It also improves normal muscle tone and movement patterns.

2.6.10 Combined treatment approach

Treatment methods used must be based on the assumption that skill acquisition emerges from interaction between the child, task and environment. People that used a combined method state that they combine therapeutic techniques prompted by the child's needs. Therefore there are no fixed combinations of techniques or intervention methods that need to be combined (Mandich, Polatajko, Macnab & Miller, 2001:60). Davidson and Williams (2000:497) did, however, found that a combined treatment (sensory integration and

perceptual motor) significantly improved the child's fine motor skills and visual motor integration.

2.6.11 Success of intervention

In summarizing the above literature findings with regard to different intervention methods, it can be stated that proof exists that supports motor skill intervention for children with DCD (Pless & Carlsson, 2000:381; Sugden, 2000:382). It is further apparent that children benefit from the learning of cognitive strategies within a problem solving framework, after which they can implement it in their daily lives (Missiuna, 2001:4). After intervention programmes such as parent supported instructions (Hamilton *et al.*, 1999:423), Le Bon Départ (which focus on rhythmic performance), sensory integration (Leemrijse *et al.*, 2000:252) and participation in cognitive orientation to everyday activities (Miller *et al.*, 2001:204), children's motor participation increased significantly. It was further found that physiotherapy for clumsy children was effective because the motor skills of these children improved (Schoemaker *et al.*, 1994:154). From behaviour observation by means of a video recording during intervention sessions of verbal self-guidance, it is also indicated that cognitive strategies play an important role in learning new motor behaviour in children with DCD (Mandich, Polatajko, Missiuna & Miller, 2001:139).

Physical education that is offered in various ways is also associated with a positive change in self-concept in boys and girls (Emmanouel *et al.*, 1992:1165). Expected competence and social acceptance also increased through participation in a motor skill intervention programme (Goodway & Rudisill, 1996:288). In some cases, it is asserted that the increase is due to the children's increased self-concept with regard to their physical competence and acceptance by friends, which then contributes to an increased willingness to participate in physical activity (Dewey & Wilson, 2001:21). According to Dewey and Wilson (2001:21), practicing physical skills is also only beneficial if it goes hand in hand with an increase in self-concept and motivation to participate in physical activities in daily life. Sensory integration therapy, perceptual motor treatment and learning appear to be equally effective in improving academic and motor performance (Mandich, Polatajko, Macnab & Miller, 2001:65).

Although a "bottom up" (sensory integration, process-orientated treatment, perceptual motor exercise and a combination of the afore-mentioned) approach has a long tradition of use, most empirical data do not support these methods as methods that improve motor proficiency in children with DCD. They also do not support the expected relationship between underlying processes and functional performance. Of the studies that do, however, support the approach, methodological weaknesses, small test groups or a lack of a control group and randomness are found (Mandich, Polatajko, Macnab & Miller, 2001:55). The "top down" approaches (task specific intervention and cognitive approaches) are, on the other hand, relatively new, and studies with regard to the effectiveness thereof are only now appearing. Earlier proof of the use of the "top down" approach in a DCD population indicates that this approach could be very effective in teaching specific tasks and at improving the functional participation of children with DCD (Mandich, Polatajko, Macnab & Miller, 2001:61).

Sims *et al.*, (1996:994) show no differences between kinaesthetic and cognitive affective exercise interventions, although motor performance improved in both these groups when compared with children who did not receive any intervention. These researchers also found that in the kinaesthetic intervention, the control group improved as much as the group that received the intervention. This improvement in the control group was in all aspects except kinaesthetic abilities in which the experimental group received specific therapy. Revie and Larkin (1993:29) found that the task specific intervention method resulted in significant improvement in various tasks that were taught to children 5 – 9 years old. Maldonado-Duran *et al.*, (2002:14), however, came to the conclusion that no single treatment was better than another. Zittel and McCubbin (1996:316) state that children with special needs must be placed in an environment that will generate optimal learning, but which will also be both physically and emotionally safe (Zittel & McCubbin, 1996:316). It therefore is important to ensure that intervention procedures, despite the method, must have a positive effect (Sigmundson *et al.*, 1998:105).

Limited research findings were evident regarding self-concept programmes for children. However, a few activities are described in the literature that could be used as guidelines to possibly improve children's self-concept. These kinds of activities are discussed in the following section.

2.7 Self-concept improvement activities

Researchers (Haynes & Comer, 1990:275) indicate that the self-concept (cognitive-academic, social-interactive, emotional, moral, and speech and language) of children aged 10-12 years increased after participation in a self-concept enhancing school development programme. Some guidelines and activities that seem to be useful in the enhancement of children's self-concept, as described by Halliday (1999:51), will subsequently be discussed.

2.7.1 Challenging educational activities

Children gain experience in activities where their participation is combined with group and individual activities. Games which include ice-breaker games are designed to help children to get to know one another, have fun, run risks and develop the willingness to appear before others. Trust exercises that are designed to build a sense of belonging, team support, empathy and cooperation, by creating opportunities for children to entrust their emotional and physical safety to others are also performed (Halliday, 1999:51). Communication activities that are needed to perform these activities successfully must make them listen and use verbal communication and physical skills to make group decisions.

2.7.2 Initiative

During physical problem solving activities, students learn to communicate, work together and learn from attempts and mistakes. As part of a group, they require problem solving and choice processes to complete a task successfully (Halliday, 1999:51).

2.7.3 Line route activities

These physically challenging activities (line route activities) are performed on specifically constructed structures of varying heights. Participation in these activities assists children in developing self-confidence, decreases their limitations of their own expected abilities and teaches them to be supportive of and motivated towards others (Halliday, 1999:51).

2.7.4 Briefing and debriefing

Briefing is a discussion time at the beginning of the class during which the teacher gives safety guidelines and instructions for activities in general. Teachers must also use this time to outline expectations of the group and individual performance, clarify group and individual responsibilities and assist students to set goals that are linked to self-esteem components (Halliday, 1999:52). Debriefing discussions give students the opportunity to reflect on and analyse the group's activity. This is usually done at the end of the activity with the whole group, in small groups or in a series of one-on-one discussions (Halliday, 1999:52). During this debriefing period, the teacher initiates and facilitates a discussion of specific questions that are designed to focus the students' attention on the self-esteem outcomes. It also offers students the opportunity to identify, process and internalise their own abilities and to shift learning to other environments in various life situations. It also helps children understand how they can implement that which they have learned in other situations in their daily lives (Halliday, 1999:52).

2.7.5 Feeling of belonging

When students feel valuable and are accepted by a group, they experience a feeling of belonging. The unit must include a variety of activities that require problem solving and group cooperation for successful completion (Halliday, 1999:52).

2.7.6 Feelings of worth

Students experience a feeling of worth when they feel that their thoughts, ideas and contributions are valuable and seen as worthwhile by others. Feelings of worth can be increased as teachers assist students in working together, especially in cooperative games and problem solving activities which cannot be performed successfully without the contribution of all in the group (Halliday, 1999:52).

2.7.7 Recognition of uniqueness

To have a high self-concept, students must recognise, respect and celebrate their personal uniqueness. The physical education class is a group experience where students, together with others who can differ largely from themselves, play and learn. As students begin to work together to reach a simple goal, they can learn to see individual differences as threats. By learning to value the differences in others, they can learn to recognize their own strengths and value their own uniqueness. Teachers must supply a variety of group activities which require a number of abilities to be successful, so that all the students will have the opportunity to discover their strengths and use them to contribute to the success of the group (Halliday, 1999:54).

2.7.8 Moral exercise

Moral means that one's performance is in line with a certain moral code which is consistent of the expectations of the culture (Halliday, 1999:55). The challenging educational class can function as a laboratory where students are helped to practice and internalize values such as respect for others, integrity, humility, fairness, friendliness, empathy, truthfulness, loyalty and patience. Many group problem solving activities are designed so that each member must complete a task successfully for the group to be successful (Halliday, 1999:55).

2.7.9 Expected ability

Expected ability is based on the child's self-evaluation of how well he/she performed a given task in relation to others. Self-concept is at least partly based on a student's perception of abilities in areas that are meaningful to him/her (Halliday, 1999:55). To build self-esteem in this area is to assist students in recognizing and reaching their abilities in areas that are important to them (Halliday, 1999:55). When students set and reach goals, their feelings of abilities increase. Teachers should grant time for students to set goals individually and in groups and to evaluate as they get closer to those goals. It is critical that students are aided so that they experience success in their attempts as well as in the completion thereof. It is also important to leave students to choose their own level of risk and when success is experienced, to ask them how the task can be made more difficult/easier. The effect of the success in tasks is much stronger if students themselves chose the level of challenge or increasing the risk. The choice in itself is a successful experience in that students have made a conscious decision to try and overcome their natural unwillingness to perform an intimidating task. Progression in the choice of risks and challenges can mean that a choice has to be made between high and low elements, if the belay is to be hooked on the front or the back, if there should be more or less attention, and if the task will be finalised with crawling, walking or jumping. It is wise to avoid humiliating students by placing them in situations where their lack of skills is displayed, especially if it is not their choice (Halliday, 1999:55).

2.7.10 Encouragement in the acceptance of the self

Students exhibit self acceptance when they realise and accept that they have weak points and limitations as well as strong points and abilities. Students must feel skilled to have a good self-esteem, but they must also accept their own weaknesses and limitations. Freedom to fail in an emotionally safe environment is one of the keys to teaching students that it is all right to exhibit weak abilities and to have weaknesses and limitations. When students are in an environment where they have the freedom to fail, they are more willing to attempt new challenging activities. This again increases feelings of worthiness as they overcome new

challenges. Teachers play an important role in shaping and maintaining the environment through acceptable selection of development strategies and in planning and going through the briefing and debriefing processes. By dissuading negative comments about others, they can learn to prevent the development of a false sense of self-esteem (that originates from the weaknesses of others, to make yourself look stronger and more able). Students are persuaded to be more supportive and motivative toward others when they do not exhibit good abilities or work in an area of weakness (Halliday, 1999:57).

2.7.11 Challenging activities for students with special needs

Challenging educational activities have great potential for the inclusion of a wide variety of students, because of the goals and underlying value that endorsed these activities. The main role of challenging activities is very individualized, so that each participant may give his/her best. By helping students set goals that are realistic, measurable and designed to facilitate positive growth, the teacher makes it possible for all to succeed (Halliday, 1999:57).

With all the above-mentioned activities in mind, it is clear that it is possible that the self-concept of children can be enhanced through activities. Further research can give clarity on the influence that a self-concept intervention programme will have on the self-concept of children with DCD.

2.8 Chapter summary

From this literature study, it is clear that self-concept and motor skills play an important role in the development of a child. Seen from the literature overview, it is evident that motor problems in children such as DCD have a negative effect on their self-concept. It is further seen that DCD does not only influence the self-concept of children negatively but is linked to various other problems such as anxiety and neuro-motor problems.

The literature study further indicated that boys and girls have certain differences with regard to the incidence of DCD and self-concept problems. It is stated that boys normally experience more motor difficulties than girls while, on the other hand, boys have a higher total as well as physical self-concept compared to girls. The literature regarding gender differences in anxiety is controversial in the fact that some researchers indicate that girls with motor problems experience higher anxiety than boys, while others state that motor problems are associated with higher anxiety; only in boys.

The literature study further indicated that there is an association between motor problems and a poor self-concept. Research on the success of intervention methods indicates that motor intervention can play an important role in improving motor proficiency as well as increasing the self-concept. Furthermore, it is also evident that there are certain self-concept enhancing activities that can be used in the improvement of children's self-concept. It therefore seems to be essential to offer intervention programmes to children with DCD or motor problems, who also experience problems with a poor self-concept. The challenge is, however, to find the most appropriate methods in this regard. Although numerous intervention methods are discussed in the literature, it is also clear that one is not necessarily better than the other.

As discussed in the literature study, DCD is linked to various other problems. Of these that came to the fore were the neuro-motor problems that children with DCD experience. These problems varied from vestibular problems to vision problems. It is concluded that it is possible that DCD children with neuro-motor problems will not improve as much after a motor intervention programme than children without any neuro-motor problems.

In conclusion it is therefore stated that children with DCD do have a low self-concept and that gender differences do exist with regard to DCD and self-concept. Furthermore, it is stated that intervention programmes can enhance children's motor proficiency as well as their self-concept. However, it is possible that neuro-motor problems experienced by children could affect their improvement after an intervention programme.

With this literature study as a background the results of the study will be analyzed and discussed in the following four chapters.

2.9 Bibliography

ALFERMANN, D. & STOLL, O. 2000. Effects of physical exercise on self-concept and well-being. *International journal of sport psychology,* 31(1):47-65, Jan.

AMERICAN PSYCHIATRIC ASSOCIATION. 1994. Diagnostic and statistical manual of mental disorders (DSM-IV). 4th ed. Washington, D.C. : Author.

ARNOLD, P. & CHAPMAN, M. 1992. Self-esteem, aspirations and expectations of adolescents with physical disability. *Developmental medicine and child neurology,* 34:97-102.

ASHMAN, A.F. & VAN KRAAYENOORD, C.E. 1998. Educational characteristics of students with high or low self-concept. *Psychology in the schools,* 35(4):391-400, Oct.

AYERS, A.J. 1972. Sensory integration and learning disorders. Los Angeles, Calif. : Western Psychological Services. 287p.

BARANOWSKI, T., BOUCHARD, C., BAR-OR, O., BRICKER, T., HEATH, G., KIMM, Y.S., MALINA, R., OBARZANEK, E., PATE, R., STRONG, W., TRUMAN, B. & WASHINGTON, R. 1999. Assessment, prevalence, and cardiovascular benefits of physical activity and fitness in youth. *Medicine and science in sports and exercise,* 24(6):237-246.

BARNETT, A. & HENDERSON, S.E. 1992. Some observations on the figure drawings of clumsy children. *British journal of educational psychology,* 62:341-355.

BARON, R.A. 1995. Psychology. 3rd ed. Needham heights. : Allyn and Bacon. 728 p.

BIDDLE. S.J.H. 2000. Emotion, mood and physical activity. (*In* Biddle, S.J.H., Fox, K.R. & Boutcher, S.H. *eds.* Physical activity and psychological well-being. New York : Routledge – Taylor and Francis group. p. 63-87.)

BLUECHARDT, M.H., WIENER, W. & SHEPHARD, R. 1995. Exercise programmes in the treatment of children with learning disabilities. *Sports medicine,* 19(1):55-69.

BOSACKI, S., INNERD, W. & TOWSON, S. 1997. Field independence-dependence and self-esteem in preadolescents: does gender make a difference? *Journal of youth and adolescence,* 26(6):691-703, December.

BOUFFARD, M.E., WATKINSON, J., CAUSGROVE DUNN, J.L. & ROMANOW, S.K.E. 1996. A test of the activity deficit hypothesis with children with movement difficulties. *Adapted physical activity quarterly,* 13:61-71.

BRACKEN, B.A., BUNCH, S., KEITH, T.Z. & KEITH, P.B. 2000. Child and adolescent multidimensional self-concept: a five-instrument factor analysis. *Psychology in the schools,* 37(6):483-493, Nov.

BRUTSAERT, H. 1990. Changing sources of self-esteem among girls and boys in secondary schools. *Urban education,* 24(4):432-435.

BUNKER, L.K. 1991. The role of play and motor skill development in building children's self-confidence and self-esteem. *Elementary school journal,* 91(5):467-471, May.

CAIRNEY, J., HAY, J., FAUGHT, B., MANDIGO, J. & FLOURIS, A. 2005. Developmental coordination disorder, self-efficacy toward physical activity, and play: does gender matter? *Adapted physical activity quarterly,* 22:67-82.

CANTELL, M.H., SMYTH, M.M. & ABONEN, T.P. 1994. Clumsiness in adolescence: educational, motor, and social outcomes of motor delay detected at 5 years. *Adapted physical activity quarterly,* 11(2):115-129, Apr.

CAUSGROVE DUNN, J.L. & WATKINSON, E.J. 1994. A study of the relationship between physical awkwardness and children's perceptions of physical competence. *Adapted physical activity quarterly,* 11(3):275-283.

CHEATUM, B.A. & HAMMOND, A.A. 2000. Physical activities for improving children's learning and behaviour: a guide to sensory motor development. Champaign, Ill. : Human Kinetics Publishers. 341 p.

CHEN, H. & COHN, E.S. 2003. Social participation for children with developmental coordination disorder: conceptual, evaluation and intervention considerations. *Physical and occupational therapy in pediatrics,* 23(4):61-78.

CHIA, M. & WANG, J. 2002. Physical activity, exercise and health of the mind in young people. *Journal of physical education and recreation,* 8(1):64-67.

CHOW, E.W. 2002. Self-esteem development through the physical: In search of the theoretical underpinning. *Journal of physical education and recreation,* 8(1):45-52.

COLCHICO, K., ZYBERT, P. & BASCH, C.E. 2000. Effects of after-school physical activity on fitness, fatness, and cognitive self-perceptions; a pilot study among urban, minority adolescent girls. *American journal of public health,* 90(6):977 (2p.) [*In* EBSCOHost : Academic Search Elite, Full display : http://www-sa.ebsco.com] [Date of access: 12 February 2001].

COLEMAN, R., PIEK, J.P. & LIVESEY, D.J. 2001. A longitudinal study of motor ability and kinaesthetic acuity in young children at risk of developmental coordination disorder. *Human movement science,* 20:95-110.

CROCKER, P.R.E., EKLUND, R.C. & KOWALSKI, K.C. 2000. Children's physical activity and physical self-perceptions. *Journal of sports sciences,* 18:383-394.

DAVIDSON, T. & WILLIAMS, B. 2000. Occupational therapy for children with developmental coordination disorder: a study of the effectiveness of a combined sensory integration and perceptual-motor intervention. *The British journal of occupational therapy,* 63(10):495-499.

DAVIES, J. & BREMBER, I. 1999. Boys outperforming girls: an 8-year cross-sectional study of attainment and self-esteem in year 6. *Educational psychology,* 19(1):5-16, Mar.

DEKEL, Y., TENENBAUM, G & KUDAR, K. 1996. An exploratory study on the relationship between postural deformities and body-image and self-esteem in adolescents: the mediating role of physical activity. *International journal of sport psychology,* 27(2):183-196, Apr.

DEWEY, D., KAPLAN, B.J., CRAWFORD, S.G. & WILSON, B.N. 2002. Developmental coordination disorder: associated problems in attention, learning, and psychosocial adjustment. *Human movement science,* 21:905-918.

DEWEY, D. & WILSON B.N. 2001. Developmental coordination disorder: What is it? *Physical and occupational therapy in pediatrics,* 20(2-3):5-27.

DUSSART, G. 1994. Identifying the clumsy child in school: an exploratory study. *British journal of special education,* 21(2):81-86, Jun.

EMMANOUEL, C., ZERVAS, Y. & VAGENAS, G. 1992. Effects of four physical education teaching methods on development of motor skill, self-concept, and social attitudes of fifth-grade children. *Perceptual and motor skills,* 74:1151-1167.

EVANS, J. & ROBERTS, G.C. 1987. Physical competence and the development of children's peer relations. *Quest,* 39:23-35.

FAUL, D. 1994. Die samestelling en evaluering van 'n selfbeeldverbeteringsprogram vir adolessente (Conducting and evaluating of 'n self-concept enrichment programme for adolescents). Potchefstroom : PU vir CHO. (Dissertation – M.A.) 230 p.

FITTS, W.H. & WARREN, W.L. 1996. Tennessee self-concept scale. 2nd ed. Los Angeles, Calif. : Western psychological services. 118 p.

FOX, A.M. 2000. Clumsiness in children. [web:] http://www.ahs.uwo.ca/orcn/orgs/DCD/CLUMS [Date of access: 28 August 2000].

FOX, K.R. 1992. Physical education and the development of self-esteem in children. (*In* Armstrong, N., *ed.* New directions in physical education. Volume 2. Champaign, Ill. : Human Kinetics Publishers. p. 33-53.)

FOX, K.R. 2000a. Self-esteem, self-perceptions and exercise. *International journal of sport psychology,* 31(2):228-240, Apr.

FOX, K.R. 2000b. The effects of exercise on self-perceptions and self-esteem. (*In* Biddle, S.J.H., Fox, K.R. & Boutcher, S.H. *eds.* Physical activity and psychological well-being. New York : Routledge – Taylor and Francis group. p. 88-117.)

FOX, K.R., BOUTCHER, S.H., FAULKNER, G.E. & BIDDLE, S.J.H. 2000. The case for exercise in the promotion of mental health and psychological well-being. (*In* Biddle, S.J.H., Fox, K.R. & Boutcher, S.H. *eds.* Physical activity and psychological well-being. New York : Routledge – Taylor and Francis group. p. 1-9.)

FOX, A.M. & LENT, B. 1996. Clumsy children – primer on developmental coordination disorder. *Canadian family physician,* 42:1965-1971.

GALLAHUE, D.L. & OZMUN, J.C. 1989. Understanding motor development. 3rd ed. Dubuque, Ia. : Brown and Benchmark. 570 p.

GARCIA, A.W., BRODA, M.A.N., FRENN, M., COVIAK, C., PENDER, N.J. & RONIS, D.L. 1995. Gender and developmental differences in exercise beliefs among youth and prediction of their exercise behavior. *Journal of school health,* 65(6):213-219.

GEUZE, R. & BöRGER, H. 1993. Children who are clumsy: five years later. *Adapted physical activity quarterly,* 10:10-21.

GILLIS, J.S. 1980. Child anxiety scale. Los Angeles, Calif. : Western Psychological Services. 27 p.

GONI, A. & ZULAIKA, L. 2000. Relationships between physical education classes and the enhancement of fifth grade pupil's self-concept. *Perceptual and motor skills,* 91(1):246-250, August.

GOODWAY, J.D. & RUDISILL, M.E. 1996. Influence of a motor skill intervention program on perceived competence of at-risk African American preschoolers. *Adapted physical activity quarterly,* 13(3):288-301.

GURLANICK, M.J. 1991. The next decade of research on the effectiveness of early intervention. *Exceptional children,* 58:174-183.

HAGGER, M., ASHFORD, B. & STAMVULOVA, N. 1998. Russian and British children's physical self-perceptions and physical activity participation. *Pediatric exercise science,* 10:137-152.

HALLIDAY, N. 1999. Developing self-esteem through challenge education experiences. *Journal of physical education, recreation and dance,* 70(6):51-60.

HAMILTON, M, GOODWAY, J. & HAUBENSTRICKER, J. 1999. Parent-assisted instruction in a motor skill program for at-risk preschool children. *Adapted physical activity quarterly,* 16(4):415-426.

HARTER, S. 1993. Causes and consequences of low self-esteem in children and adolescents. (*In* Baumeister, R.F. *ed.* Self-esteem: The puzzle of low self-regard. New York : Plenum Press. p. 87-116.)

HAY, I., ASHMAN, A.F. & VAN KRAAYENOORD, C.E. 1998. The influence of gender, academic achievement and non-school factors upon pre-adolescent self-concept. *Educational Psychology,* 18(4). [Available on Internet:] wysiwyg:// bodyfram.7/http://globalvgw3.... 20ft% 20y%and%20rv% 20y%20%29& fuzzyTerm [Date of access: 12 February 2001].

HAY, J. & MISSIUNA, C. 1998. Motor proficiency in children reporting low levels of participation in physical activity. *Canadian journal of occupational therapy,* 65:64-71.

HAYNES, N.M. & COMER, J.P. 1990. The effects of a school development program on self-concept. *The yale journal of biology and medicine,* 63:275-283.

HENDERSON, S.E., MAY, D.S. & UMNEY, M. 1989. An exploratory study of goal-setting behaviour, self-concept and locus of control in children with movement difficulties. *European journal of special needs education,* 4(1):1-14.

HENDERSON, L., ROSE, P. & HENERSON, S. 1992. Reaction time and movement time in children with a developmental coordination disorder. *Journal of child psychology and psychiatry and allied disciplines,* 33:895-905, Jul.

HENDERSON, S.E. & SUGDEN, D.A. 1992. Movement assessment battery for children. London : The Psychological Corporation. 240 p.

HOARE, D. & LARKIN, D. 1991a. Coordination problems in children. *National sports research centre,* 18:1-15.

HOARE, D. & LARKIN, D. 1991b. Kinaesthetic abilities of clumsy children. *Developmental medicine and child neurology,* 33(8):671-678, Aug.

HUGO, L. 2005. The development and evaluation of a self-concept enrichment programme for children aged 7-9 years. Potchefstroom : North-West University. (Mini-dissertation-MA) 70 p.

HUH, J., WILLIAMS, H.G. & BURKE, J.R. 1998. Development of bilateral motor control in children with developmental coordination disorder. *Developmental medicine and child neurology,* 40:474-484.

HULME, C., BIGGERSTAFF, A., MORAN, G. & MCKINLAY, I. 1982. Visual, kinaesthetic and cross-modal judgements of length by normal and clumsy children. *Developmental medicine and child neurology,* 24:461-471.

KAPLAN, B.J., POLATAJKO, H.J., WILSON, B.N. & FARIS, P.D. 1993. Reexamination of sensory integration treatment: A combination of two efficacy studies. *Journal of learning disabilities,* 26:342-347.

KAVUSSANU, M. & HARNISCH, D.L. 2000. Self-esteem in children: do goal orientations matter? *British journal of educational psychology,* 70:229-242, Jan.

KELTIKANGAS-JARVINEN, L. 1990. The stability of self-concept during adolescence and early adulthood: a six-year follow-up study. *Journal of general psychology,* 117(4). [Available on Internet:] wysiwyg://bodyfram.7/http://globalvgw3 ....20ft%20y%and%20rv%20y%20%29& fuzzyTerm [Date of access: 12 February 2001].

LEEMRIJSE, C. MEIJER, O.G., VERMEER, A., ADèR, H.J. & DIEMEL, S. 2000. The efficacy of le bon départ and sensory integration treatment for children with developmental coordination disorder: a randomized study with six single cases. *Clinical rehabilitation,* 14:247-259.

LERNER, J. 1993. Learning disabilities: theories, diagnosis and teaching strategies. 6th ed. Boston, Mass. : Houghton Mifflin. 271 p.

LEUPKER, R.V. 1999. How physically active are American children and what can we do about it? *International journal of obesity,* 23(2):12-17.

LORD, R. & HULME, C. 1987a. Perceptual judgements of normal and clumsy children. *Developmental medicine and child neurology,* 29(2):250-257, Apr.

LORD, R. & HULME, C. 1987b. Kinaesthetic sensitivity of normal and clumsy children. *Developmental medicine and child neurology,* 29:720-725.

LOSSE, A., HENDERSON, S.E., ELLIMAN, D., HALL, D., KNIGHT, E. & JONGMANS, M. 1991. Clumsiness in children - do they grow out of it? A 10-year follow-up study. *Developmental medicine and child neurology,* 33:55-68.

MACMAHON, J.R. 1990. The psychological benefits of exercise and the treatment of delinquent adolescents. *Sports medicine,* 9(6):344-351, June.

MAELAND, A.F. 1994. Self-esteem in children with motor coordination problems (clumsy children). (*In* Alston, J., *ed.* Handwriting review. Maidstone : Handwriting Interest Group Committee. p. 128-133.)

MALDONADO-DURAN, M., GLINKA, J. & LUBIN, S. 2002. Motor skills disorder. *EMedicine Journal,* 3(2):1-16.

MANDICH, A.D., POLATAJKO, H.J., MACNAB, J.J. & MILLER, L.T. 2001. Treatment of children with developmental coordination disorder: what is the evidence? (*In* Missiuna, C. *eds.* Children with developmental coordination disorder. New York : Haworth Press, Inc. p. 51-68.)

MANDICH, A.D., POLATAJKO, H.J., MISSIUNA, C. & MILLER, L.T. 2001. Cognitive strategies and motor performance in children with developmental coordination disorder. *Physical and occupational therapy in pediatrics,* 20(2-3):125-143.

MARSH, H.W. & REDMAYNE, R.S. 1994. A multidimensional physical self-concept and its relations to multiple components of physical fitness. *Journal of sport and exercise psychology.* 16(1):43-55, Mar.

MARSH, H.W., ROCHE, L.A. & PERRY, C. 1997. Structure of physical self-concept: elite athletes and physical education students. *Journal of educational psychology,* 89(2):369-380, Jun.

MARTINI, R. & POLATAJKO, H.J. 1998. Verbal self-guidance as a treatment approach for children with developmental coordination disorder: a systematic replication study. *The occupational therapy journal of research,* 18(4):157-181.

MARUFF, P., WILSON, P., TREBILCOCK, M. & CURRIE, J. 1999. Abnormalities of imagined motor sequences in children with developmental coordination disorder. *Neuropsychologia,* 37:1317-1324, Oct.

MBOYA, M.M. & MWAMWENDA, T.S. 1996. Self-concept and locus of control among South African adolescents. *Psychological reports,* 79(3 Part 2):1235-1238, December.

MICHELLE GRAIN, R. & BRACKEN, B.A. 1994. Age, race, and gender differences in child and adolescent self-concept: evidence from a behavioral acquisition, context-dependent model. *School Psychology Reveiw,* 23(3). [Available on Internet:] wysiwyg://bodyfram.7/http://globalvgw3.... 20ft% 20y%and%20rv% 20y%20%29& fuzzyTerm [Date of access: 12 February 2001].

MILLER, L.T., POLATAJKO, H.J., MISSIUNA, C., MANDICH, A.D. & MACNAB, J.J. 2001. A pilot trial of a cognitive treatment for children with developmental coordination disorder. *Human movement science,* 20:183-210.

MISSIUNA, C. 1994. Motor skill acquisition in children with developmental coordination disorder. *Motor skill acquisition,* 214-235.

MISSIUNA, C. 2001. Strategies for success: working with children with developmental coordination disorder. *Physical and occupational therapy in pediatrics,* 20(2-3):1-4.

MISSIUNA, C., MANDICH, A.D., POLATAJKO, H.J. & MALLOY-MILLER, T. 2001. Cognitive orientation to daily occupational performance (CO-OP): Part I - theoretical foundations. (*In* Missiuna, C. *eds.* Children with developmental coordination disorder. New York : Haworth Press, Inc. p. 69-81.)

MON-WILLIAMS, M.A., MACKIE, R.T., MCCULLOCH, D.L. & PASCAL, E. 1996. Visual evoked potentials in children with developmental coordination disorder. *Ophthalmic and physiological optics,* 16(2):178-183.

OHANNESSIAN, C.M., LERNER, R.M., LERNER, J.V. & VON EYE, A. 1999. Does self-competence predict gender differences in adolescent depression and anxiety? *Journal of adolescence,* 22(3):397-411, June.

PALUSKA, S.A. & SCHWENK, T.L. 2000. Physical activity and mental health – current concepts. *Sports medicine,* 29(3):167-180.

PEENS, A., PIENAAR, A.E. & NIENABER, A.W. 2004. Selfkonsep van 10- tot 12-jarige seuns en meisies met en sonder DCD in die Noordwesprovinsie (The self-concept of 10 to 12 year old boys and girls with and without DCD in the North West Province). *Journal for social sciences,* 44(1):52-61, Mar.

PEENS, A., PIENAAR, A.E. & NIENABER, A.W. 2005. The effect of different intervention programmes on the self-concept and motor proficiency of 7-10 year old DCD-children. *Manuscript submitted for publication.*

PIEK, J.P. & COLEMAN-CARMAN, R. 1995. Kinaesthetic sensitivity and motor performance of children with developmental coordination disorder. *Developmental medicine and child neurology,* 37(11):976-984, Nov.

PIEK, J.P., DWORCAN, M., BARRETT, N.C. & COLEMAN, R. 2000. Determinants of self-worth in children with and without developmental coordination disorder. *International journal of disability, development and education,* 47(3):259-272.

PIENAAR, A.E. 2004. Developmental coordination disorder in an ethno-racially diverse African nation: should norms of the MABC be adjusted? *Journal of human movement studies,* 47:75-92.

PIERS, E.V. 1984. Piers-Harris children's self-concept scale. Los Angeles, Calif. : Western Psychological Services. 104 p.

PLESS, M. & CARLSSON, M. 2000. Effects of motor skill intervention of developmental coordination disorder: a meta-analysis. *Adapted physical activity quarterly,* 17(4):381-401, Oct.

PLESS, M., CARLSSON, M., SUNDELIN, C. & PERSSON, K. 2000. Effects of group motor skill intervention of five- to six-year-old children with developmental coordination disorder. *Pediatric physical therapy,* 12:183-189.

PLESS, M., CARLSSON, M., SUNDELIN, D. & PERSSON, K. 2001. Pre-school children with developmental co-ordination disorder: self-perceived competence and group motor skill intervention. *Acta paediatrica,* 90(5):532-538, May.

POLATAJKO, H.J., KAPLAN, B.J. & WILSON, B.N. 1992. Sensory integration treatment for children with learning disabilities: its status 20 years later. *The occupational therapy journal of research,* 12:323-341.

POLATAJKO, H.L.J., MANDICH, A.D., MILLER, L.T. & MACNAB, J.J. 2001. Cognitive orientation to daily occupational performance (CO-OP): Part II – the evidence. (*In* Missiuna, C. *eds.* Children with developmental coordination disorder. New York : Haworth Press, Inc. p. 83-106.)

REVIE, G. & LARKIN, D. 1993. Task-specific intervention with children reduces movement problems. *Adapted physical activity quarterly,* 10:29-41.

RODGER, S., ZIVIANI, J., WATTER, J., OZANNE, A. WOODYATT, G. & SPRINGFIELD, E. 2003. Motor and functional skills of children with developmental coordination disorder: a pilot investigation of measurement issues. *Human movement science,* 22(4-5):461-478.

ROSE, B., LARKIN, D., & BERGER, B.G. 1999. Athletic anxiety in boys and girls with low and high levels of coordination. *The ACHPER healthy lifestyles journal,* 64(2/3):10-13.

ROUX, C.J. & MALAN, J.H. 2001. The effect of selected initiative and cultural activities on the self-concept of young adults at a multicultural institution. *S.A. journal for research in sport, physical education and recreation,* 23(2):89-103.

ROYEEN, C.B. & DEGANGI, G.A. 1992. Use of neurodevelopmental treatment as an intervention: Annotated listing of studies 1980-1990. *Perceptual and motor skills,* 75:175-194.

SALOKUN, S.O. 1994. Positive change in self-concept as a function of improved performance in sports. *Perceptual and motor skills,* 78(3):752-754, Jun.

SANTROCK, J.W. 1993. Children. 3rd ed. Dubuque, Ia. : Brown and Benchmark. 595 p.

SCHOEMAKER, M.M., HIJKEMA, M.G.J. & KALVERBOER, A.F. 1994. Physiotherapy for clumsy children: an evaluation study. *Developmental medicine and child neurology,* 36:143-155.

SCHOEMAKER, M.M. & KALVERBOER, A.F. 1994. Social and affective problems of children who are clumsy: How early do they begin? *Adapted physical activity quarterly,* 11(2):130-140.

SIGMUNDSSON, H. & HOPKINS, B. 2005. Do 'clumsy' children have visual recognition problems? *Child care, health and development,* 31(2):155-158.

SIGMUNDSSON, A., PEDERSEN, A.V., WHITING, H.T.A. & INGVALDSEN, R.P. 1998. We can cure your child's clumsiness! A review of intervention methods. *Scandinavian journal of rehabilitation medicine,* 30:101-106.

SIGURDSSON, E., VAN OS, J. & FOMBONNE, E. 2003. Childhood motor impairment is associated with male anxiety at 11 and 16 years. *Evidence-based mental health*, 6(1):18, Feb.

SIMS, K., HENDERSON, S.E., MORTON, J. & HULME, C. 1996. The remediation of clumsiness II: is kinaesthesis the answer? *Developmental medicine and child neurology,* 38:988-997.

SKINNER, R.A. & PIEK, J.P. 2001. Psychosocial implications of poor motor coordination in children and adolescents. *Human movement science,* 20:73-94.

SMITH, K.E. & CROOM, L. 2000. Multidimensional self-concept of children and teacher beliefs about developmentally appropriate practices. *Journal of educational research,* 93(5):312-321, May.

SMYTH, M.M. & ANDERSON, H.I. 2000. Coping with clumsiness in the school playground: social and physical play in children with coordination impairments. *British journal of developmental psychology,* 18:389-413.

STEIN, R.J. BRACKEN, B.A., HADDOCK, C.K. & SHADISH, W.R. 1998. Preliminary development of the children's physical self-concept scale. *Journal of developmental and behavioural pediatrics,* 19(1):1-8, Feb.

STEPTOE, A. & BUTLER, N. 1996. Sports participation and emotional well-being in adolescents. *Lancet,* 347:1789-1792.

SUGDEN, D.A. 2000. Thy dynamics of optimism. *Quest,* 52:382-391.

SUGDEN, D.A. & CHAMBERS, M.E. 2003. Intervention in children with developmental coordination disorder: the role of parents and teachers. *British journal of educational psychology,* 73:545-561.

SUGDEN, D.A. & SUGDEN, L. 1991. The assessment of movement skill problems in 7- and 9-year old children. *British journal of educational psychology,* 61:329-345.

TAYLOR, A.H. 2000. Physical activity, anxiety, and stress. (*In* Biddle, S.J.H., Fox, K.R. & Boutcher, S.H. *eds.* Physical activity and psychological well-being. New York : Routledge – Taylor and Francis group. p. 11-62.)

VAN WAALVELDE, H., DE WEERDT, W., DE COOK, P. & SMITS-ENGELSMAN, B.O.M. 2004. Association between visual perceptual deficits and motor deficits in children with developmental coordination disorder. *Developmental medicine and child neurology,* 46(10):661-666.

VARGAS, S. & CAMILLI, G. 1999. A meta-analysis of research on sensory integration treatment. *The American journal of occupational therapy,* 53:189-198.

WALL, A.E., REID G. & PATON J. 1990. The syndrome of physical awkwardness. (*In* Reid, G. *ed.* Problems in movement control. North-Holland : Elsevier Science Publishers B.V. p. 283-316.)

WATKINS, D., DONG, Q. & ZIA, Y. 1997. Age and gender differences in the self-esteem of Chinese children. *Journal of social psychology,* 137(3):374-379.

WELK, G.J., CORBIN, C.B. & LEWIS, L.A. 1995. Physical self-perceptions of high school athletes. *Pediatric exercise science,* 7(2):152-161, May.

WRIGHT, H.C. & SUGDEN, D.A. 1996. The nature of developmental coordination disorder: inter- and intragroup differences. *Adapted physical activity quarterly,* 13:357-371.

ZITTEL, L.L. & MCcUBBIN, J.A. 1996. Effect of an integrated physical education setting on motor performance of preschool children with developmental delays. *Adapted physical activity quarterly,* 13:316-333.

CHAPTER 3

THE INFLUENCE OF DCD ON THE SELF-CONCEPT AND ANXIETY OF 7-9 YEAR OLD CHILDREN

The influence of DCD on the self-concept and anxiety of 7-9 year old children

Anquanette Peens (MA, Kinderkinetics)
(Correspondence author)
School for Biokinetics, Recreation and Sport Science
North-West University
Private bag X6001
Internal box 494
Potchefstroom
2520
South Africa
E-mail: mbwap@puknet.puk.ac.za
Phone number: +27 018 299 1797
Fax number: +27 018 299 1825

and
Anita, E. Pienaar (Ph.D Kinderkinetics)
School for Biokinetics, Recreation and Sport Science
North-West University
Private bag X6001
Internal box 616
Potchefstroom
2520
South Africa
Phone number: +27 018 299 1796
Fax number: +27 018 299 1796

Running title: DCD's influence on self-concept and anxiety

ABSTRACT

Background: Literature indicates that children who experience motor problems may have a lower self-concept (Skinner & Piek, 2001) as well as higher anxiety (Rose *et al.*, 1999) than children without movement problems. The aim of this study was to determine whether DCD has an influence on 7-9 year old children's self-concept and anxiety and to determine whether the extent of their motor problems will influence their self-concept and anxiety differently.

Methods: Teachers identified 201 potential DCD candidates. The Movement Assessment Battery for Children (Henderson & Sugden, 1992) identified 66 with DCD (41 boys and 25 girls). Self-concept and anxiety were determined by the Tennessee Self-Concept Scale (Child Form) (Fitts & Warren, 1996) and Child Anxiety Scale (Gillis, 1980) respectively. A correlation matrix as well as independent t-tests were conducted in analyzing the results.

Results: Correlational analysis indicates relationships between motor proficiency, anxiety and self-concept. Children with moderate and severe DCD have normal anxiety but a non-significantly lower self-concept score than what is indicated as the normal range. Children with severe and moderate DCD do not, however, differ statistically significantly from one another with regard to anxiety and self-concept. Girls with severe DCD have a moderately significantly lower moral self-concept ($p=0.09$) than girls with moderate DCD.

Conclusion: The self-concept of children between 7 and 9 years of age are negatively influenced by DCD. However, the severity of their motor problems does not influence their self-concept and anxiety differently, although a tendency of this was found among the girls, especially with regard to their moral self-concept.

Keywords: self-concept, children, DCD

INTRODUCTION

Developmental Coordination Disorder (DCD) is a common and usually permanent condition that interferes with the well-being of patients and their families (American Psychiatric Association, 1994; Fox & Lent, 1996). According to Fox (2000), there is at least one clumsy child in every elementary school classroom. Children with movement problems such as DCD find it difficult to learn and perform simple and complex movements (Hoare & Larkin, 1991). They subsequently find it difficult to participate in the same sport activities that their friends enjoy (Hoare & Larkin, 1991) and further experience problems in school where they are usually chosen last to participate in sporting games (Hoare & Larkin, 1991; Cairney, Hay, Faught, Mandigo & Flouris, 2005).

Also, other non-motor problems exist that are linked to DCD. In this regard, Schoemaker and Kalverboer (1994) found that children who are clumsy are more introverted, judge themselves to be less competent both physically and socially and are significantly more anxious than children without movement problems. Rose, Larkin and Berger (1999) also found that children who face repeated failure in physical education and sport are likely to experience higher anxiety than their peers, while Smyth and Anderson (2000) state that children with impaired coordination can also become isolated on the school playground.

According to Meek and Sugden (1997), children with DCD experience a significantly lower self-worth than their class peers at 14 years of age. Henderson, May and Umney (1989) also found that children with movement difficulties have a lower self-concept than children without movement difficulties. Children with DCD also have lower self-perceptions in the athletic competence domain than children without DCD (Piek, Dworcan, Barrett & Coleman, 2000). According to Skinner and Piek (2001), DCD children reported lower self-perceptions and total self-worth than the control group in their study. Various researchers indicate that good motor skills can be associated with a good self-concept and that children with motor problems had a lower self-concept (Bluechardt, Wiener & Shephard, 1995; Losse, Henderson, Elliman, Hall, Knight & Jongmans, 1991; Peens, Pienaar & Nienaber, 2004; Skinner & Piek, 2001). Studies by Piek *et al.* (2000) and Skinner and Piek (2001) also indicate that children with DCD have lower self-perceptions in the athletic domain.

With regard to gender differences, boys are seen to have more motor problems than girls (Missiuna, 1994). Regarding the self-concept of children, some researchers found no differences between boys and girls (Bosacki, Innerd & Towson, 1997; Hay, Ashman & Van Kraayenoord, 1998), whereas other researchers found that boys have a higher self-concept than girls (Davies & Brember, 1999; Ohannssian, Lerner, Lerner & Von Eye, 1999). Other

researchers also found higher non-academic self-concepts for boys and higher reading self-concepts among girls (Hay *et al.*, 1998). Peens *et al.* (2004) further found that the total self-concept of girls and the popularity and total self-concept of boys aged 10-12 years are significantly influenced by DCD. The conclusion can therefore be made that children with a higher self-concept are socially better off than children with a lower self-concept.

According to Bluechardt *et al.* (1995) correlational studies suggest that motor proficiency in children is associated with self-worth and also that longitudinal studies indicate that self-worth increases with the improvement of motor proficiency.

From the literature it is clear that children with motor problems such as DCD, tend to have a lower self-concept and higher anxiety than children without motor problems. It is further clear that children with a low self-concept find it difficult to meet the expectations of their peer group. These findings are mainly based on older children but in this study the question as to whether DCD has an influence on self-concept and anxiety of 7-9 year old children, and boys and girls separately, needs to be answered. From this question, another arises namely whether the severity of the impairment will influence the self-concept and anxiety of 7-9 year old children. Answering the above-mentioned questions could help professionals that work with DCD children in gaining a better understanding of their feelings towards themselves and this can guide them in handling them in a group of children.

METHODS

Participants

Class teachers (n=78) from the nine different primary schools in the Potchefstroom district in the North West Province of South Africa identified 413 possible DCD candidates in the age group seven to nine years, according to guidelines set by the researcher. Two hundred and one of these children's parents gave informed consent for participation in the study. The Movement Assessment Battery for Children (MABC) was used to determine their DCD state and 71 were classified in the DCD group. One of the 71 was excluded from the study because of possible mental retardation as well as the results of another four who had incomplete test results, resulting in 66 children left in the study.

Apparatus

Movement Assessment Battery for Children (MABC)

The measuring instrument used in this study was the MABC (Henderson & Sugden, 1992) which has good reliability (Henderson & Sugden, 1992) and can be used on 4-12 year old

children. The MABC evaluates manual dexterity (MD) (three tests), ball skills (BS) (two tests) and balance skills (BAS) (three tests). These subtests can be scored as three separate sub-scores or combined as a total score. The test is a norm based test and classifies children on or under the 5th percentile as children with DCD who need intervention (severe DCD). When a child falls above the 5th but on or under the 15th percentile, he/she is at risk for DCD and may need intervention later in life and is classified in the moderate DCD category. All the children who fell on or under the 15th percentile participated in the study. A higher total MABC score indicates a lower motor ability. The primary researcher was responsible for this part of the study.

The Tennessee Self-Concept Scale (Child Form) (TSCS-CF)

The TSCS-CF (Fitts & Warren, 1996) is a questionnaire that consists of 76 self-descriptive statements that allow the individual to portray his/her own self-picture using five response categories, namely "Always False", "Mostly False", "Partly False and Partly True", "Mostly True" and "Always True". Children in the age group 7-14 years who can read at a second-grade level or higher, can complete the test. This form evaluates the following: Four validity scores (Inconsistent Responding, Self-Criticism, Faking Good, and Response Distribution), two summary scores (Total Self-Concept and Conflict), six self-concept scores [Physical (PHY), Moral (MOR), Personal (PER), Family (FAM), Social (SOC) and Academic/Work (ACA)] and three supplementary scores (Identity, Satisfaction and Behaviour) (Fitts & Warren, 1996). The six self-concept scores and the total self-concept score will be used for analysis in this study. Each of the six self-concept scores can be calculated individually or combined as a Total Self-Concept Score. The TSCS-CF shows good internal consistency 0.73 (median) and the test-retest reliability is 0.74 (median) (Fitts & Warren, 1996). The higher the score, the higher the self-concept will be. A median for the total score can be set between 256 and 260. A psychologist was responsible for this part of the study.

Child Anxiety Scale (CAS)

The CAS is a self-report questionnaire for children 5-12 years (Gillis, 1980). This questionnaire consists of 20 questions to determine young children's anxiety. The child is requested to make a cross (X) on the appropriate circle (either red or blue) according to the question being asked and the possible answers. After completion of the test an answering key is placed over the answer sheet so that the X's show through the circles. The number of X's is counted to form the raw score and is then converted into a standard score. This standard

score is then converted into a stanine which is used to determine low or high anxiety. The higher the score, the higher the child's anxiety will be. The questionnaire shows good reliability 0.81 (median) (Gillis, 1980). A psychologist was responsible for obtaining the results for this part of the study.

Procedure

The study received ethical approval from the North-West University. All headmasters of primary schools in the Potchefstroom district (n=9) were asked permission for this study. When granted, teachers of children in the age range of 7-9 years received a letter explaining the characteristics of a DCD-child and they were asked to identify possible candidates. Four hundred and thirteen were identified and those whose parents consented (n=201) were evaluated with the MABC during school hours to determine their DCD status. Seventy one fell on or under the 15th percentile indicating DCD, and were tested with the TSCS-CF and the CAS to evaluate their self-concept and anxiety. Five children were then excluded from the study, one because of possible mental retardation and another four had incomplete test results. The MABC were administered by the primary researcher (kinderkineticist), while the TSCS-CF and CAS were administered by a registered psychologist. The children identified with DCD (n=66) were divided into two groups — those with moderate DCD and those with severe DCD. The number of children in each group and gender are displayed in Table 1.

Insert Table 1 around here

Table 2 displays the normal range of each of the self-concept as well as anxiety scales. This table is included because the mean scores of each group (Table 4) are compared in this study with this normal range to determine whether these DCD children had a lower than normal self-concept and higher than normal anxiety.

Insert Table 2 around here

Statistical procedure

The Statistica 5.5 (STAT 99) for Windows computer package was used (StatSoft, 2005) for the statistical analysis. Information was analyzed for descriptive statistics by means of means (M), standard deviations (SD) and maximum and minimum values. A correlation matrix was firstly conducted to determine correlations between the subcomponents. An independent t-test was then conducted to determine differences between the children with moderate DCD and severe DCD, regarding their anxiety and self-concept ($p<0.05$). Differences between girls with moderate and severe DCD with regard to their self-concept and anxiety were also

determined by an independent t-test. For practical significance, a *d*-value of 0.2 indicates a small significance, 0.5 a moderate significance and a *d*-value of 0.8 shows a large practical significance (Thomas & Nelson, 1996).

RESULTS

As a first step, correlation coefficients determined which of the evaluated components (MABC-total, CAS-total, TSCS-total and TSCS-subscales) that were tested, had an underlying correlation with other subcomponents. In Table 3 only the correlations that showed significant relationships relevant to the study, are shown.

Insert Table 3 around here

According to the results with regard to possible correlations between anxiety and motor proficiency, Table 3 shows that there is a significant correlation in the total group (r=0.27) as well as for the girls (r=0.44). This correlation indicates that the higher the MABC-total (in other words the lower the motor proficiency), the higher the anxiety of the group was.

In the total group as well as in boys and girls groups separately, a relationship between self-concept and anxiety is also seen. The TSCS as well as many of the subscales (PHY, PER, FAM, SOC and ACA) showed a negative correlation with anxiety, indicating that the lower the child's self-concept, the higher the child's anxiety is. In the girls' group there was also a negative correlation between the MABC and TSCS, which indicates that, when the girls have a high MABC-total, they have a low self-concept (TSCS). In this group, a negative correlation between the MABC-total and the moral subscale was also found. Although this group's moral count falls in the normal range, this correlation indicates that there is a relationship between low motor proficiency and the moral aspect of a girl's self-concept.

From the above-mentioned results, it is clear that there is a correlation between the MABC and anxiety, TSCS and anxiety, the MABC and certain TSCS subscales as well as the MABC and TSCS, especially for the girls. These correlations were further analyzed by conducting an independent t-test to determine whether the self-concept and anxiety of children in the severe and moderate DCD groups differ significantly. These results are shown in Table 4.

Insert Table 4 around here

With regard to anxiety, it is obvious from Table 2 that the normal stanine counts for the CAS are between 4 and 7. A low stanine count (0-3) indicates a low anxiety while a higher stanine count (8-10) indicates high anxiety. From the mean scores in Table 4 (5.32 and 5.51)

it is seen that the anxiety of children in the moderate and severe DCD groups, are both in the normal range. Their poor motor proficiency therefore seems not to contribute to higher anxiety. However, it could be seen from Table 4 that children with severe DCD have slightly, but non-significantly, higher anxiety (M=5.51) than children with moderate DCD (M=5.32).

According to the TSCS norm scale (Table 2), a normal self-concept score ranges between 256 and 260. From the mean scores in Table 4 it can be seen that both groups with DCD (moderate and severe) have a lower self-concept score than is indicated as the normal range. This table further indicates that the self-concept of children in the severe DCD group (M=255.48) was slightly higher than the self-concept of children in the moderate DCD group (M=252.28), although this difference was not significant. However, it does seem that children with DCD have a lower than normal self-concept. This same tendency was also found for all the subscales of the TSCS, except for the moral subscale where the children with severe DCD had a moral self-concept score within the normal range.

According to the results in Table 4 it is, however, clear that those children with severe and moderate DCD did not differ statistically significantly from one another with regard to their anxiety and self-concept. For the TSCS-total and all the subscales, except the physical subscale it does, however, seem that children in the moderate DCD group had a slightly lower self-concept compared to children in the severe DCD group. With regard to the CAS it was found that children in the severe DCD group had slightly higher anxiety than the children in the moderate DCD group. However, none of these differences were significant. It does therefore seem that children with DCD have a lower than average self-concept, although it was not possible to distinguish between the self-concept of the children with severe DCD and that of those with moderate DCD.

From the correlation coefficients that were conducted (Table 3), it came to the fore that girls were the only gender that showed a relationship between motor problems and self-concept. Subsequently an independent *t*-test was conducted to determine possible differences between the self-concept and anxiety scores of girls with moderate and severe DCD.

Insert Table 5 around here

From Table 5 it becomes clear that, although the anxiety of girls is in the normal range (4-7), the girls in the severe DCD group (M=5.47) experienced slightly but non-significantly higher anxiety compared to the girls in the moderate DCD group (M=5.00).

With regard to the subscales of the TSCS, it can also be seen from Table 5 that girls in the severe DCD group had a non-significantly lower self-concept compared to girls with

moderate DCD. However, this difference was only moderately significant (p=0.09) as well as moderately practical significant (d=0.71) for the moral subscale, indicating that girls in the severe DCD group had a significantly lower moral self-concept total compared to girls in the moderate DCD group. With regard to the above-mentioned results, there seems to be a tendency that the more severe the girls' motor problems are, the lower their self-concept is and the higher their anxiety.

Thus it seems that the self-concept of children with motor proficiency problems is negatively influenced by DCD, but that the severity of their problems does not influence their self-concept significantly.

DISCUSSION

The aim of this study was firstly to determine whether poor motor proficiency (DCD) has a negative influence on the self-concept and anxiety of 7-9 year old children. Secondly, the study aimed at determining whether children with more severe DCD have a lower self-concept and higher anxiety compared to children with moderate DCD, and whether the genders differ with regard to these aspects.

The results of the correlation coefficients and derived means indicate that although children with DCD's anxiety is within the normal range, it seemed that when they have poor motor proficiency their anxiety levels increase. This tendency was found in the total group as well as among the girls, although the same tendency was not found in boys. The normal range of their anxiety differs from other literature, indicating that children with motor problems have high anxiety levels (Peens *et al.*, 2004; Rose *et al.* 1999). However, the children with more severe motor problems experienced higher anxiety and this is in agreement with the studies of Ohannessian *et al.* (1999) and Rose *et al.* (1999) who reported that children with motor problems experience higher anxiety.

The results of this study further show that the self-concept of children as young as 7-9 years are negatively influenced by DCD. These results confirm the results of Peens *et al.* (2004) and Skinner and Piek (2001) who also found that the self-concept of children is negatively influenced by DCD. The results of this study do, however, not indicate that children with more severe DCD have a lower self-concept. It might be that they are still too young to experience the influence of a more severe motor problem in their daily lives.

From the correlation coefficients, more relationships between motor proficiency, self-concept and anxiety were seen among girls compared to boys. Although Dussart (1994) did not find any correlation between DCD, self-concept and gender, other researchers found that

boys have a higher total (Garcia, Broda, Frenn, Coviak, Pender & Ronis, 1995; Stein, Bracken, Haddock & Shadish, 1998) as well as physical self-concept (Crocker, Eklund & Kowalski, 2000; Smith & Croom, 2000; Stein *et al.*, 1998) than girls. This indicates that girls' self-concept might be more vulnerable to motor problems. Although no indications of an effect of the severity of the problem was found in the group, it was found that girls with severe DCD have a non-significantly lower self-concept as well as non-significantly higher anxiety compared to girls with moderate DCD. The moral self-concept score of the girls with severe DCD was also significantly lower ($p=0.09$) than that of the girls with moderate DCD, although this difference was not practically significant. This subscale determines whether a child sees him/herself as a good or bad person (Fitts & Warren, 1996). Research from Brutsaert (1990) indicates that, when a girl does not feel instrumentally involved in her achievements, it can influence her self-concept negatively. Thus, it can be that they realize that they have motor problems, but that they cannot change that, making them feel out of control and contributing to feelings of seeing themselves a bad person. However, this is a somewhat surprising result, as one would have expected that the physical competence sub-domain would rather been influenced negatively by their motor problems.

In conclusion, it could be stated that the self-concept of children between 7 and 9 year is negatively influenced by DCD. However, there are no indications that children with more severe DCD have a lower self-concept or higher anxiety compared to children with moderate DCD. With regard to the influence of motor problems on the self-concept of boys and girls, more relationships were found between motor proficiency and self-concept in the girls. In girls, the tendency was also found that the severity of their motor problems influences their self-concept and anxiety negatively.

The results of this study indicate possible relations between DCD and self-concept. However, it is recommended that similar studies should be conducted in the future to further explore these results but with the inclusion of a control group without DCD.

REFERENCES

American Psychiatric Association. (1994). *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) (4th ed).* Washington, DC: Author.

Bluechardt, M.H., Wiener, J. & Shephard, R.J. (1995). Exercise programs in the treatment of children with learning disabilities. *Sports Medicine,* 19, 55-69.

Bosacki, S., Innerd, W. & Towson, S. (1997). Field independence-dependence and self-esteem in preadolescents: does gender make a difference? *Journal of Youth and Adolescence,* 26, 691-703.

Brutsaert, H. (1990). Changing sources of self-esteem among girls and boys in secondary schools. *Urban Education,* 24, 432-435.

Cairney, J., Hay, J., Faught, B., Mandigo, J. & Flouris, A. (2005). Developmental coordination disorder, self-efficacy toward physical activity, and play: does gender matter? *Adapted Physical Activity Quarterly,* 22, 67-82.

Crocker, P.R.E., Eklund, R.C. & Kowalski, K.C. (2000). Children's physical activity and physical self-perceptions. *Journal of Sports Sciences,* 18, 383-394.

Davies, J. & Brember, I. (1999). Boys outperforming girls: an 8-year cross-sectional study of attainment and self-esteem in year 6. *Educational Psychology,* 19, 5-16.

Dussart, G. (1994). Identifying the clumsy child in school: an exploratory study. *British Journal of Special Education,* 21, 81-86.

Fitts, W.H. & Warren, W.L. (1996). Tennessee self-concept scale. (2nd ed). Los Angeles, Calif.: Western psychological services.

Fox, A.M. (2000). *Clumsiness in Children.* Retrieved August 28, 2000, from http://www.ahs.uwo.ca/orcn/orgs.

Fox, A.M. & Lent, B. (1996). Clumsy children – primer on developmental coordination disorder. *Canadian Family Physician,* 42, 1965-1971.

Garcia, A.W. Broda, M.A.N., Frenn, M., Coviak, C., Pender, N.J. & Ronis, D.L. (1995). Gender and developmental differences in exercise beliefs among youth and prediction of their exercise behaviour. *Journal of School Health,* 65, 213-219.

Gillis, J.S. (1980). Child anxiety scale. Los Angeles, Calif.: Western psychological services.

Hay, I., Ashman, A.F. & Van Kraayenoord, C.E. (1998). The influence of gender, academic achievement and non-school factors upon pre-adolescent self-concept. *Educational Psychology,* 18(4). [Available on Internet:] [Date of access: 12

February 2001].

Henderson, S.E., May, D.S. & Umney, M. (1989). An exploratory study of goal-setting behavior, self-concept and locus of control in children with movement difficulties. *European Journal of Special Needs Education,* 4, 1-14.

Henderson, S.E. & Sugden, D.A. (1992). *Movement Assessment Battery for Children.* London: The Psychological Corporation.

Hoare, K. & Larkin, D. (1991). Coordination problems in children. *National Sports Researcher Centre,* 18, 1-15.

Losse, A., Henderson, S.E., Elliman, D., Hall, D., Knight, E. & Jongmans, M. (1991). Clumsiness in children – do they grow out of it? A 10-year follow-up study. *Developmental Medicine and Child Neurology,* 33, 55-68.

Meek, G.A. & Sugden, D.A. (1997). Attitude formation towards physical activity in children with developmental coordination disorder. *European Journal of Special Needs Education,* 12, 157-169.

Missiuna, C. (1994). Motor skill acquisition in children with developmental coordination disorder. *Motor Skill Acquisition,* 214-235.

Ohannessian, C.M., Lerner, R.M., Lerner, J.V. & Von Eye, A. (1999). Does self-competence predict gender differences in adolescent depression and anxiety? *Journal of Adolescence,* 22(3):397-411, June.

Peens, A., Pienaar, A.E. & Nienaber, A.W. (2004). The self-concept of 10 to 12 year old boys and girls with and without DCD in the North West Province. *Journal for Social Sciences,* 44, 52-61.

Piek, J.P., Dworcan, M., Barrett, N.C. & Coleman, R. (2000). Determinants of self-worth in children with and without developmental coordination disorder. *International Journal of Disability, Development and Education,* 47, 259-272.

Rose, B., Larkin, D., & Berger, B.G. (1999). Athletic anxiety in boys and girls with low and high levels of coordination. *The ACHPER Healthy Lifestyles Journal,* 64, 10-13.

Schoemaker, M.M. & Kalverboer, A.F. (1994). Social and affective problems of children who are clumsy: How early do they begin? *Adapted Physical Activity Quarterly,* 11, 130-140.

Skinner, R.A. & Piek, J.P. (2001). Psychosocial implications of poor motor coordination in children and adolescents. *Human Movement Science,* 20, 73-94.

Smith, K.E. & Croom, L. (2000). Multidimensional self-concept of children and teacher

beliefs about developmentally appropriate practices. *Journal of Educational Research,* 93, 312-321.

Smyth, M.M. & Anderson, H.I. (2000). Coping with clumsiness in the school playground: social and physical play in children with coordination impairments. *British Journal of Developmental Psychology,* 18, 389-413.

StatSoft. (2005). *Statistica for Windows: General Conventions and Statistics.* Tilsa, OK : Statsoft.

Stein, R.J. Bracken, B.A., Haddock, C.K. & Shadish, W.R. (1998). Preliminary development of the children's physical self-concept scale. *Journal of Developmental and Behavioural Pediatrics,* 19, 1-8.

Thomas, J.R. & Nelson, J.K. (1996). *Research methods in physical activity (3rd ed.).* Champaign, IL: Human Kinetics.

Table 1: Number of participants in each group

	Moderate DCD	Severe DCD	Total
Total group	25	41	**66**
Boys	17	24	**41**
Girls	8	17	**25**

Table 2: Normal score range of CAS, TSCS-total and subscales

Test component	Normal range
CAS stanine	4 to 7
Physical	46
Moral	36
Personal	43
Family	45.5
Social	51
Academic	38
TSCS-total	256 to 260

Table 3: Significant interrelationships between the different subcomponents, $p<0.05$

All children	r	Boys	r	Girls	r
MABC and CAS	0.27	FAM and CAS	-0.39	TSCS and MABC	-0.48
PHY and CAS	-0.31	SOC and CAS	-0.32	TSCS and CAS	-0.41
PER and CAS	-0.28	ACA and CAS	-0.39	CAS and MABC	0.44
FAM and CAS	-0.25	TCSC and CAS	-0.37	MOR and MABC	-0.49
SOC and CAS	-0.25			PER and CAS	-0.42
ACA and CAS	-0.45			ACA and CAS	-0.54
TSCS and CAS	-0.37			ACA and MABC	-0.54

Table 4: Significance of differences between moderate and severe DCD groups for the CAS, TSCS and subscales

	Mean Moderate DCD	Deviation from normal range	Mean Severe DCD	Deviation from normal range	t-value	df	p-value
CAS	5.32	Normal	5.51	Normal	0.39	64	0.70
Physical	45.84	-0.16	45.56	-0.44	-0.14	64	0.89
Moral	35.72	-0.28	37.29	1.29	0.87	64	0.39
Personal	41.76	-1.24	42.34	-0.66	0.31	64	0.76
Family	42.48	-3.02	42.68	-2.82	0.12	64	0.91
Social	50.04	-0.96	50.41	-0.59	0.16	64	0.87
Academic	36.44	-1.56	37.20	-0.80	0.41	64	0.68
TSCS	252.28	-3.72	255.48	-0.52	0.36	64	0.72

*$p \leq 0.10$; **$p \leq 0.05$; ***$p \leq 0.01$

Table 5: Significance of differences between girls with moderate and severe DCD with regard to CAS, TSCS and subscales

	Mean Moderate DCD	Deviation from normal range	Mean Severe DCD	Deviation from normal range	t-value	df	p-value	d-value
CAS	5.00	Normal	5.47	Normal	0.56	23	0.58	-
Physical	46.25	0.25	44.71	-1.29	-0.49	23	0.63	-
Moral	40.13	4.13	36.53	0.53	-1.76	23	0.09*	0.71**
Personal	42.50	0.50	42.47	-0.53	-0.01	23	0.99	-
Family	42.88	-2.62	42.71	-2.79	-0.07	23	0.94	-
Social	53.75	-2.75	49.53	-1.47	-1.23	23	0.23	-
Academic	39.50	1.50	36.47	-1.53	-0.96	23	0.35	-
TSCS	265.00	5.00	252.41	-3.59	-1.18	23	0.25	-

*p≤0.10; **p≤0.05; ***p≤0.01; *d = 0.2 small practical significance; **d = 0.5 moderate practical significance; ***d = 0.8 large practical significance

CHAPTER 4

THE EFFECT OF DIFFERENT INTERVENTION PROGRAMMES ON THE SELF-CONCEPT AND MOTOR PROFICIENCY OF 7-9 YEAR OLD DCD CHILDREN

Descriptive Title

The effect of different intervention programmes on the self-concept and motor proficiency of 7-9 year old DCD children

Short Title

Effect of intervention programmes

Authors

Peens, A., Pienaar, A.E. and Nienaber, A.W.

Abstract

Background The self-concept of children is influenced by Developmental Coordination Disorder (DCD) (Colchico *et al.*, 2000). The aim was to determine the most effective method in enhancing motor proficiency and self-concept of 7-9 year old DCD children.

Methods Teachers at 9 different schools identified 201 possible DCD candidates. The Movement Assessment Battery for Children (Henderson & Sugden, 1992) identified 58 with DCD (36 boys and 22 girls). Self-concept and anxiety were determined by the Tennessee Self-Concept Scale (Child Form) (Fitts & Warren, 1996) and Child Anxiety Scale (Gillis, 1980) respectively. A four group pretest-posttest, with two follow-up tests were used. The children were randomly grouped into four experimental groups [motor based intervention (MG), self-concept (SG) enhancing intervention, psycho-motor intervention (P-MG) and a control group (CG)]. A one way ANOVA and repeated measures ANOVA followed by a Bonferroni post-hoc analysis was conducted to determine between group and within group differences respectively.

Results After completion of the intervention programmes, no significant improvement in motor proficiency was found in the SG group, while the MG, P-MG and CG groups improved significantly ($p<0.01$). The mean total improvement of the MG and P-MG groups was, however, higher compared to the CG. After the retention period the MG, SG and CG groups improved further ($p>0.05$), while the P-MG showed no further improvement. From the pretest to retest 2 the MG, P-MG and CG improved ($p<0.01$), while the SG showed lower motor proficiency. Anxiety decreased ($p>0.05$) in the SG, while the total self-concept of the P-MG showed the biggest improvement ($p<0.05$).

Conclusion The motor skill intervention programme had the biggest effect in enhancing the motor proficiency of DCD children. Motor proficiency and self-concept of DCD children benefit from intervention, but both should be addressed for optimal benefits.

Keywords: self-concept enhancement, intervention programmes, children, DCD

Introduction

Children with DCD (Developmental Coordination Disorder) experience problems with a variety of tasks (Fox & Lent, 1996) and activities (Henderson & Sugden, 1992) in their daily lives. Other problems linked to DCD are the development of a poor self-concept (Henderson & Sugden, 1992; Loss *et al.*, 1991; Skinner & Piek, 2001), a poor physical self-perception (Maeland, 1994; Piek *et al.*, 2000; Skinner & Piek, 2001), socialization problems (Geuze & Börger, 1993, Hoare & Larkin, 1991; Schoemaker & Kalverboer, 1994), academically related problems (Dussart, 1994; Fox, 2000; Hoare & Larkin, 1991; Maeland, 1994) and anxiety to participate in motor tasks (Rose *et al.*, 1999; Schoemaker & Kalverboer, 1994). It is, therefore, not surprising that it is believed that the self-concept of children is influenced by motor problems such as DCD (Colchico *et al.*, 2000; Dekel *et al.*, 1996; Goni & Zulaika, 2000; MacMahon, 1990; Salokun, 1994).

Physically awkward children often do not know how to approach a movement problem. In addition, they have no idea how to analyze the demands of a task and simply do not have the planning skills that are required to learn on their own (Wall *et al.*, 1990). Furthermore, children with movement difficulties are much less able to learn by themselves and do not simply absorb the rules and requirements of a skill (Henderson & Sugden, 1992). Therefore, motor competence will affect their willingness to participate in a movement learning situation as well as their ability to evaluate their own performance realistically (Henderson & Sugden, 1992). This explains why such children need intervention to teach them certain strategies. Wall *et al.* (1990) indicated that an important objective in their instructional progress should be the designing of strategies to encourage them to practice effectively on their own or with supportive others, not only during scheduled instruction but during their free time as well.

They also need to be taught how to use the equipment, apparatus and physical layout of their environment, indoors and outdoors, to facilitate their own skill learning (Wall *et al.*, 1990). Mandich *et al.* (2001) further proposed that treatment methods must be based on the

assumption that skill acquisition emerges from the interaction of the child, the task and the environment.

With regard to improvement of the self-esteem, Halliday (1999) stated that different discussion techniques can be used to enhance children's self-concept. Evidence, although limited, also exists that motor skill intervention not only remediates children's motor problems (Pless & Carlsson, 2000), but also enhances their self-concept after completion of a physical education programme (Bunker, 1991). In this regard, Dewey and Wilson (2001) stated that training of physical skills only make sense when it is accompanied by an increase in self-esteem and motivation to encounter physical activities in daily life.

From the above findings it can be concluded that motor intervention will most probably enhance the motor proficiency and the self-concept of DCD children. The question whether a pure motor based intervention, an integrated psycho-motor intervention, or a psychological based intervention will be the most effective in the intervention of children with DCD, wants to be answered by this research.

Methods

Participants

Class teachers (n=78) from the nine different primary schools in the Potchefstroom district in the Northwest Province of South Africa identified 413 possible DCD candidates in the age group seven to nine years, according to guidelines set by the researcher. Parents of 201 of these children gave informed consent for participation in the study. The Movement Assessment Battery for Children (MABC) was used to determine their DCD state and 71 were classified in the DCD group, although the results of only 58 could be used in the final analysis. One of the 71 was excluded from the study because of possible mental retardation as well as the results of another two who had incomplete test results, resulting in only 68

children left for the study. The children (N=68) were randomly grouped into four experimental groups. A statistical equation [n = $(1.96)^2(6.52)^2/(3,75)^2$] (Steyn *et al.*, 2000) based on relevant results (Ernst, 2004) determined that each of these groups should consist of at least 11.6 (n=12) children in order for the results to have statistical power. All efforts were made to allocate DCD children randomly of the same age, gender and ethnic group in each of the four different groups. For this purpose, the technique of paring was recommended by a statistician. However, practical considerations like different venues (schools) where the intervention programmes had to be conducted were a problem experienced by the researcher who were responsible for the psychological intervention programme. The number of children in each group, therefore, differs although a statistician recommended that subjects should not be excluded in order to even the groups.

Insert Table 1 about here

Each of the four groups were randomly allocated to an intervention method; group 1 (motor based intervention), group 2 (psychological intervention), group 3 (integrated psycho-motor intervention) and group 4 (control group with no intervention). Before the first retest, two children moved and before the second retest another eight relocated, resulting in only 58 children for the final analysis of this study (36 boys and 22 girls). The final groupings for the study (number, age and gender of the participants allocated to different groups) can be seen in Table 1.

Apparatus

Movement Assessment Battery for Children (MABC)

The measuring instrument that was used in this study was the MABC (Henderson & Sugden, 1992) which has good reliability (Henderson & Sugden, 1992) and can be used in 4-12 year

old children. The MABC evaluates manual dexterity (MD) (three tests), ball skills (BS) (two tests) and balance skills (BAS) (three tests) which could be scored as three separate sub-scores or a total score. A higher score indicates lower motor ability. The test is a norm based test and classifies children on or under the 5th percentile as children with DCD who need intervention. When a child falls above the 5th but on or under the 15th percentile they are at risk for DCD and may need intervention later in life. All the children who fell on or under the 15th percentile participated in the study. The primary researcher was responsible for this part of the study.

The Tennessee Self-Concept Scale (Child Form) (TSCS-CF)

The TSCS-CF (Fitts & Warren, 1996) is a questionnaire that consist of 76 self-descriptive statements that allow the individual to portray his/her own self-picture using five response categories namely "Always False", "Mostly False", "Partly False and Partly True", "Mostly True" and "Always True". The Child Form can be completed by children 7-14 years who can read at a second-grade level or higher. This form evaluates the following: Four validity scores (Inconsistent Responding, Self-Criticism, Faking Good, and Response Distribution), two summary scores (Total Self-Concept and Conflict), six self-concept scores [Physical (PHY), Moral (MOR), Personal (PER), Family (FAM), Social (SOC) and Academic/Work (ACA)] and three supplementary scores (Identity, Satisfaction and Behaviour) (Fitts & Warren, 1996). Each of the six self-concept scores can be calculated individually or combined as a Total Self-Concept Score. The TSCS-CF shows good internal consistency 0.73 (median) and the test-retest reliability is 0.74 (median) (Fitts & Warren, 1996). The higher the score, the higher the self-concept will be. A median for the total score can be set between 256 and 260. A psychologist was responsible for this part of the study.

Child Anxiety Scale (CAS)

The CAS is a self-report questionnaire for children 5-12 years (Gillis, 1980). This questionnaire consists of 20 questions to determine anxiety of young children. The child is asked to make an X on the appropriate circle (either red or blue) according to the question being asked and the possible answers. After completion of the test an answering key is put over the answer sheet so that the X's show through the circles. The number of X's is counted to form the raw score. The raw score is then converted into a standard score. The higher the score, the higher the child's anxiety will be. The questionnaire shows good reliability 0.81 (median) (Gillis, 1980). A psychologist was also responsible for this part of the study.

Procedure

The study received ethical approval from the North-West University. All headmasters of primary schools in the Potchefstroom district (n=9) were asked permission for this study. When granted, teachers of children in the age range of 7-9 years received a letter explaining the characteristics of a DCD-child and they were asked to identify possible candidates. Four hundred and thirteen children were identified by them and those whose parents consented (n=201) were evaluated with the MABC during school hours to determine their DCD status. Seventy one fell on or under the 15th percentile and were tested with the TSCS-CF and the CAS to evaluate their self-concept and anxiety. Three children were then excluded from the study, one because of possible mental retardation and another two had incomplete test results. These children (N=68) were then randomly divided into four groups [experimental group 1 (motor based intervention programme), experimental group 2 (psychological intervention programme), experimental group 3 (integrated psycho-motor intervention programme) and group 4 (control group with no intervention)]. All the tests of the MABC were administered by the primary researcher (kinderkineticist), while the psychological testing was administered by a registered psychologist.

After completion of the motor based intervention programme (8 weeks for 30 minutes twice a week), the psychological intervention programme (8 weeks for 45 minutes once a week) and the integrated psycho-motor intervention (children followed both the motor and psychological intervention programmes) all subjects (including control group) were tested again (posttest), with the MABC to determine the effect of the motor based intervention. The lasting effect of the programmes on the motor proficiency, self-concept and anxiety were retested after a lapse of two months without any further intervention. During this retest the children (N=66) completed the MABC, TSCS-CF and CAS. Two children moved and their results had to be excluded in the retest session. During the period of one year that led to the second retest session, another eight children moved that resulted in only 58 children remaining. In the second follow-up test, all the remaining children (N=58) were tested with the MABC only.

Intervention programmes

Psychological intervention programme

The self-concept enhancing intervention programme was centered around the discovering of the self – "Who am I?". In this part the issue of self-acceptance was also involved. The enhancing and enriching of the self-concept through awareness, uniqueness, individuality, competence, virtue (enriching self-esteem), belonging, interpersonal relations, handling anxiety, as well as a session for the parents on parenting skills was also involved in the programme (Hugo, 2005). The psychologist responsible for this part of the study conducted the programme.

Motor based intervention programme

The motor based intervention programme involved the integration of the task-specific, kinaesthetic and sensory integration treatment methods. A detailed programme (eight weeks,

twice a week for 30 minutes) was implemented and was based on the age appropriate motor developmental characteristics for children in the age group seven to nine years. An example of two intervention sessions (Lesson 7 and 8) are given below. Each session started with fundamental locomotor activities combined with activities for improvement of vestibular stimulation and kinaesthesis (for example: rolling, skipping, hopping, jumping, galloping and animal walks – all these activities were also done while turning). The rest of the content was divided into different sections [ball skills (2-3 activities), balance skills (2-3 activities), fine motor coordination (2-3 activities) and eye control (1-2 activities)]. Task specific intervention was mainly used to improve the ball and balance skills. All the activities were done in a group, except for the eye control activities which were done on an individual basis with each child. The primary researcher compiled and conducted the programme which was progressively adapted, once a week.

Lesson 7 (Tuesday)

Introductory activities

Fundamental skills (± 5 minutes)

(Vestibular and kinaesthesis)

- Two legged jumps.
- One legged jumps.
- Tonic labyrinthine prone (airplane hold).
- The airplane rolls over (log rolls).

Balance (± 5 minutes)

- Two legged jumps in hoops - freeze in last hoop – to hold balance.
- Stand on toes with eyes open and closed.

Lesson 8 (Thursday)

Introductory activities

Fundamental skills (± 5 minutes)

(Vestibular and kinaesthesis)

- Glide (sideways).
- Run backwards.
- Baboon walk (while turning around).

Balance (± 5 minutes)

- Walk heel-to-toe over balancing board.
- Walk over bridge built with balancing boards.

- Stand on one leg.

Ball skills (Eye-hand-coordination)

(± 5 minutes)

- Throw and catch tennis ball.
- Bounce and catch tennis ball.
- Throw ball in air, clap hands, catch ball.

Fine motor skills (Manual dexterity)

(± 5 minutes)

- Draw a circle path on paper and walk with left and right hand's thumb and forefinger on the path (this path forms an elephant's ears).
- Pinch washing pins on elephants head.

Eye control (± 5 minutes)

- Take the elephant they drew, move it closer and further from the child's face. Child must focus on the elephant's eyes.

- Stand on one leg on bridge.

Ball skills (Eye-hand-coordination)

(± 5 minutes)

- Roll tennis ball through hoop.
- Throw ball into hoop on the ground.
- Throw ball in air, touch nose, catch ball.

Fine motor skills (Manual dexterity)

(± 5 minutes)

- Cut out pictures with scissors.
- Take a stick with a piece of string attached in the middle with a small sandbag attached to the end. Roll this string up the stick making use of both hand's fingers.

Eye control (± 5 minutes)

- The child must follow the beam of a flashlight against the wall. The child is only allowed to use his eyes.

Statistical procedure

For the statistical analysis the Statistica 5.5 (STAT 99) for Windows computer package was used (StatSoft, 2005). Information was analyzed for descriptive statistics by means of means (M), standard deviations (SD) and maximum and minimum values. A repeated measures ANOVA was conducted followed by a Bonferroni post hoc analysis to determine how the different groups differ between the four testing periods (within group differences). A one

way ANOVA followed by a Tukey post-hoc analysis was also conducted to determine between-group differences at the pre, post and retest.

Results

Insert Table 2 about here

Table 2 displays the descriptive statistics of all the measured test variables in the different tests and subtests (MABC, TSCS and CAS). Figure 1 illustrates the results obtained in the different groups for the different testing opportunities of the MABC and subtests. With regard to the MABC, group 1 (Motor based intervention) improved significantly (p=0.00) after the intervention programme, with further non-significant improvements after the retention period (p=0.80) and from the first to the second retest (p=0.89). The mean of the group at retest 2 (M=6.53) was significantly lower than compared to before the start of the programme (M=16.28, Table 2) and this improvement was significant from the pre to retest 2 (p=0.00). Group 2 (psychological intervention) showed no statistical significant increases in motor ability after the intervention (p=1.00) or the retention period (p=0.32), and they even showed a significant decrease in motor proficiency from retest 1 to retest 2 (p=0.02). Their MABC-total was basically the same during the retest 2 (M=15.60) compared to before the programme started (M=15.50, Table 2). The motor proficiency of group 3 (integrated psycho-motor intervention) improved significantly after the intervention period (p=0.00), decreased slightly after the retention period (p=1.00), with a slight improvement from retest 1 to retest 2 (p=1.00). However, this group improved significantly from the pretest (M=17.73) to retest 2 (M=9.64, p=0.00). Group 4 who received no intervention, also showed improved motor proficiency between the pre and posttest (p=0.00), as well as between the pre and

retests (p=0.00). They also showed a significant increase in motor proficiency from the pretest (M=17.09) to the retest 2 (M=10.82). However, group 1 and group 3 had the lowest MABC-totals (indicating better motor proficiency) during the last testing session (Fig 1a), which was not the case during the pretest (Table 2).

Insert Figure 1 about here

Table 2 and Figure 1 (b-d) indicate the following within-group differences for the subtests of the MABC. The MD of group 1 (Fig. 1b) increased after the intervention, although not significantly (p=0.21). Thereafter a significant increase was seen from the pre to retest period (p=0.00) with a further non-significant increase from retest 1 to retest 2 (p=0.62). Their MD improved significantly (p=0.00) from the pretest (M=8.98) to retest 2 (M=4.33). The psychological group (group 2) showed a slight decrease between the pre and posttest (p=1.00) with a borderline significant increase between the post and retest 1 (p=0.07), and a non-significant decrease between retest 1 and retest 2 (p=0.26). Their MD proficiency decreased significantly (p=0.00) from pretest (M=8.35) to retest 2 (M=9.05). Group 3 experienced a moderately significant improvement after the intervention programme (M=7.32; p=0.06), a further slight improvement after the retention period (M=6.64; p=1.00), after which no further change was seen in the mean scores during retest 2 (M=6.86) (Fig. 1b). However, a significant improvement was seen (p=0.02) from the pre-testing (M=10.23) to retesting 2. No significant differences were found in the MD proficiency of the control group between testing opportunities (M=8.32, 8.18, 6.85, 6.29), only a borderline significant improvement between the pre and retest 2 (p=0.08).

In the BS subtest (Fig 1c), group 1 improved significantly after the intervention period (M=1.95; p=0.01), with a further non-significant improvement after the retention period (M=1.70; p=1.00) and between retest 1 and retest 2 (M=0.75; p=0.53). The score at retest 2

(M=0.75) was significantly better (p=0.00) than the pretest score (M=3.80). No statistical significant differences could, however, be found between the mean scores (Table 2) for the psychological and psycho-motor groups at the different testing periods. In contrast, the control group showed a significant improvement from the pre to the posttest (though they had no intervention) (p=0.02), a slight decrease after the retention period (p=1.00) and again a slight increase from retest 1 to retest 2 (p=0.34). The improvement from pretest (M=3.50) to retest 2 (M=1.35) was also significant (p=0.00).

The balancing proficiency (BAS) of group 1 (Fig 1d) improved significantly after the intervention period (p=0.00), with a further non-significant improvement after the retention period (p=1.00) and a slight decrease from retest 1 to retest 2 (p=1.00). A significant improvement from pretest (M=3.50) to retest 2 (M=1.45) was also seen. The psychological group (group 2) showed a slight non-significant improvement after the intervention period (p=1.00) but a decrease between retest 1 and retest 2 is visible (p=0.11) from Figure 1d. Table 2 and Figure 1d indicates that their balancing proficiency was non-significantly poorer (p=1.00) at retest 2 (M=4.05) than in the pretest (M=3.50). The psycho-motor group (group 3) improved significantly after the intervention programme (p=0.00), with a slight decrease in balancing proficiency after the retention period (p=1.00), followed by a slight increase from retest 1 to retest 2 (p=1.00). The difference in mean scores between pretest (M=4.50) and retest 2 (M=1.32) was significant (p=0.00). A similar tendency was found in the control group (group 4).

Insert Figure 2 about here

Only group 2 and 3 received an intervention programme (which was part of the self-concept enhancing programme) to help them to cope with anxiety. However, no significant differences were indicated between the different testing periods in the levels of anxiety of the

different groups. However, tendencies of slightly lower anxiety were observed in group 2 (M=8.80 and M=7.50) and 3 (M=6.72 and M=6.27) after participating in the intervention programme, compared to group 1 that almost stayed the same from the pretest (M=7.60) to the retest (M=7.70) and the control group who showed slightly higher anxiety levels in the posttest (M=8.41 and M=9.35, p=0.52) (Table 2 and Fig. 2).

Insert Figure 3 about here

The psychological group (group 2) and psycho-motor group (group 3) participated in an intervention programme to improve their self-concept. Interpretation of the TSCS-CF (Fig. 3a) scores of the different groups indicates that the self-concept of both these groups improved significantly after participating in the intervention programme (p=0.00, respectively). They also showed statistically significant improvement (p-values ranged between 0.00 and 0.04) in all the subscales of the TSCS-CF after intervention (Fig 3b,d,e,f,g), except for the MOR (Fig 3c) where improvement was only significant in the psycho-motor group (p=0.01). In contrast, group 1 improved non-significantly (p=0.47), while a non-significantly lower (p=0.86) self-concept was found in the control group after the period of intervention.

A One-way ANOVA was also conducted to determine between-group differences in the pretest, posttest and retest sessions. No statistical significant differences could be found in the subtests, nor in the MABC-total, CAS and TSCS-CF during each of these testing sessions. Due to limited space these results were not tabulated, although these differences can be seen in Figures 1, 2 and 3.

Discussion

Most children diagnosed with DCD also have self-concept related problems (Henderson & Sugden, 1992; Loss *et al.*, 1991; Skinner & Piek, 2001). This study confirmed lower than average self-concept values in this 7 to 9-year old group (M=253.21, Table 2), considering that the 50th percentile for the Tennessee Self-Concept Scale (Child Form) (Fitts & Warren, 1996) is indicated to be between 256 and 260.

This study aimed to determine which of a motor based intervention programme, a psychological intervention programme or an integrated psycho-motor intervention programme will have the biggest influence in the intervention of DCD children's motor problems and their self-concept. The motor based intervention programme, consisting of task-specific, kinaesthetic and sensory integration methods showed the biggest contribution to the enhancement of children's motor proficiency. In this study, the children with DCD in group 1 showed significant improvements in the MABC-total and in all the subtests (except MD; p=0.21) after completing the intervention programme. In addition, they were the only group that showed further improvement in all the MABC scales after the retention period, contributing to a further significant difference between the pre and retest one year later. This improvement between the pre and retest was also significant (p=0.00) in the MD scale. It can, therefore, be concluded that the motor based intervention programme contributed to improvement in all the aspects of motor proficiency that were practiced. This finding is in agreement with findings by Emmanouel *et al.* (1992), Goodway and Rudisill (1996) and Pless and Carlsson (2000) who showed that motor intervention can enhance the motor proficiency of children. However, the self-concept of this group did not improve significantly, which is contradictory to the findings of Bunker (1991) and most other researchers who indicated that motor intervention for children with coordination problems will also enhance their self-concept. It should, however, be kept in mind that the self-concept

of this group (M=255.35, Table 2) fell in the lower normal range at the beginning of the programme.

The psychological treatment of group 2 and 3 encouraged them to discover themselves and reach a point of self-acceptance. Awareness, uniqueness, individuality, competence, virtue and belonging were used to enrich their self-concept (Hugo, 2005). This content was similar to the activities mentioned by Halliday (1999) who stated that different challenging, educational activities could be used to enhance the self-concept of children. The self-concept of group 2 (psychological intervention) and group 3 (psycho-motor intervention) improved significantly after the intervention period. The psychological group's motor proficiency improved non-significantly after the intervention period and the retention period, leading to a significant difference between the pre and retest 1. Then there was a non-significant decrease in this group's motor proficiency that led to almost the same score as in the pretest. The psycho-motor group's motor proficiency on the other hand improved significantly after the intervention programme with a further non-significant improvement after the retention period and from retest 1 to retest 2, leading to a significant difference between the pre and retest 2.

After completion of the integrated psycho-motor intervention programme (group 3), where the two intervention methods were combined, the motor proficiency of this group increased significantly in all the subscales, except for BS, while the self-concept also showed significant improvement. This group's self-concept shows a bigger improvement compared to group 2 who only followed the psychological programme (Table 2 and Fig. 3a). One reason for this improvement in the psycho-motor group may be imbedded in the theory that the mastering of a challenging activity like exercise might lead to a feeling of success and worthiness (Chia & Wang, 2002). In addition, Kapp (1991) and De Witt (1985) portray the human being as a three dimensional unit (mind, body and soul), an existence that can be defined but not separated, implicating that improvement in one dimension may lead to improvement in another. However, the reverse is also true. It could also be possible that

these children experienced improvement and, on a conscious level, learned to accept themselves and their shortcomings.

The control group showed a non-significant decrease in self-concept after the intervention period (with no intervention) although a significant improvement was seen in their motor proficiency after this period.

The anxiety of the psychological and psycho-motor group decreased (although non-significantly) after the intervention period. In comparison, the anxiety of the motor group stayed almost the same after the intervention programme, while a non-significant increase in anxiety was seen in the control group. This tendency might be an indication of a positive effect of the psychological and the psycho-motor based intervention programmes in decreasing children's anxiety, although no definite conclusion can be made from these results.

While the results clearly indicated the positive contribution of the self-concept treatment of DCD children, the contribution of the motor intervention programme is confounded by significant improvements that were also found in the control group during the post-testing. Although the motor proficiency improved significantly in all the groups, except for the psychological group, during the post-testing, a further non-significant improvement from the post to the retest (except for the BS and BAS in the psycho-motor group that did not show any significant differences) was only found in the motor based intervention and the integrated psycho-motor intervention groups. The motor group and the psycho-motor group were also the only two groups that showed significant improvements from the pre to retest 2 (except for BAS in the psycho-motor group that did not show any significant differences). Contradictory to this, the MD subscale of the control group showed no improvement and non-significant decreases were found between the post and retest 1 in the BS and BAS subscales of this group. In addition, the psychological group who can also be viewed as a control group for the effect of the motor intervention because they did not receive any motor intervention, also

showed no significant changes in their BS as well as non-significant decreases in MD between the pre and posttest. Their BAS increased non-significantly after the intervention period and after the retention period, which most probably contributed to a significant increase from the pre to the retest 1. Sims *et al.* (1996) who obtained similar results of improvement with regard to their control group during kinaesthetic intervention, attributed this improvement to the fact that they used the procedure of parameter estimation by sequential testing (PEST) to determine the initial level of kinaesthetic acuity, and that this testing could have had a training effect. Other reasons could also be offered, although speculative in nature. One such possible explanation is the influence of maturity on motor development which is still considerable at this young age (Malina *et al.*, 2004). It should also be noted that in some cases the motor intervention programme had to be conducted during break times and a secluded spot was not always available. This contributes to the fact that children in the control group could have observed what was done and subsequently could have practiced it. Contradictory to this, the psychological group showed a lower MABC-total in retest 2 than in the pretest. From the results it is clear that in some cases children can improve without any intervention, but the reverse is also true, as seen in the psychological group. Their results indicate that if no remedial help is offered to some children, their problems may even worsen.

Nethertheless, it can be concluded that the motor proficiency of the children who followed the motor based and integrated psycho-motor intervention programmes showed a tendency to more sustainable improvement of their motor proficiency, compared to that of the control and psychological groups. It can also be concluded that it is necessary to provide intervention to both aspects of a DCD child's development (motor and self-concept), and that it will be more beneficial to the DCD child when each programme is conducted by a specialist in each of these fields. It is also suggested that it might be beneficial, but also important to combine both the intervention methods. In this regard Dewey and Wilson

(2001) state that the practice of physical skills only makes sense when it is accompanied by an enhancement in self-concept and motivation to make physical activity part of their daily lives.

Shortcomings of the study should, however, also be mentioned. The intervention programme was conducted on the school grounds during school hours and sometimes during break times. Children who were not part of the intervention progamme, like the control group, were, therefore, exposed to the content. Most of the activities could easily be practiced on their own, except for the fine motor and eye control activities, where special equipment was used and individual instruction was needed. The duration and frequency of the programme was also influenced by the school semester and the school day. Although the results indicated that the self-concept programme needs only 8 weeks to show an effect, it is specifically recommended that the motor intervention programme should be conducted over a longer period of time or more times per week. In addition, a testing session before the pre-testing (for example six to eight weeks before the pretest) is recommended to determine a possible training effect for the test battery.

In conclusion, it is important to remember that the motor competence and the self-concept of children are two important components of their total well-being which seemed to be interlinked from a very young age. When they experience problems such as those indicated for DCD, specific intervention seems to be necessary in order to optimally improve these aspects.

References

Bunker, L.K. (1991) The role of play and motor skill development in building children's self-confidence and self-esteem. *Elementary School Journal,* **91**, 467-471.

Chia, M. & Wang, J. (2002) Physical activity, exercise and health of the mind in young people. *Journal of Physical Education and Recreation,* **8**, 64-67.

Colchico, K., Zybert, P. & Basch, C.E. (2000) Effects of after-school physical activity on fitness, fatness, and cognitive self-perceptions; a pilot study among urban, minority adolescent girls. *American Journal of Public Health,* **90**, 977-978.

Dekel, Y., Tenenbaum, G & Kudar, K. (1996) An exploratory study on the relationship between postural deformities and body-image and self-esteem in adolescents: the mediating role of physical activity. *International Journal of Sport Psychology,* **27**, 183-196.

Dewey, D. & Wilson, B.N. (2001) Developmental coordination disorder: What is it? *Physical and Occupational Therapy in Pediatrics,* **20**, 5-27.

De Witt, M.M. (1985) The meaning of physical movement in the psychological life living of the 0-6 year old child. (Doctoral dissertation, University of Pretoria).

Dussart, G. (1994) Identifying the clumsy child in school: an exploratory study. *British Journal of Special Education,* **21**, 81-86.

Emmanouel, C., Zervas, Y. & Vagenas, G. (1992) Effects of four physical education teaching methods on development of motor skill, self-concept, and social attitudes of fifth-grade children. *Perceptual and Motor Skills,* **74**, 1151-1167.

Ernst, J.E. (2004) The influence of an intervention programme on 9-12 year old farmworker children with developmental coordination disorder, based on an integrated approach. (Master's Thesis, Potchefstroom : North-West University).

Fitts, W.H. & Warren, W.L. (1996) Tennessee self-concept scale. (2nd ed). Los Angeles, Calif.: Western psychological services.

Fox, A.M. (2000) Clumsiness in children. Retrieved August, 28, 2000 from http://www.ahs.uwo.ca/orcn/orgs/DCD/CLUMS

Fox, A.M. & Lent, B. (1996) Clumsy children – primer on developmental coordination disorder. *Canadian Family Physician,* **42**, 1965-1971.

Geuze, R. & Börger, H. (1993) Children who are clumsy: five years later. *Adapted Physical Activity Quarterly,* **10**, 10-21.

Gillis, J.S. (1980) Child anxiety scale. Los Angeles, Calif.: Western psychological services.

Goni, A. & Zulaika, L. (2000) Relationships between physical education classes and the enhancement of fifth grade pupil's self-concept. *Perceptual and Motor Skills,* **91**, 246-250.

Goodway, J.D. & Rudisill, M.E. (1996) Influence of a motor skill intervention program on perceived competence of at-risk African American preschoolers. *Adapted Physical Activity Quarterly,* **13**, 288-301.

Halliday, N. (1999) Developing self-esteem through challenge education experiences. *Journal of Physical Education, Recreation and Dance,* **70**, 51-60.

Henderson, S.E. & Sugden, D.A. (1992) Movement assessment battery for children. London : The Psychological Corporation.

Hoare, D. & Larkin, D. (1991) Coordination problems in children. *National Sports Research Center,* **18,** 1-15.

Hugo, L. (2005) The development and evaluation of a self-concept enrichment programme for children aged 7-9 years. (MA, Mini-dissertation, Potchefstroom : North-West University).

Kapp, J.A. (1991) Children with problems: an orthopedic outlook. Pretoria : J.L. van Schaik publishers.

Losse, A., Henderson, S.E., Elliman, D., Hall, D., Knight, E. & Jongmans, M. (1991) Clumsiness in children – do they grow out of it? A 10-year follow-up study. *Developmental Medicine and Child Neurology,* **33**, 55-68.

MacMahon, J.R. (1990) The psychological benefits of exercise and the treatment of delinquent adolescents. *Sports Medicine,* **9**, 344-351.

Maeland, A.F. (1994) Self-esteem in children with motor coordination problems (clumsy children). In Alston, J., (Ed.), *Handwriting review* (pp. 128-133).

Malina, R.M., Bouchard, C. & Bar-Or, O. (2004) Growth, maturation, and physical activity. 2nd Ed. Champaign, IL. : Human kinetics.

Mandich, A.D., Polatajko, H.J., Macnab, J.J. & Miller, L.T. (2001) Treatment of children with developmental coordination disorder: what is the evidence? In Missiuna, C. (Ed.), *Children with developmental coordination disorder* (pp. 51-68).

Piek, J.P., Dworcan, M., Barrett, N.C. & Coleman, R. (2000) Determinants of self-worth in children with and without developmental coordination disorder. *International Journal of Disability, Development and Education,* **47**, 259-272.

Pless, M. & Carlsson, M. (2000) Effects of motor skill intervention on developmental coordination disorder: a meta-analysis. *Adapted Physical Activity Quarterly,* **17**, 381-401.

Rose, B., Larkin, D., & Berger, B.G. (1999) Athletic anxiety in boys and girls with low and high levels of coordination. *The ACHPER Healthy Lifestyles Journal,* **64**, 10-13.

Salokun, S.O. (1994) Positive change in self-concept as a function of improved performance in sports. *Perceptual and Motor Skills,* **78**, 752-754.

Schoemaker, M.M. & Kalverboer, A.F. (1994) Social and affective problems of children who are clumsy: How early do they begin? *Adapted Physical Activity Quarterly,* **11**, 130-140.

Sims, K., Henderson, S.E., Hulme, C. & Morton, J. (1996) The remediation of clumsiness I:

an evaluation of Laszlo's kinaesthetic approach. *Developmental Medicine and Child Neurology,* **38**, 976-987.

Skinner, R.A. & Piek, J.P. (2001) Psychosocial implications of poor motor coordination in children and adolescents. *Human Movement Science,* **20**, 73-94.

StatSoft. (2005) Statistica for Windows: General conventions & statistics. Tilsa, Okla. : Statsoft.

Steyn, S., Smit, C.F., Du Toit, J. & Strasheim, A.D. (2000) Moderne statistiek vir die praktyk. [Modern statistics for the practice]. Pretoria : Van Schaik Academics.

Wall, A.E., Reid, G. & Paton, J. (1990) The syndrome of physical awkwardness. In Reid, G. (Ed.), *Problems in movement control* (pp. 283-316). North-Holland : Elsevier Science Publishers B.V.

Word count: 4 145

Table 1. Age, gender and number of children in each group

Age (years)	7		8		9		
Gender	Male	Female	Male	Female	Male	Female	Total
Group 1 (MG)	6	3	1	1	7	2	20
Group 2 (PG)	1	4	1	0	3	1	10
Group 3 (P-MG)	2	3	1	0	2	3	11
Group 4 (CG)	5	1	2	1	5	3	17
Total	14	11	5	2	17	9	58

MG – Motor based intervention group, PG – Psychological intervention group, P-MG – Psycho-Motor based intervention group, Control group.

Table 2. Descriptive statistics for all the tests and subtests (MABC, TSCS and CAS)

	Pretest		Posttest		Retest 1		Retest 2	
	M	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**
				Group 1				
MABC	16.28	5.54	10.25	5.61	8.35	5.31	6.53	5.87
MD	8.98	2.95	7.13	4.16	5.75	4.01	4.33	4.56
BS	3.80	2.84	1.95	2.74	1.70	1.83	0.75	1.47
BAS	3.50	3.41	1.18	1.08	0.90	1.35	1.45	1.68
TSCS	255.35	50.33			266.40	35.25		
PHY	47.50	9.56			47.40	8.03		
MOR	36.20	8.94			38.50	7.47		
PER	42.10	9.18			44.50	6.71		
FAM	43.50	9.01			46.00	5.39		
SOC	48.90	11.61			50.05	9.19		
ACA	37.15	9.16			39.95	9.10		
CAS	7.60	3.28			7.70	4.68		
				Group 2				
MABC	15.55	5.30	13.65	5.03	10.45	5.93	15.60	8.26
MD	8.35	3.05	9.60	3.39	7.00	4.27	9.05	4.39
BS	3.70	3.08	1.70	1.21	1.90	1.93	2.50	2.95
BAS	3.50	3.09	2.35	2.66	1.55	1.50	4.05	3.41
TSCS	240.60	23.78			281.90	30.35		
PHY	41.20	6.32			48.30	6.34		
MOR	35.00	6.78			36.80	7.96		

PER	41.60	6.24			49.10	5.47		
FAM	39.40	6.28			48.50	2.99		
SOC	47.80	8.69			57.90	5.47		
ACA	35.60	5.80			41.30	9.30		
CAS	8.80	3.49			7.50	4.81		
				Group 3				
MABC	17.73	6.74	10.91	9.45	11.36	9.89	9.64	8.58
MD	10.23	2.52	7.32	4.32	6.64	4.50	6.86	4.90
BS	3.00	3.15	2.55	3.12	3.05	3.62	1.45	2.99
BAS	4.50	3.63	1.05	3.47	1.68	3.56	1.32	1.90
TSCS	244.36	26.04			300.09	16.46		
PHY	43.45	5.87			52.18	5.56		
MOR	35.91	5.34			42.00	3.90		
PER	39.64	8.02			50.45	5.09		
FAM	41.45	5.11			49.91	1.64		
SOC	48.73	6.50			60.00	6.13		
ACA	35.18	7.77			45.55	5.05		
CAS	6.73	3.72			6.27	4.29		
				Group 4				
MABC	17.09	7.54	12.50	8.43	11.85	7.12	10.82	9.18
MD	8.32	3.11	8.18	4.05	6.85	3.88	6.29	4.24
BS	3.50	3.25	1.82	2.93	2.41	2.22	1.35	2.67
BAS	5.26	3.75	2.50	3.02	2.59	2.65	3.18	3.38
TSCS	263.82	27.69			260.41	66.89		
PHY	47.53	6.77			46.53	13.87		

MOR	36.59	6.72	35.94	10.76
PER	44.18	6.00	46.18	11.80
FAM	44.24	4.60	44.59	9.47
SOC	53.00	8.15	50.65	14.24
ACA	38.29	6.38	36.53	12.47
CAS	8.41	4.58	9.35	5.73

Figure 1. Within-group differences between different testing sessions for MABC (a), MD (b), BS (c) and BAS (d)

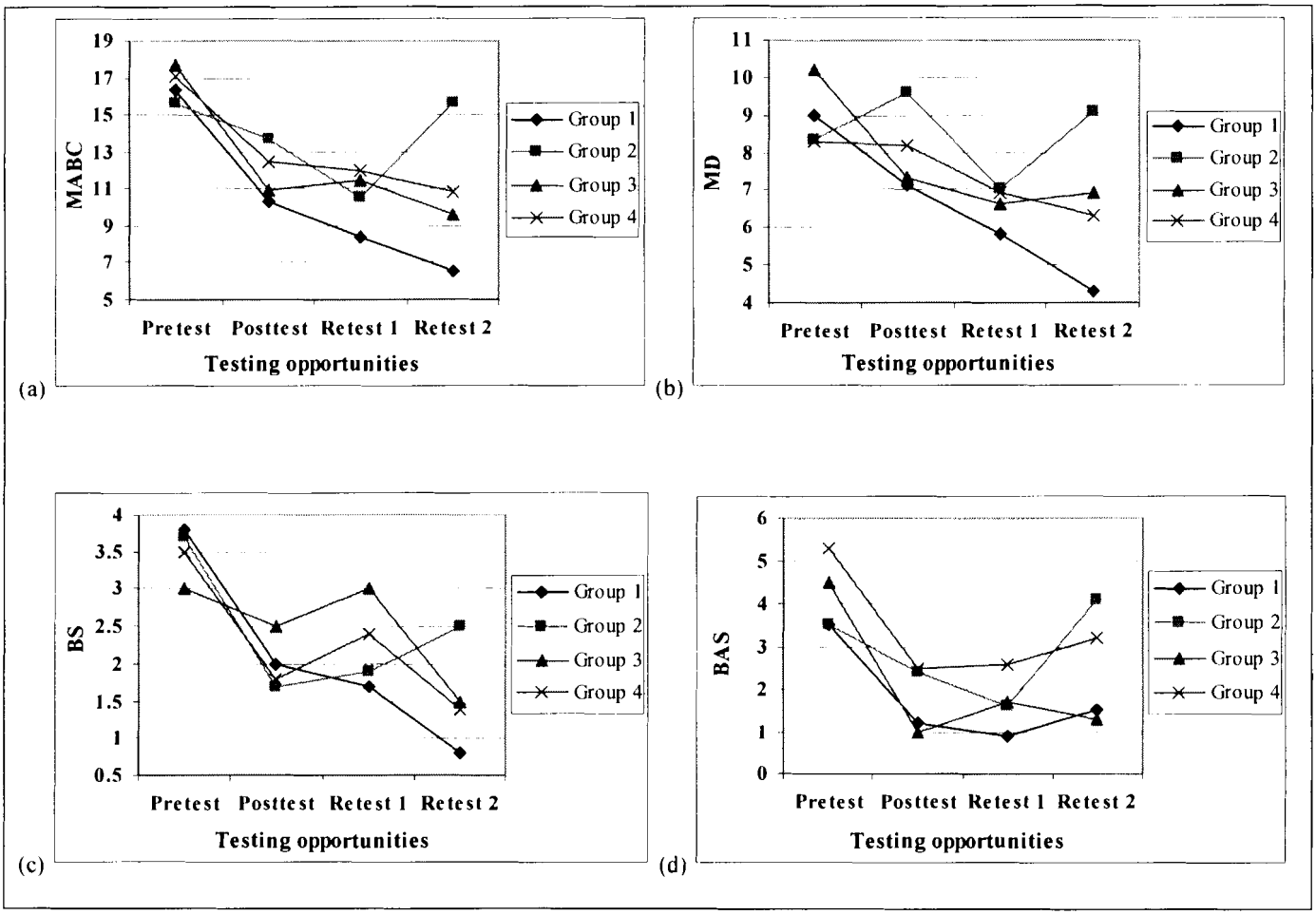


Figure 2. Within-group differences of CAS between different testing sessions

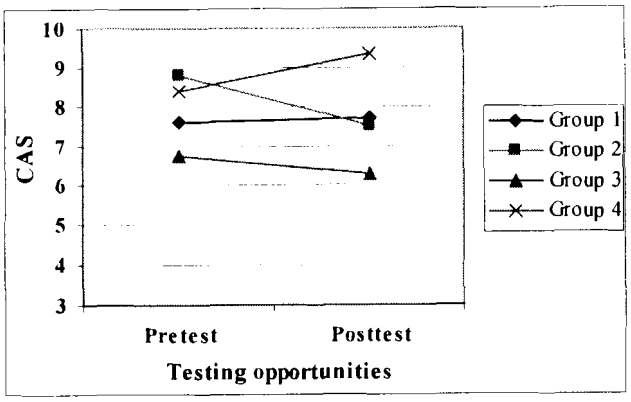
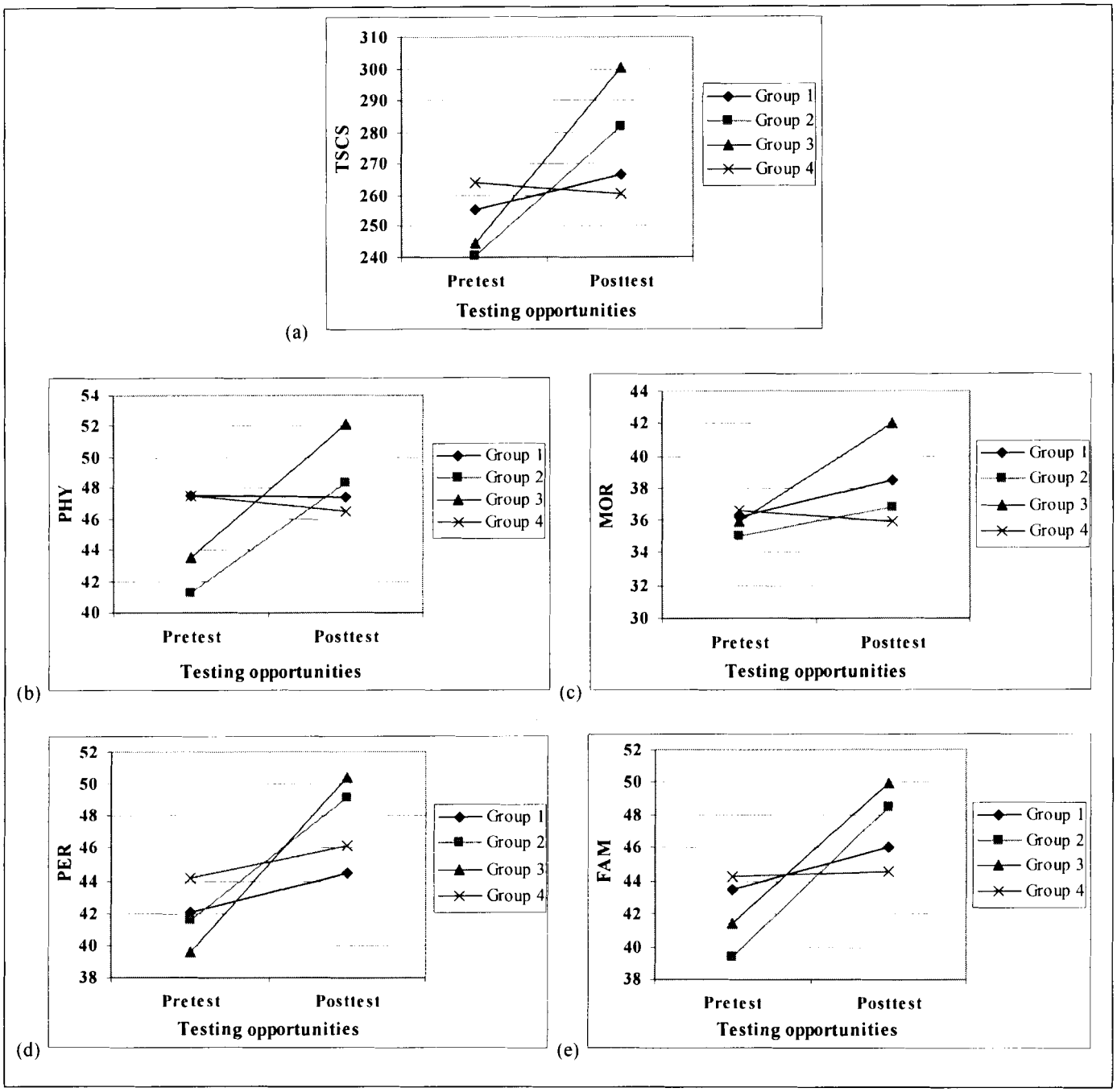
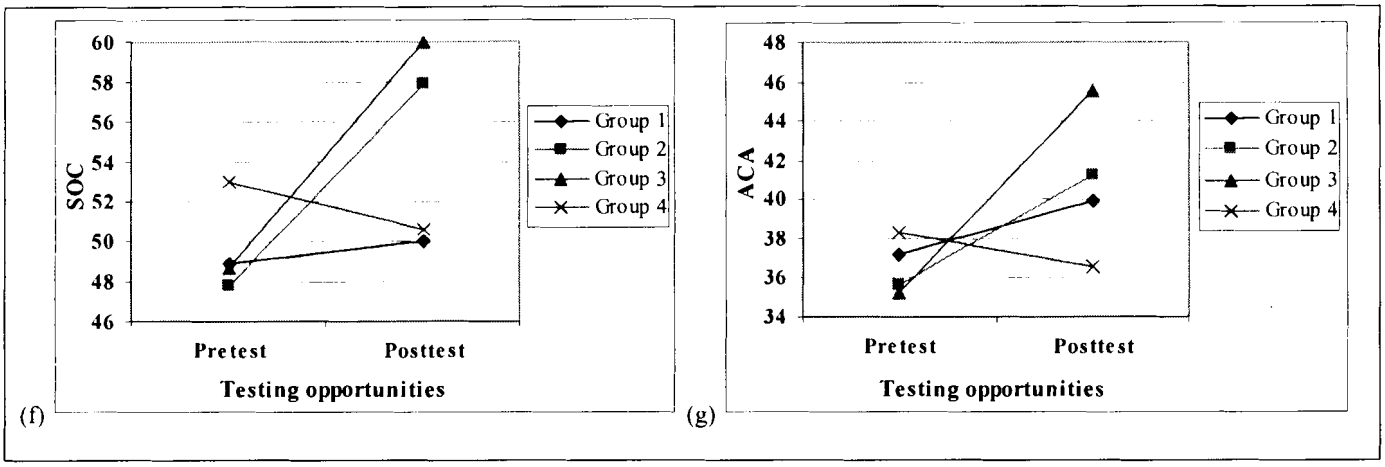


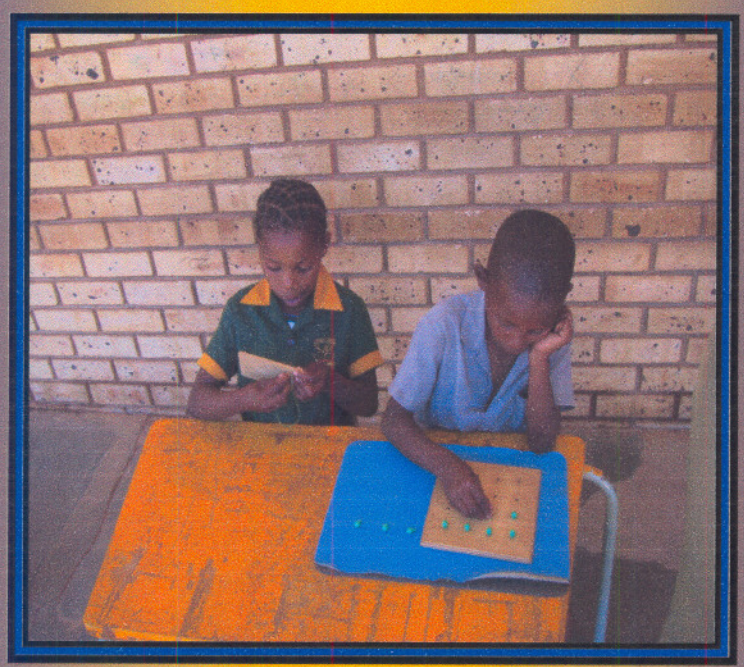
Figure 3. The differences between the different testing opportunities for each of the groups on the TSCS-CF (3a), PHY (3b), MOR (3c), PER (3d), FAM (3e), SOC (3f) and ACA (3g)




(f)
SOC
60
58
56
54
52
50
48
46
Pretest
Posttest
Testing opportunities
Group 1
Group 2
Group 3
Group 4
(g)
ACA
48
46
44
42
40
38
36
34
Pretest
Posttest
Testing opportunities
Group 1
Group 2
Group 3
Group 4

CHAPTER 5

THE EFFECT OF GENDER AND ETHNIC DIFFERENCES ON THE SUCCESS OF INTERVENTION PROGRAMMES FOR THE MOTOR PROFICIENCY AND SELF-CONCEPT OF 7-9 YEAR OLD DCD CHILDREN



Descriptive Title

The effect of gender and ethnic differences on the success of intervention programmes for the motor proficiency and self-concept of 7-9 year old DCD children

Short Title

Gender and ethnic differences on success of intervention programmes

Authors

Peens, A. and Pienaar, A.E.

Abstract

Background A higher percentage of boys is diagnosed with DCD (Maldonado-Duran, 2002) compared to girls. With regard to gender differences in the self-concept domain, boys normally have a higher global (Davies & Brember, 1999) and physical self-concept (Crocker *et al.*, 2000) than girls. However, no literature exists with regard to ethical differences among South African children. No differences are also documented between genders and ethnic groups after intervention. The aim of this study was therefore to determine the effect of gender and ethnic group on the success of different intervention programmes.

Methods Teachers at 9 different schools identified 201 potential DCD candidates. The Movement Assessment Battery for Children (Henderson & Sugden, 1992) identified 58 with DCD [36 boys (14 white, 13 black, 9 coloured) and 22 girls (10 white, 4 black, 8 coloured)]. The Tennessee Self-Concept Scale (Child Form) (Fitts & Warren, 1996) and Child Anxiety Scale (Gillis, 1980) were administered to determine the children's self-concept and anxiety respectively. A four-group pretest-posttest, with two follow-up tests were used. Children were randomly grouped into experimental groups (motor based intervention, self-concept enhancing intervention, integrated psycho-motor intervention and control group). A repeated measures ANOVA was used to determine interactions within the groups, while independent t-tests were conducted to determine gender differences. A one-way ANOVA was further conducted to determine differences between the three ethnic groups. For these analyses a adjusted mean was used for all the test totals.

Results The self-concept of the girls in the psychological group improved moderately significantly ($p=0.09$) more than that of the boys. With regard to the ethnic differences, it was found that, in the motor based intervention group, the white children's motor proficiency improved significantly more than that of the black children from the first to the last testing opportunity.

Conclusion Although two statistically significant differences were found with regard to gender and ethnic groups, these differences were not significant enough to justify different intervention programmes for different ethnic groups and genders.

Keywords: gender, ethnic, race, children, DCD

Introduction

Children with Developmental Coordination Disorder (DCD) experience problems with a variety of tasks (Fox & Lent, 1996) and activities (Henderson & Sugden, 1992) in their daily routine. Various non-motor problems are also associated with DCD (Piek *et al.*, 2000; Skinner & Piek, 2001). The development of a poor self-concept (Colchico, Zybert & Basch, 2000; Goni & Zulaika, 2000; Peens *et al.*, 2004,; Skinner & Piek, 2001) and poor physical self-perception (Piek *et al.*, 2000; Skinner & Piek, 2001) are two of these.

It is generally found that a higher percentage of boys are diagnosed with DCD (Henderson & Sugden, 1992; Maldonado-Duran, 2002; Missiuna, 1994; Sugden & Sugden, 1991), than girls, although Dussart (1994) indicated no relationship between DCD and gender. Similar findings are reported in connection with gender and self-concept. Some researchers report no differences in the self-concept of boys and girls (Bosacki *et al.*, 1997). Most researchers, however, found that boys have a higher total (Davies & Brember, 1999; Garcia *et al.*, 1995; Stein *et al.*, 1998) as well as physical self-concept (Crocker *et al.*, 2000; Hagger *et al.*, 1998; Smith & Croom, 2000; Stein *et al.*, 1998) than girls. Ohannessian *et al.* (1999) further state that a significantly higher level of self-competence is reported by boys than by girls.

These findings indicate that there are differences between boys and girls with regard to their self-concept and motor proficiency. When the effect of intervention programmes to improve self-concept or motor proficiency on the two genders was analyzed, no significant gender differences were found after motor skill intervention (Emmanouel *et al.*, 1992; Goodway & Rudisill, 1996). In general, it is found that motor intervention could enhance the motor proficiency and self-concept of children (Goni & Zulaika, 2000). However, no research findings regarding a relationship between ethnic differences and the success of intervention were found.

From these literature findings it is clear that motor intervention will most probably enhance the motor proficiency and self-concept of DCD-children. From very limited research findings in this regard it seems that boys and girls will not react differently to motor intervention. The effect of gender and ethnic groups on the success of a purely motor based intervention, integrated psycho-motor intervention and psychological intervention will be analyzed in this study.

Method

Participants

Four hundred and thirteen (N=413) potential DCD candidates in the age group seven to nine years were identified by class teachers (n=78) from the nine different primary schools in the Potchefstroom district in the Northwest Province of South Africa, in accordance with guidelines set by the researcher. Parents of 201 of these children gave informed consent for participation in the study. The Movement Assessment Battery for Children (MABC) was used to determine their DCD state. Of the 201 children, 71 were classified in the DCD group. One child was excluded because of possible mental retardation and another two because of incomplete test results. The children were then randomly divided into four groups. A statistical equation [$n = (1.96)^2(6.52)^2/(3,75)^2$] (Steyn, Smit, Du Toit & Strasheim, 1998), based on relevant results (Ernst, 2004), determined that each of these groups should consist of at least 11.6 (n=12) children in order for the results to have statistical power. A statistician recommended the technique of paring in order to randomly allocate DCD-children of the same age, gender and ethnic group in each of the four different groups. However, practical considerations such as different venues (schools) where the intervention programmes had to be conducted were problems experienced the researchers experienced. Therefore the number of children in each group differs. A statistician did, however, recommend that subjects should not be excluded in order to even the groups. After the intervention programme and a

lapse of two months, two more children were excluded from the study because of relocation. Another eight children were excluded one year later for the final test due to the same reason, resulting in 58 children on whom this study was conducted. The number of children in each gender and ethnic group and in each intervention group (1-4) is reported in Table 1.

Insert Table 1 about here

Measuring instruments

Movement Assessment Battery for Children (MABC)

The measuring instrument that was used in this study was the MABC (Henderson & Sugden, 1992), which has good reliability (Henderson & Sugden, 1992) and can be used on children 4-12 years of age. The MABC tests manual dexterity (MD) (three tests), ball skills (BS) (two tests) and balance skills (BAS) (three tests). Each of the three sub-scores can be calculated separately or combined as a total score. The higher the score, the lower the child's motor ability will be. The test is a norm based test and classifies children on or under the 5th percentile as children with DCD who need intervention. Children that fall above the 5th but on or under the 15th percentile are at risk of having DCD and may need intervention later in life. All the children on or under the 15th percentile participated in this study. The primary researcher (kinderkineticist) was responsible for this part of the study.

The Tennessee Self-Concept Scale (Child Form) (TSCS-CF)

The TSCS-CF (Fitts & Warren, 1996) is a questionnaire which consists of 76 self-descriptive statements that allow the individual to portray his/her own self-picture using five response categories, namely "Always False", "Mostly False", "Partly False and Partly True", "Mostly True" and "Always True". The Child Form can be completed by children 7-14 years who

can read at a second-grade level or higher. This form evaluates four validity scores (Inconsistent Responding, Self-Criticism, Faking Good, and Response Distribution), two summary scores (Total Self-Concept and Conflict), six self-concept scores [Physical (PHY), Moral (MOR), Personal (PER), Family (FAM), Social (SOC) and Academic/Work (ACA)] and three supplementary scores (Identity, Satisfaction and Behaviour) (Fitts & Warren, 1996). Each of the six self-concept scores can be calculated individually or combined as a Total Self-Concept Score. The TSCS-CF shows good internal consistency 0.73 (median), and the test-retest reliability is 0.74 (median) (Fitts & Warren, 1996). The higher the score, the higher the self-concept will be. A median for the total score can be set between 256 and 260. A psychologist was responsible for this part of the study.

Child Anxiety Scale (CAS)

The CAS is a self-report questionnaire to determine the anxiety of children 5-12 years of age (Gillis, 1980). This questionnaire consists of 20 questions and shows a good reliability of 0.81 (median) (Gillis, 1980). The child is requested to make an X on the appropriate circle (either red or blue) according to the question being asked and the possible answers. After completion of the test, an answering key is placed over the answer sheet so that the Xs show through the circles. The Xs are counted to form the raw score which is then converted into a standard score. The higher the score, the higher the child's anxiety will be. A psychologist was responsible for this part of the study as well.

Procedure

All headmasters of the nine primary schools in the Potchefstroom district were visited to obtain permission for the study to be conducted in their schools. After permission was granted, teachers of children in the age range 7-9 years received a letter explaining the characteristics of a DCD-child to help them identify potential candidates. They identified

four hundred and thirteen (413) children with such characteristics. An informed consent document was then sent to the parents of these children to ask permission for them to participate in the study. All the identified children whose parents gave informed consent (n=201) were evaluated with the MABC, during school hours, to determine their DCD status. After confirmation of DCD, the children with DCD (n=71) were tested with the TSCS-CF and the CAS, so as to determine their functioning regarding self-concept and anxiety. One of the children was, however, excluded from the study because of possible mental retardation. Of another two children the test results were incomplete and were therefore also excluded. The remaining children (n=68) were then randomly divided into four groups [experimental group 1 (motor based intervention programme), experimental group 2 (psychological intervention programme), experimental group 3 (integrated psycho-motor intervention programme) and control group (no intervention)].

After completion of the motor based intervention programme (8 weeks for 30 minutes twice a week), the psychological intervention programme (8 weeks for 45 minutes once a week) and the integrated psycho-motor intervention (children followed both the motor and psychological intervention programmes) all subjects (including the control group) were again tested (posttest) with the MABC to determine the effect of the motor based intervention. The lasting effect of the programmes on the motor proficiency, self-concept and anxiety were retested after a lapse of two months without any further intervention. In this retest, where children completed the MABC, TSCS-CF and CAS, only 66 children were tested because two moved out of town. In a second retest, a year later, the children completed the MABC to determine the lasting effect of the programmes on the children's motor proficiency after a year without any intervention. In this retest there were only 58 children because of the relocation of a further eight. The MABC was administered by the primary researcher (kinderkineticist), while the psychological testing was administered by a registered psychologist.

When analyzing the MABC, TSCS and CAS scores, an adjusted mean was calculated. The total of the final testing session was subtracted from the total of the first testing session. In the case of the MABC total and subscales, the score of retest 2 was subtracted from the pretest score, while for the TSCS-total, TSCS subscales and CAS the score of retest 1 was subtracted from the pretest score. With the MABC, a lower score indicates a higher motor proficiency, thus a negative adjusted mean score indicates improvement while a positive score indicates a decrease in motor proficiency. However, with regard to the TSCS, the opposite is true. For the CAS, a negative score indicates a decrease in anxiety.

Intervention programmes

Motor based intervention programme

The motor based intervention programme involved the integration of different motor interventions. The task-specific intervention, kinaesthetic intervention and sensory integration treatment methods were integrated. Examples of two intervention sessions are given below. The session started with a locomotor activity combined with vestibular movement and kinaesthetic training (for example rolling, skipping, hopping, jumping, galloping and animal walks – all these activities were also done while turning). The rest of the content was divided into different sections [ball skills (2-3 activities), balance skills (2-3 activities), fine motor coordination (2-3 activities) and eye movement activities (1-2 activities)]. Each session included all these components. Task specific intervention was used to treat the ball and balance skills. All the activities were done in a group except for the eye movement activities that were done individually with each child. No distinction was made between gender and ethnicity in conducting the programme. The primary researcher compiled and conducted the programme which was progressively adapted once a week.

Lesson 9 (Tuesday)

Introductory activities

Fundamental skills (± 5 minutes)

(Vestibular and kinaesthesis)

- Baboon walk.
- Crab walk.
- Frog jumps.
- All of the above were also done while turning.

Balance (± 5 minutes)

- Walk on stilts over bean bags and inside hoops.
- Stand on one leg with eyes open and closed.
- Walk over bridge.

Ball skills (eye-hand-coordination)

(± 5 minutes)

- Hit tennis ball with cricket bat.
- Throw ball against wall and catch.
- Throw and catch ball.

Fine motor skills (Manual dexterity)

(± 5 minutes)

- Copy small figures.
- Finger tapping.

Lesson 10 (Thursday)

Introductory activities

Fundamental skills (± 5 minutes)

(Vestibular and kinaesthesis)

- Glide (sideways).
- Leap.
- Galloping.
- Animal walks from lesson 9 backwards and turning.

Balance (± 5 minutes)

- Walk heel-to-toe forward and backwards over balancing beam.
- Skipping with a hoop.
- Balance on different body parts (ex. hand and knee, hand and foot).

Ball skills (eye-hand-coordination)

(± 5 minutes)

- Throw and catch bean bag.
- Throw bean bag in hoop.
- Two-two friends throw and catch bean bag.

Fine motor skills (Manual dexterity)

(± 5 minutes)

- Walk on path with fingers.
- Put two-two washing pins together.

Eye control (± 5 minutes)

- Follow bubbles with eyes.
- Follow ball on rope with eyes.

Eye control (± 5 minutes)

- Hold little object and child focus with both eyes, then left and right eye separately.
- Tracking with both eyes around a square and triangle.

Psychological intervention programme

The self-concept enhancing intervention programme was centred around discovering the self – "Who am I?". In this part the issue of self-acceptance was also involved. Enhancing and enriching the self-concept through awareness, uniqueness, individuality, competence, virtue (enriching self-esteem), belonging, interpersonal relations, handling anxiety, as well as a session for the parents on parenting skills were also involved in the programme (Hugo, 2005). The genders and ethnic groups were not separated, so they all received the same intervention programme. The psychologist responsible for this part of the study conducted the programme.

Statistical procedure

For the statistical analysis, the Statistica 5.5 (STAT 99) for Windows 2005 computer package was used (StatSoft, 2005). Information was analyzed for descriptive purposes through means (M), standard deviations (SD) and maximum and minimum values. A repeated measures analysis of variance was conducted to determine the interaction between gender, ethnic group, group and the different testing opportunities. An independent t-test was done to determine possible differences between the two genders, while a one-way ANOVA followed by an Unequal N HSD post-hoc analysis was conducted to determine differences between the different ethnic groups.

Ethical consideration

The ethics committee of the North-West University gave approval for this study.

Results

For the first step in analyzing the data a repeated measures analysis of variance was used to determine possible interactions between ethnic group, intervention group and different testing opportunities (MABC, TSCS and CAS), as well as between gender, intervention group and different testing opportunities (MABC, TSCS and CAS). This analysis was divided into two sections on account of the fact that there were no coloured girls in group 1 as well as no black girls in group 4 due to the dropouts during the period of the study. The analysis for the MABC and the interaction between gender, intervention group and testing opportunities, showed a significant interaction between intervention group and testing opportunity [$F(3; 150) = 3.70$ ($p = 0.00$)]. For the interaction between ethnic group, intervention group and testing opportunity a significant interaction was documented between ethnic group and testing opportunity $F(3;138) = 2.4501$ ($p = 0.03$).

For the interaction between gender, intervention group and different testing opportunities as well as ethnic group, intervention group and different testing opportunities with regard to the TSCS, significant interactions were documented between intervention group and testing opportunities [$F(1;50) = 6.75$ ($p = 0.00$) and $F(1;46) = 3.11$ ($p = 0.04$) respectively]. With regard to CAS no significant interactions were found between ethnic group, intervention group and different testing opportunities, but a significant interaction $F(1;50)$ 3.17 ($p=0.03$) for gender and the intervention group, was found between gender, intervention group and different testing opportunities. Due to limited space, these results will not be presented in a table.

Although no significant interactions were found in the repeated measures analysis of variance between intervention group and gender, an interaction with regard to ethnic group

was found that justifies further analysis in this regard. Though there was no interaction between gender and different testing opportunities, it seemed necessary to determine where the genders differ after completion of an intervention programme. Therefore, as a next step, an independent t-test was conducted to analyze differences between the genders in order to determine which gender in which intervention group showed the best improvement after having participated in an intervention programme. The above-mentioned results are shown in Table 2.

Insert Table 2 about here

According to the results in Table 2, it is clear that the adjusted means for the genders for the MABC, TSCS and CAS do not differ significantly from the first to the last testing opportunity in any of the different intervention groups (group 1 to 4). With regard to their MABC-total, the motor proficiency of girls in the motor based intervention group (group 1) and in the integrated psycho-motor intervention group (group 3) improved slightly more compared to that of the boys. In the psychological intervention group (group 2) the girls' motor proficiency decreased, while in the control group (group 4) the boys' motor proficiency improved non-significantly more than that of the girls, from the first to the last testing opportunity. With regard to the TSCS it can be seen that, in the psychological group (group 2) and in the integrated psycho-motor intervention group (group 3), the girls' self-concept improved more than that of the boys from the first to the last testing opportunity. There was a moderately statistical significant difference between the genders with regard to the TSCS ($p=0.09$) in group 2. The self-concept of the girls in groups 1 and 4 on the other hand decreased non-significantly from the first to the last testing opportunity, although it should be kept in mind that the girls in these groups did not receive any psychological

intervention. In contrast to this finding, the self-concept of the boys in these groups (group 1 and 4) improved slightly, but non-significantly, from the first to the last testing opportunity.

With regard to anxiety (CAS), the results indicate that girls in groups 1 and 2 experienced a slight decrease in anxiety from the first to the last testing opportunity, while boys in these groups showed a slight increase in anxiety during this period. In group 3 both boys and girls showed a slight decrease in anxiety whereas in group 4 both the boys and girls showed an increase in anxiety from the first to the last testing opportunity.

Because the girls in group 2 showed a moderate statistically significant improvement in TSCS compared to the boys, the subscales of the TSCS in group 2 were also analyzed by making use of an independent t-test (Table 3).

Insert Table 3 about here

From this analysis it seemed that the self-concept of the girls improved non-significantly more after the completion of a psychological intervention programme than that of boys in all the subscales, except for the social subscale. The difference between the boys and girls were statistically significant at a moderate level in the personal subscale ($p=0.06$).

With regard to differences between the three ethnic groups (white, black and coloured), change after intervention was analyzed by making use of a one-way variance of analysis test.

Insert Table 4 about here

The results in Table 4 revealed a statistically significant difference with regard to the MABC-total between the white and the black children in group 1 ($p=0.05$), indicating that

white children's motor proficiency improved significantly more from the first to the last testing opportunity than in the case of the black children after completion of a motor based intervention programme.

With regard to the rest of the results, no significant differences could be documented between any of the ethnic groups in any of the intervention groups with regard to their MABC, TSCS and CAS. However, from the results in Table 4 it does seem that the MABC-total of white children in groups 1, 3 and 4 improved most, although not significantly. The motor proficiency of the white children did therefore improve most after following the motor based intervention as well as integrated psycho-motor intervention programme. They were also the ethnic group within the control group (who did not receive any intervention) whose motor proficiency improved the most. In contrast, in group 2 they were the ethnic group whose motor proficiency decreased most from the first to the last testing opportunity. Though the children in group 2 received only psychological intervention, the coloured children showed improvement in their motor proficiency from the first to the last testing opportunity. In group 1 the black children showed the least improvement after the motor based intervention programme, while the coloured children showed the second most improvement. The black and coloured children in groups 3 and 4 showed the same amount of improvement from the first to the last testing opportunity.

With regard to the TSCS it seemed that the self-concept of the children in the groups that received psychological intervention had improved. There could, however, not be identify one ethnic group that, in general, improved more than the others. One interesting finding was, however, that the black girls, who did not receive psychological intervention, showed a decrease in their self-concept score from the first to the last testing opportunity.

With regard to the CAS, it was found that the anxiety of white children in groups 1, 3 and 4 decreased most from the first to the last testing opportunity. In group 2 the black children showed the largest decrease, while the coloured children in this group showed an

increase in anxiety. In groups 1 and 4 the white children were the only group that showed a decrease in anxiety while, on the other hand, the black children in these groups showed an increase in anxiety and the coloured children in group 1 an increase in anxiety but in group 4 their anxiety score stayed the same. It seems that the only group in which all three the ethnic groups showed a decrease in anxiety was group 3 (integrated psycho-motor intervention).

Because of the fact that the white children in group 1 had a significantly more marked improvement in their MABC-total than the black children, a one-way analysis of variance was conducted for the subscales of the MABC in this group (Table 5).

Insert Table 5 about here

The results of this analysis (Table 5) displayed no significant differences between the different ethnic groups with regard to the MABC subscales. Table 5 does, however, show that the white children showed the most improvement for the MD and BS subscales. On the other hand, it was the coloured children in the BAS subscale who showed the largest increase in balance proficiency, while the black children showed a slight decrease in their balance proficiency from the first to the last testing opportunity.

Discussion

The aim of this study was to determine the effect of gender and ethnic group on the success of a purely motor based intervention, integrated psycho-motor intervention and psychological intervention for children 7–9 years of age diagnosed with DCD.

In general it can be concluded that no significant differences exist between the genders after participation in the different intervention programmes. Emmanouel *et al.* (1992) and Goodway and Rudisill (1996) also reported no differences between genders at ages 10 and 4 respectively after participation in a motor intervention programme. The only statistically significant difference found between the two genders was in group 2 (who followed the psychological intervention programme) where the self-concept of girls improved moderately significantly more than the self-concept of boys from the first to the last testing session. The same tendency, although not significant, was also found in group 3 (who received psychological and motor intervention) where the girls again showed a more marked improvement in self-concept compared to the boys. It therefore seems that, in general, the girls in this study react more positively to a psychological intervention programme than the boys. With regard to the subscales of the TSCS it was found that the girls showed the most improvement from the first to the last testing opportunity in all the subscales (specifically the personal subscale), except for the social subscale.

When the results regarding anxiety of the children are taken into consideration, it seems that the girls in the motor based intervention group, in the integrated psycho-motor intervention group as well as in the self-concept intervention group showed a general decrease in anxiety from the first to the last testing opportunity, whereas the boys in the motor based intervention group and psychological intervention groups showed a general increase in anxiety. The boys in the integrated psycho-motor intervention group were the only ones that showed a decrease in anxiety. However, these tendencies were not significant. The increase in anxiety among the boys in the motor based intervention group could be due to

the fact that they realized during the motor intervention period, that they experienced certain problems, which possibly could have led to a raise in anxiety. The fact that this same tendency was evident in the psychological group is, however, difficult to explain. In general, the boys showed higher anxiety compared to the girls, which is contradictory to findings of Ohannesian *et al.* (1999) and Rose *et al.* (1999), which states that girls with motor problems displayed higher anxiety than boys but in line with findings of Sigurdsson *et al.* (2003) who found that the anxiety of boys is associated with motor impairment.

With regard to the influence of ethnicity on improvement, it seemed that the motor proficiency of the white children in group 1 improved significantly more than the motor proficiency of the black children in the same group after completion of the motor intervention programme. A possible reason for this could be the fact that some of the black children who participated in the study, and who are in a double medium school (Afrikaans and English) could, however, not speak or understand English or Afrikaans very fluently. Hence, they could have struggled to understand and follow all the instructions enabling them to participate in the intervention programme to their full potential. A further explanation could be the fact, as explained in Peens *et al.* (submitted for publication), that neuro-motor problems could influence the effect of an intervention programme negatively. It could therefore be possible that some of the black children in this study had certain underlying neuro-motor problems that could have negatively influenced the effect of the intervention programmes, although this conclusion is only speculative. A further possibility could be that the black children do not have the same opportunities and exposure for motor development as the white children might have. Further analysis of the subscales of the MABC, however, showed no differences between the ethnic groups, which could have provided some further explanation for the differences found. However, no literature could be traced that indicates that adaptations should be made to motor intervention programmes based on specific ethnic considerations.

With regard to the total self-concept of the different race groups, it seemed that the self-concept of coloured children in groups 1 and 3 improved most, while on the other hand the self-concept of white children in groups 2 and 4 improved the most from the first to the last testing opportunity. However, none of the above-mentioned differences were significant. As for anxiety, it was found that in groups 1 and 4 it was only the white children's anxiety that decreased. In group 3 the anxiety of the white children decreased most of all the ethnic groups while in group 2 it was the black children whose anxiety decreased most. These differences with regard to anxiety were not statistically significant. It was only in group 3 (psycho-motor programme) that the anxiety of all three the ethnic groups decreased. It therefore seemed necessary for children to partake in both a psychological and motor based intervention programme in order to decrease the anxiety that is associated with their motor problems and low self-concept.

In conclusion, it could be stated that ethnicity and gender did not influence the effect of the different intervention programmes they were subjected to. This statement is based on the fact that the motor proficiency of the children (of both genders and different ethnic groups) improved after participation in the motor based intervention as well as the integrated psycho-motor intervention programme. In addition, the children that participated in the psychological and integrated psycho-motor intervention programme showed similar improvement in their self-concept. The only exception was found with regard to anxiety which was discussed with regard to gender and ethnic groups.

Although two statistically significant differences were found in the results of this study, it did not seem to be significant enough to justify the use of different intervention programmes for the two genders and the different ethnic groups.

Certain limitations that did, however, come to the fore was, first of all, the high number of dropouts in the study. If all the participants could have been in the study from the first to the last testing opportunity, and thereby could have represented all genders and ethnic groups

in each intervention group, more relevant in-depth analyses could have been done to distinguish between gender and ethnic group in each intervention group. A further confounding factor was the fact that all the children, although they were in double medium schools, could not speak and understand the medium of instruction fluently. A final limiting factor was that the control group in this study was not totally inactive during the intervention period. Limitations of this nature should thus be addressed in future studies of this nature.

Word count: 4 813 words

References

Bosacki, S., Innerd, W. & Towson, S. (1997) Field independence-dependence and self-esteem in preadolescents: does gender make a difference? *Journal of Youth and Adolescence,* **26**, 691-703.

Colchico, K., Zybert, P. & Basch, C.E. (2000) Effects of after-school physical activity on fitness, fatness, and cognitive self-perceptions; a pilot study among urban, minority adolescent girls. *American Journal of Public Health,* **90,** 977-978.

Crocker, P.R.E., Eklund, R.C. & Kowalski, K.C. (2000) Children's physical activity and physical self-perceptions. *Journal of Sports Sciences,* **18**, 383-394.

Davies, J. & Brember, I. (1999) Boys outperforming girls: an 8-year cross-sectional study of attainment and self-esteem in year 6. *Educational Psychology,* **19**, 5-16.

Dussart, G. (1994) Identifying the clumsy child in school: an exploratory study. *British Journal of Special Education,* **21,** 81-86.

Emmanouel, C., Zervas, Y. & Vagenas, G. (1992) Effects of four physical education teaching methods on development of motor skill, self-concept, and social attitudes of fifth-grade children. *Perceptual and Motor Skills,* **74,** 1151-1167.

Ernst, J.E. (2004) The influence of an intervention programme on 9-12 year old farmworker children with developmental coordination disorder, based on an integrated approach. Potchefstroom : North-West University. (Master's Thesis).

Fitts, W.H. & Warren, W.L. (1996) Tennessee self-concept scale. (2^{nd} ed). Los Angeles, Calif.: Western psychological services.

Fox, A.M. & Lent, B. (1996) Clumsy children – primer on developmental coordination disorder. *Canadian Family Physician,* **42,** 1965-1971.

Gillis, J.S. (1980) Child anxiety scale. Los Angeles, Calif.: Western psychological services.

Goni, A. & Zulaika, L. (2000) Relationships between physical education classes and the enhancement of fifth grade pupil's self-concept. *Perceptual and Motor Skills,* **91,** 246-250.

Goodway, J.D. & Rudisill, M.E. (1996) Influence of a motor skill intervention program on perceived competence of at-risk African American preschoolers. *Adapted Physical Activity Quarterly,* **13,** 288-301.

Hagger, M., Ashford, B. & Stamvulova, N. (1998) Russian and British children's physical self-perceptions and physical activity participation. *Pediatric Exercise Science,* **10,** 137-152.

Henderson, S.E. & Sugden, D.A. (1992) Movement assessment battery for children. London : The Psychological Corporation.

Hugo, L. (2005) The development and evaluation of a self-concept enrichment programme for children aged 7-9 years. Potchefstroom : North-West University. (Mini-dissertation-MA).

Missiuna, C. (1994) Motor skill acquisition in children with developmental coordination disorder. *Motor Skill Acquisition,* 214-235.

Ohannessian, C.M., Lerner, R.M., Lerner, J.V. & Von Eye, A. (1999) Does self-competence predict gender differences in adolescent depression and anxiety? *Journal of Adolescence,* **22,** 397-411.

Peens, A., Pienaar, A.E. & Nienaber, A.W. (2004) The self-concept of 10 to 12 year old boys and girls with and without DCD in the North West Province. *Journal for Social Sciences,* **44**, 52-61.

Peens, A. & Pienaar, A.E. Effect of various neuro-motor difficulties on the success of motor intervention for seven to nine year old DCD children. *Submitted for publication.*

Piek, J.P., Dworcan, M., Barrett, N.C. & Coleman, R. (2000) Determinants of self-worth in children with and without developmental coordination disorder. *International Journal of Disability, Development and Education,* **47,** 259-272.

Rose, B., Larkin, D. & Berger, B.G. (1999) Athletic anxiety in boys and girls with low and high levels of coordination. *The ACHPER Healthy Lifestyles Journal,* **64,** 10-13.

Sigurdsson, E., Van Os, J. & Fombonne, E. (2003) Childhood motor impairment is associated with male anxiety at 11 and 16 years. *Evidence-Based Mental Health,* **6**, 18.

Skinner, R.A. & Piek, J.P. (2001) Psychosocial implications of poor motor coordination in children and adolescents. *Human Movement Science,* **20,** 73-94.

Smith, K.E. & Croom, L. (2000) Multidimensional self-concept of children and teacher beliefs about developmentally appropriate practices. *Journal of Educational Research,* **93**, 312-321.

StatSoft. (2005) Statistica for Windows: General conventions and statistics. Tilsa, Okla. : StatSoft.

Stein, R.J. Bracken, B.A., Haddock, C.K. & Shadish, W.R. (1998) Preliminary development of the children's physical self-concept scale. *Journal of Developmental and Behavioural Pediatrics,* **19**, 1-8.

Steyn, S., Smit, C.F., Du Toit, J. & Strasheim, A.D. (1998) Moderne statistiek in Praktyk. Strasharm.

Sugden, D.A. & Sugden, L. (1991) The assessment of movement skill problems in 7- and 9-year old children. *British Journal of Educational Psychology,* **61,** 329-345.

Wall, A.E., Reid, G. & Paton, J. (1990) The syndrome of physical awkwardness. In Reid, G. (Ed.), *Problems in movement control* (pp. 283-316). North-Holland : Elsevier Science Publishers B.V.

Table 1. Number of children in each gender and ethnic group in each intervention group

Ethnic group	**White**		**Black**		**Coloured**		
Gender	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Total**
Group 1	5	4	6	2	3	0	**20**
Group 2	2	3	2	1	1	1	**10**
Group 3	1	1	1	1	3	4	**11**
Group 4	6	2	4	0	2	3	**17**
Total	14	10	13	4	9	8	**58**

Group1: Motor based intervention; Group 2: Psychological intervention; Group 3: Integrated psycho-motor intervention; Group 4: Control group.

Table 2. Significance of differences between boys and girls for the different tests

Test	Girls Adjusted Mean	SD-Girls	Boys Adjusted Mean	SD-Boys	t-value	df	p-value
			Group 1				
MABC	-10.92	9.07	-9.25	5.60	-0.51	18	0.62
TSCS	-18.33	61.90	10.21	38.75	-1.26	18	0.22
CAS	-0.17	6.82	0.21	4.87	-0.14	18	0.89
			Group 2				
MABC	1.00	9.46	-0.90	3.85	0.42	8	0.69
TSCS	52.60	24.88	30.00	10.22	1.88	8	0.09*
CAS	-2.80	5.54	0.20	7.01	-0.75	8	0.66
			Group 3				
MABC	-9.67	5.31	-6.20	4.40	-1.16	9	0.27
TSCS	60.67	28.16	49.80	29.63	0.62	9	0.55
CAS	-0.33	7.37	-0.60	1.67	0.08	9	0.94
			Group 4				
MABC	-5.10	2.86	-6.75	4.96	0.69	15	0.50
TSCS	-5.80	44.18	15.08	44.11	-0.89	15	0.39
CAS	1.60	7.64	0.67	5.52	0.28	15	0.78

*p≤0.10; **p≤0.05; ***p≤0.01

Table 3. Significance of differences between boys and girls for the TSCS subscales in group 2

Test	Girls Adjusted Mean	SD-Girls	Boys Adjusted Mean	SD-Boys	t-value	df	p-value
Physical	11.00	9.67	3.20	8.58	1.35	8	0.21
Moral	3.20	7.79	0.40	7.30	0.59	8	0.57
Personal	10.20	3.03	4.80	4.76	2.14	8	0.06*
Family	10.40	8.08	7.80	7.82	0.52	8	0.62
Social	9.80	7.73	10.40	5.13	-0.14	8	0.89
Academic	8.00	3.16	3.40	5.86	1.55	8	0.16

*$p \leq 0.10$; **$p \leq 0.05$; ***$p \leq 0.01$

Table 4. Significance of differences between the different ethnic groups for each specific intervention group

	Group 1		
	MABC		
Test component	**M(1)=-13.28**	**M(2)=-5.63**	**M(3)=-10.17**
White children (1)		0.05**	0.79
Black children (2)	0.05**		0.62
Coloured children (3)	0.79	0.62	
	TSCS		
Test component	**M(1)=9.78**	**M(2)=-22.38**	**M(3)=41.33**
White children (1)		0.33	0.65
Black children (2)	0.33		0.20
Coloured children (3)	0.65	0.20	
	CAS		
Test component	**M(1)=-1.78**	**M(2)=2.25**	**M(3)=0.00**
White children (1)		0.30	0.91
Black children (2)	0.30		0.86
Coloured children (3)	0.91	0.86	
	Group 2		
	MABC		
Test component	**M(1)=2.40**	**M(2)=0.50**	**M(3)=-6.50**
White children (1)		0.94	0.42
Black children (2)	0.94		0.57
Coloured children (3)	0.42	0.57	
	TSCS		

Test component	M(1)=47.60	M(2)=43.33	M(3)=22.50
White children (1)		0.97	0.51
Black children (2)	0.97		0.62
Coloured children (3)	0.51	0.62	
	CAS		
Test component	**M(1)=-2.80**	**M(2)=-3.33**	**M(3)=5.00**
White children (1)		0.99	0.30
Black children (2)	0.99		0.32
Coloured children (3)	0.36	0.32	
	Group 3		
	MABC		
Test component	**M(1)=-10.75**	**M(2)=-7.50**	**M(3)=-7.50**
White children (1)		0.82	0.82
Black children (2)	0.82		1.00
Coloured children (3)	0.82	1.00	
	TSCS		
Test component	**M(1)=36.50**	**M(2)=46.00**	**M(3)=64.00**
White children (1)		0.94	0.61
Black children (2)	0.94		0.80
Coloured children (3)	0.61	0.80	
	CAS		
Test component	**M(1)=-1.50**	**M(2)=-0.50**	**M(3)=-0.14**
White children (1)		0.98	0.97
Black children (2)	0.98		1.00
Coloured children (3)	0.97	1.00	

Group 4			
MABC			
Test component	**M(1)=-7.31**	**M(2)=-5.50**	**M(3)=-5.20**
White children (1)		0.84	0.75
Black children (2)	0.84		1.00
Coloured children (3)	0.75	1.00	
TSCS			
Test component	**M(1)=19.75**	**M(2)=-10.50**	**M(3)=7.20**
White children (1)		0.62	0.90
Black children (2)	0.62		0.84
Coloured children (3)	0.90	0.84	
CAS			
Test component	**M(1)=-1.63**	**M(2)=3.50**	**M(3)=3.00**
White children (1)		0.45	0.44
Black children (2)	0.45		0.99
Coloured children (3)	0.44	0.99	

*p≤0.10; **p≤0.05; ***p≤0.01

Table 5. Significance of differences between the different ethnic groups for the MABC subscales in group 1

Manual Dexterity Skills (MD)			
Test component	**M(1)=-5.56**	**M(2)=-3.94**	**M(3)=-3.83**
White children (1)		0.72	0.87
Black children (2)	0.72		1.00
Coloured children (3)	0.87	1.00	
Ball Skills (BS)			
Test component	**M(1)=-4.33**	**M(2)=-1.88**	**M(3)=-2.33**
White children (1)		0.18	0.63
Black children (2)	0.18		0.98
Coloured children (3)	0.63	0.98	
Balance Skills (BAS)			
Test component	**M(1)=-3.39**	**M(2)=0.19**	**M(3)=-4.00**
White children (1)		0.10	0.97
Black children (2)	0.10		0.28
Coloured children (3)	0.97	0.28	

*p≤0.10; **p≤0.05; ***p≤0.01

CHAPTER 6

EFFECT OF VARIOUS NEURO-MOTOR DIFFICULTIES ON THE SUCCESS OF MOTOR INTERVENTION FOR 7 - 9 YEAR OLD DCD CHILDREN

Effect of various neuro-motor difficulties on the success of motor intervention for 7 – 9 year old DCD children

Anquanette Peens and Anita E. Pienaar

North-West University

Author Note

Anquanette Peens, School for Biokinetics, Recreation and Sport Science, North-West University (Potchefstroom Campus); Anita, E. Pienaar, School for Biokinetics, Recreation and Sport Science, North-West University (Potchefstroom Campus).

Correspondence concerning this article should be addressed to Anquanette Peens, School for Biokinetics, Recreation and Sport Science, North-West University (Potchefstroom Campus), Private Bag X6001, Internal Box 494, Potchefstroom, 2520, South Africa. E-mail: mbwap@puknet.puk.ac.za

Effect of various neuro-motor difficulties on the success of motor intervention for 7 – 9 year old DCD children

Abstract

Children with Developmental Coordination Disorder (DCD) form a heterogeneous group and research evidence indicates a relationship between neuro-motor problems and DCD. Children (N = 58) in the age group 7 to 9 years took part in this study. They were evaluated with the Movement Assessment Battery for Children (MABC) during the pretest, posttest and retest 1 (2 months after the intervention programme had been conducted). During retest 2 (1 year after retest 1) they were evaluated with the MABC, Bruininks-Oseretsky Test for Motor Proficiency – Short Form, Sensory input measurement instrument as well as the Quick Neurological Screening Test II to re-determine their motor proficiency and possible neuro-motor problems. The results indicate that children without any neuro-motor problems improved significantly more (p = .01) after an intervention programme than children with neuro-motor problems. It is concluded that the effect of an intervention programme can be negatively influenced by underlying neuro-motor problems.

Effect of various neuro-motor difficulties on the success of motor intervention for 7 – 9 year old DCD children

Developmental Coordination Disorder (DCD) describes a group of people which is, according to the DSM-IV (APA, 1994), known for their motor coordination problems, while they have normal intelligence and no known neurological condition or physical disability. The motor problems they experience influence their routine of daily living as well as their academic performance (APA, 1994). Various researchers (Fox, 2000; Geuze & Börger, 1993; Hoare, 1994; Hoare & Larkin, 1991; O'Hare & Khalid, 2002) state that children with DCD are a heterogeneous group, with problems that differ from one individual to another. These problems include a lower performance IQ (Piek & Coleman-Carman, 1995) as well as problems concerning kinaesthetic tasks and perception (Coleman, Piek & Livesay, 2001; Hoare & Larkin, 1991; Lord & Hulme, 1987; Piek & Coleman-Carman, 1995). Vision problems (Hulme, Biggerstaff, Moran & Mckinlay, 1982; Lord & Hulme, 1987; Mon-Williams, Mackie, Mcculloch & Pascal, 1996; Sigmundsson & Hopkins, 2005; Smits-Engelsman, Niemeijer & Van Galen, 2001; Van Waalvelde, De Weerdt, De Cook & Smits-Engelsman, 2004) slower movement times (Henderson, Rose & Henderson, 1992; Huh, Williams & Burke, 1998; Maruff, Wilson, Trebilcock, & Currie, 1999; Van der Meulen, Denier van der Gon, Gielen, Gooskens & Willemse, 1991) and problems when working under pressure of time (Rodger et al., 2003) are also doccumented. It is suggested that children diagnosed with DCD should receive remedial help as soon as possible (Schoemaker & Kalverboer, 1994; Schoemaker, Hijlkeme & Kalverboer, 1994). In this regard Guralnick (1991) states that early intervention minimizes declines in development. Losse et al. (1991) emphasized that if remedial help is not received, problems of these children will continue into adolescence and even adulthood.

Regarding the origin and complexity of the difficulties that DCD children experience, research evidence indicates a relationship between neuro-motor problems and DCD (Hoare &

Larkin, 1991; Lord & Hulme, 1987; Piek & Coleman-Carman, 1995). An association between vision-related problems and DCD is also indicated (Hulme et al., 1982; Lord & Hulme, 1987; Mon-Williams et al., 1996; Sigmundsson & Hopkins, 2005; Smits-Engelsman et al., 2001; Van Waalvelde et al., 2004). Other neuro-motor functions related to DCD are kinaesthesis (Hoare & Larkin, 1991; Lord & Hulme, 1987; Piek & Coleman-Carman, 1995), reflexes (Cheatum & Hammond, 2000) and vestibular functioning (Cheatum & Hammond, 2000).

A variety of different intervention methods (Pless, Carlsson, Sundelin & Persson, 2000; Revie & Larkin, 1993) are described in the literature which substantiates the different problems that DCD children experience. Wright and Sugden (1996) stressed that intervention programmes should take into consideration differences found in the subtypes of children with DCD, while Sugden and Sugden (1991) and Mandich, Polatajko and Rodger (2003) also highlighted that the remediation process should include a wide range of activities stressing all processes of motor control. However, contradictory results with regard to the success rate of intervention for DCD children are still reported. In some studies all the children improved after intervention (Peens, Pienaar & Nienaber, in press; Peters & Wright, 1999; Pless et al., 2000; Sims, Henderson, Hulme & Morton, 1996). In studies by Revie and Larkin (1993), Schoemaker et al. (1994), Zittel and McCubbin (1996) the experimental groups improved, while Sugden and Chambers (2003) also found that some children's problems worsened. In addition, researchers found that some children can also improve without any intervention (Malina, Bouchard & Bar-Or, 2004), which is mainly attributed to maturation.

According to the above-mentioned literature, it is clear that the problems that DCD children experience incorporate much more than just the impairment of their motor abilities. It is also seen that intervention programmes do not benefit all DCD children to the same extent. Although it is clear that a relationship exists between DCD and neuro-motor

problems, the role of this relationship in the outcome of an intervention programme have not been analyzed yet. In this study answers to the question whether underlying neuro-motor difficulties could limit the success of intervention programmes for DCD children are sought. The results of this research could help professionals working with such children to plan their intervention programmes more efficiently.

Method

Participants

This is a follow-up of a study where the effect of different intervention programmes on the self-concept and motor proficiency of 7 – 9 year old DCD children were tested (Peens et al., submitted for publication). Four groups formed part of the experimental design of the initial study, namely an experimental group 1 (Motor intervention group), experimental group 2 (Psychological intervention group), experimental group 3 (Psycho-motor intervention group) and group 4 (Control group with no intervention). For the purpose of the present study group 1 and 3 were combined and formed one experimental group (n = 31). Group 2 (who received no motor intervention, only psychological intervention) and group 4 from the first study were grouped to form one control group (n = 27). The total group of participants in this study, therefore, is 58 children.

Apparatus

Movement Assessment Battery for Children (MABC)

The MABC which has good reliability (Henderson & Sugden, 1992) and which can be used in four to twelve year old children was used. The MABC tests manual dexterity (three tests), ball skills (two tests) and balance skills (three tests) which could be scored as three separate sub-scores or a total score. The higher the score, the lower the child's motor ability will be. The test is a norm based test and classifies children on or under the 5th percentile as children with DCD who need intervention. When a child falls above the 5th but

on or under the 15th percentile they are at risk for DCD and may need intervention later in life. In this study all the children classified as DCD were on or under the 15th percentile.

Bruininks-Oseretsky Test for Motor proficiency – Short Form (BOTMP-SF)

The Bruininks-Oseretsky Test for Motor proficiency – Short Form was additionally used to analyze the children's motor proficiency. This test is a norm based test used to determine motor proficiency in children 4.6 – 14.6 years of age (Bruininks, 1978). The short form includes subtests for running speed and agility, balance, bilateral integration, upper limb coordination, reaction speed and visual-motor control. The BOTMP-SF standard score is calculated and converted into a percentile score ranking. According to the BOTMP manual, a child with a percentile lower than 42 is considered to have DCD.

The Sensory Input Measurement Instrument (SIM)

The Sensory Input Measurement Instrument by Pyfer and Strauss (Auxter, Pyfer & Huettig, 1997) is a criterion referenced instrument. It consists of subtests for reflexes, equilibrium, vestibular functioning and visual functioning, and is applicable for all ages (Auxter et al., 1997). Reflexes are divided in tonic labyrinthine in supine (TLS) tonic labyrinthine in prone (TLP) and the positive support reaction (PSR). In this test the child receives a (2) if he/she cannot successfully comply with the criterion and a (1) if he/she can successfully comply with the criterion. Vestibular function and equilibrium reaction on both sides (left and right) were tested separately. Visual functioning was evaluated by eleven tests, fixation (both eyes and the left and right eye separately), ocular alignment (left and right eye separately), visual tracking (both eyes as well as with the left and right eye separately), convergence-divergence and visual tracking of a horizontal and vertical line (both eyes). For the total score a maximum of (40) and a minimum of (20) are possible. A higher neuro-motor total indicates more neuro-motor problems.

Quick Neurological Screening Test II (QNST)

The Quick Neurological Screening Test II (Mutti, Martin, Sterling & Spalding, 1998) is a criterion based measuring instrument that evaluates visual discrimination, visual perception, fine motor control, hand-eye coordination, muscle tone, motor planning and sequencing, spatial orientation and bilateral coordination. This measuring instrument is suited for persons from 5 years to adulthood (Mutti et al., 1998). In this instrument the child receives a (3) for a major problem and a (1) for a minor problem. If there is no problem present the child receives a (0). The higher the total score the more neuro-motor problems are present or the neuro-motor problems are more complex. Because of the limited time available to test all the children only the most relevant subtests of this test battery were used (figure recognition, arm and leg extension, finger-to-nose, thumb-finger-circles and rapidly repetitive hand movements). For the purpose of this study these components were the most important to determine. For certain analysis (Table 6) in this study only a (1) was given for no problems and a (2) for problems in a specific component. The reason for this being that this specific statistical analysis could only be conducted with test items with only two factorial values.

Statistical procedure

For the analysis of the data use was made of the Statistica for Windows (StatSoft, 2005) computer package to determine descriptive statistics (means, maximum and minimum values). Independent t-testing was then done to analyze differences between the experimental and control group for the MABC-total and between the improvement and the non-improvement groups. Co-variance of analysis was conducted adjusting for the neuro-motor tests to determine what role they have in statistically significant differences between the experimental and control groups. For statistically significant differences found by means of the t-tests and the co-variance of analysis, effect sizes were calculated to determine the practical significance of differences. For statistical significance, a p-value of $\leq .10$ was seen as significant and considered as a moderate statistical significance. A p-value of $\leq .05$ has a

statistical significance on the 95th percentile while a *p*-value of ≤ .01 is seen as significant on the 99th percentile. For practical significance, a *d*-value of .2 indicates a small significance, .5 a moderate significance and a *d*-value of .8 shows a large practical significance (Thomas & Nelson, 1996). Contingency tables were used to determine the number and percentages of children in the experimental group and control group who respectively improved and didn't improve after the intervention programme. Lastly, a factorial ANOVA (two way analysis of variance) followed by an unequal NHSD post hoc test was conducted to analyze differences between the different groups for the reaction speed.

Procedure

The initial study (Peens et al., submitted for publication) involved four testing sessions, a test-retest (one before and one after the eight week intervention programme) and two follow-up testing sessions (two months after completion of the intervention and the second one, a year later) to determine the lasting effect of the intervention programme. In the first and third testing sessions the participants completed the MABC and two psychological tests (not relevant to this study). During the second testing session (post-test) only the MABC was completed. During the second follow-up testing session, the participants were tested with the MABC, BOTMP-SF, QNST and the SIM.

The MABC-total they obtained was used to divide the children into an improvement group (IG) and a non-improvement group (NIG). Those grouped in the improvement group improved significantly from the first to the last testing session (n = 38), whereas the non-improvement group did not (n = 20). These two groups were further divided into an experimental improvement group (EIG), experimental non-improvement group (ENIG), control improvement group (CIG) and control non-improvement group (CNIG). The number (n) of children in these groups, as well as the percentage of children who improved in the different groups can be seen in Table 1.

Insert Table 1 about here

This analysis indicates that 81% of the children in the experimental group improved after intervention, compared to 48% in the control group who also improved, but without any intervention. However, the higher percentage of improvement reported in the experimental group suggests that the intervention programme had a positive effect on this group (group 1 and 3), which is substantiated by a calculated effect size of .70 (moderate practical significance) for the above percentage differences. The question why six children (19%) in the experimental group did not improve while thirteen in the control group (48%) improved without any intervention still remains unanswered. Underlying neuro-motor problems may be a reason for this tendency that children in the experimental group did not improve and maturation may have an effect on the children in the control group that did improve. This hypothesis will be analyzed in the following section.

Results

As a first step, in determining if neuro-motor problems could limit the success of an intervention programme, an independent t-test (Table 2) was done to determine possible differences in the MABC-total between the experimental and control groups. The MABC-total used in this and further analysis is the total of the pre-testing session subtracted from the second retest (adjusted mean for the MABC-total). The results in Table 2 confirm the data shown in Table 1 that the experimental group (n = 31) (M = -9.16, SD = 6.10) improved statistically as well as practical significantly more than the control group (n = 27) (M = -3.93, SD = 6.17), $t(56) = -3.25$, $p = .00$ (one-tailed), $d = .85$.

Insert Table 2 about here

In a next step there was corrected for the neurological test totals (SIM and QNST) that each group achieved by making use of a co-variance of analysis (Table 3). This analysis indicates that the corrected mean for the MABC-totals of the experimental and control group, differ statistically significantly when the SIM, $F(1,55) = 13.02$, $p = .00$ and QNST, $F(1,55) = 9.05$, $p = .00$, is accounted for. These differences showed a large practical significance (SIM; d =

.97 en QNST; d = .81) respectively. These results confirm that neuro-motor problems found in children with DCD might have an influence on their improvement after an intervention programme. This could also be the reason why some of the children in the control group did not improve during that time. These results justify further statistical procedures to analyse the influence of neurological components on DCD children who did not improve after intervention. An explanation for why some of the children in the control group improved without any intervention is also being sought.

Insert Table 3 about here

Yet another step was to analyse the effect of neuro-motor problems on the children in the improvement group (IG) and the non-improvement group (NIG). An independent t-test (Table 4) was done to compare the totals of the two neurological tests (SIM and QNST) in the IG and the NIG.

Insert Table 4 about here

With regard to the QNST total, a statistical as well as a moderately practically significant difference is seen between the IG (M = 11.13, SD = 3.27), and the NIG (M = 13.90, SD = 3.86), $t(56) = -2.88$, p = .01 (one-tailed), d = .72, (Table 4). On the other hand, a moderate statistically significant and small practically significant difference between the IG (M = 29.71, SD = 3.64) and NIG (M = 31.50, SD = 4.38), $t(56) = -1.66$, p = .10 (one-tailed), d = .41, are seen for the SIM total. In both instances it is clear that the IG had fewer neuro-motor problems compared to the NIG. Although the same tendencies were found when the experimental and control group were analysed separately with regard to the IG and NIG, the difference was only significant ($p < .05$) in the control group. From the above-mentioned results it seems that children in the IG had fewer or less complex neurological problems compared to children in the NIG. Neurological problems could, therefore, have a negative influence on the success of the intervention programme.

A following step was to make use of subcomponents of the neurological tests to analyse further the possible effect of the underlying neurological components on no improvement (Table 5 and 7). For this analysis an independent t-test was used to determine differences regarding subcomponents of the neurological tests between the NIG and the IG. In the analysis in Table 5 and 6 the same subtests were used, except for reaction speed and the reflex total that are not shown in Table 6, but in Table 7. For these last two mentioned subcomponents, scoring is of such a nature that there could not be given just a (1) or a (2). Therefore, another statistical analysis was used to analyse these results.

Insert Table 5 about here

Certain subtests of the BOTMP-SF were also used for this analysis because they can be seen as neuro-motor components. Only components of the BOTMP-SF, SIM and QNST that showed significant differences are documented in Table 5. From the BOTMP-SF, fourteen subcomponents were evaluated from which three showed significant differences between the IG and NIG (copying pencils, drawing a line and reaction speed). The SIM consists of eight subtests although the eye functions are subdivided into another eleven subtests. From this test one of the eight (reflex total) and three of the eleven eye function tests (fixation with the right eye, tracking with both eyes and the left eye separately) showed significant differences between the IG and NIG. From the QNST five subtests were evaluated and one of them showed significant differences between the IG and NIG (visual perceptual memory) (Table 5).

The "copying pencils" subtest in the BOTMP-SF requires visual motor integration from the child to complete the task successfully. In Table 5 it can be seen that the children in the NIG (M = 1.95, SD = 0.22) reproduce the figure incorrect more often than those in the IG (M = 1.53, SD = 0.51), $t(56)$ = -3.55, p = .00 (one-tailed), d = .84, when it is taken into account that a (1) is given for the correct reproduction and a (2) for incorrect reproducing the figure.

The same variables were analysed by contingency tables in Table 6, to determine what percentage of the children experienced problems or no problems in the experimental improvement group (EIG), experimental non-improvement group (ENIG), control improvement group (CIG) and control non-improvement group (CNIG) respectively. An equal distribution of visual-motor integration problems was found in the EIG (problems: 48%, no problems: 52%) as well as in the CIG (problems: 46.15%, no problems: 53.85%). When the differences between the children in the ENIG and CNIG are analysed it seems that 100% (ENIG) and 92.86% (CNIG) of the children experienced problems with regard to visual-motor integration, respectively. From the results in Table 5 and 6 it is clear that children in the NIG experienced more visual-motor integration problems than the children in the IG.

For a visual motor control task (drawing a line) the child also needs visual-motor integration to complete the task successfully. Results regarding this task (Table 5) also show a statistically as well as practically significant difference between children in the IG (M = 1.37, SD = 0.49) and those in the NIG (M = 1.70, SD = 0.47), $t(56) = -2.49$, $p = .02$ (one-tailed), $d = .68$. This result is confirmed in Table 6 where 56% (EIG) and 76.72% (CIG) of children that improved experienced no problems compared to 50% (ENIG) and 21.43% (CNIG) of children that did not improve. The results in Table 5 and 6, therefore, show that children in the NIG experience more problems in this task than children in the IG.

Insert Table 6 about here

The same tendencies were found with regard to reaction speed (Table 5). Children in the IG (M = 49.11, SD = 29.35) had statistically as well as moderately practically significant better reaction speed than those in the NIG (M = 27.85, SD = 22.13), $t(56) = 2.84$, $p = .01$ (one-tailed), $d = .72$. It seems that during the performance of the reaction speed task the interplay between the things one is visually aware of and those that are done motorically isn't always so effective. This can be an indication of poor visual-motor integration. For a further

analysis with regard to reaction speed, a factorial ANOVA was conducted to determine differences between the EIG, ENIG, CIG and CNIG. In this analysis it was found (Table 7) that the reaction speed of the CNIG (M = 26.286) was statistically significantly worse than that of the CIG (M = 58.00). Although there were no statistically significant differences between the EIG and the ENIG, it is seen that the ENIG had a lower reaction speed (M = 31.50) than the EIG (M = 44.48). From the results of the reaction speed (Table 5 and 7), it is clear that children in the NIG had slower reaction speed than children in the IG.

Insert Table 7 about here

From the results obtained in Table 5 with regard to eye functions it seems that when eye function problems are present, the children did not improve after the intervention programme. The specific eye control problems that were more present in the children in the NIG than in those in the IG were problems regarding fixation with the right eye [NIG (M = 1.60, SD = 0.50) and IG (M = 1.21, SD = 0.41), $t(56)$ = -3.16, p = .00 (one-tailed), d = .77], tracking with both eyes [NIG (M = 1.60, SD = 0.50) and IG (M = 1.24, SD = 0.43), $t(56)$, p = .01 (one-tailed), d = .72] and tracking with the left eye separately [NIG (M = 1.95, SD = 0.22) and IG (M = 1.71, SD = .046), $t(56)$ = -2.19, p = .03 (one-tailed), d = .52]. The results in Table 6 confirm that the ENIG and CNIG had a bigger percentage of the above-mentioned problems compared to children in the EIG and CIG.

With regard to the reflex total (Table 5), a moderate statistically significant difference is documented between the IG (M = 4.55, SD = 0.83) and NIG (M = 4.95, SD = 0.89), $t(56)$ = -1.69, p = .10 (one-tailed), d = .45. From the analysis in Table 7 there are, however, no significant differences between the EIG, CIG, ENIG and CNIG. The reflex total (sum total of the tonic labyrinthine supine, tonic labyrinthine prone and the positive support reaction) indicates a total of a (6) if they do not successfully comply with the criterion of all the reflexes and a total of a (3) if they successfully comply with the criterion of all the reflexes.

It does, however, seem that children in the ENIG (M = 5.17) and CNIG (M = 4.86) experienced more reflex problems than those in the EIG (M = 4.48) and CIG (M = 4.69).

For visual perceptual memory (Table 5), a moderately statistical as well as a moderately practically significant difference was found between the IG (M = 1.21, SD = 1.26) and the NIG (M = 2.70, SD = 1.78), $t(56)$, p = .09 (one-tailed), d = .50. Table 6 on the other hand also shows that children in the CNIG had more problems concerning visual perceptual memory (78.57%) than those in the CIG (only 46.15% had problems). For the CNIG, 83.33% of children showed problems while only 16.67% of the ENIG showed problems. The reason for the above-mentioned finding is unclear.

Discussion

The aim of this study was to determine whether the success of an intervention programme for DCD children could be influenced negatively by underlying neuro-motor problems. The influence of visual-motor integration, vestibular functioning, reflexes and eye functions are examined. Only the aspects that showed significant influences are shown in tables and are further discussed in this study. In a stepwise analyses of the results it was found that the group that received intervention had a significantly better MABC-total compared to the group that did not receive intervention, implying that the intervention programme that were conducted in this study could improve a child's motor proficiency. Although the children in the intervention group improved their motor proficiency, there were children (n = 6) who did not improve, while some of the children in the control group (n = 13) improved. In further analyses the differences between the improvement group (IG) and non-improvement group (NIG) were analyzed to determine whether neuro-motor problems had an effect on the non-improvement that certain children in the intervention group experienced. The results showed that DCD children who did not improve, experienced a variety of neuro-motor problems as discussed below.

The analyses showed that three of the fourteen subtests of the Bruininks Oseretsy Test of Motor Profiency – Short Form (BOTMP-SF) showed a clear difference between the IG and the NIG. These subtests were the overlapping pencils and drawing a line (subtests of the visual-motor control test) as well as reaction speed. The aim of the "overlapping pencils" test was to determine problems in the integration and/or coordination of visual perceptual and motor (finger and hand movements) abilities. In accordance with the above-mentioned, Beery (1997) stated that the general spatial organization of forms is developed at the age of six. Although the children in this study are aged 7 to 9 years they were not able to comply to the test requirements of the overlapping pencil drawing. That was not the case in this study. Children also need visual-motor control to complete the task successfully. Van Waalvelde et al. (2004) confirmed that DCD children experience visual-motor integration problems which are underlined by this research. Rodger et al. (2003) on the other hand, state that DCD children's visual-motor integration is in the normal boundaries. In the present study it seemed that DCD children who did not improve after the intervention programme, had more visual-motor integration problems than those who did improve.

Researchers (Henderson, May & Umney, 1989; Huh et al., 1998; Van der Meulen et al., 1991) also indicate that children with DCD had poor reaction speed. It was further found that although all the children in this study had DCD, children in the NIG had slower reaction speed compared to the children in the IG. Poor eye control could have been an underlying cause of the problems in the above-mentioned subtests.

From results obtained by the Sensory Input Measurement instrument (SIM), it is clear that four of the eleven subtests (reflex total, fixation with the right eye, tracking with both eyes and left eye separately) showed significant differences between the IG and NIG. Cheatum and Hammond (2000) in this regard state that if a child's reflexes are not inhibited, it could possibly lead to motor problems. Children in the NIG had more reflex problems than the children in the IG. This shows that the children in the NIG's reflexes are not inhibited to

the full extent. From further results of the SIM it is clear that children in the NIG had more eye problems (with regard to eye control) compared to children in the IG.

Regarding the Quick Neurological Screening Test (QNST), one of the five subtests showed significant differences between the IG and the NIG. This subtest (visual-perceptual memory – drawing of a figure and identifying differences between the drawn and original figure) showed that children in the IG were more able to identify differences between the original and drawn figure compared to children in the NIG. In this subtest the functioning of the eyes could have played a role. It, therefore, seems as if eye control could be a major underlying cause of all the above-mentioned problems.

There were, however, children that improved without intervention, as can be seen in the improvement in the control group. There are also some researchers (Sugden & Chambers, 2003) that state that some children improve spontaneously without any intervention. The age range seven to nine years is a period where maturity can influence the motor development, which could be a possible explanation for children in the control group who improved without any intervention (Malina et al., 2004).

It seems, however, that children that did not improve had more problems regarding their eye control. Eye control can, therefore, be seen as an important factor in visual-motor integration, visual-perception and reaction speed. From the results it is clear that the children who did not improve after the intervention programme, had more, but also more complex neuro-motor problems than those that did improve after the intervention programme. The SIM and QNST totals of the children who did, however, improve were lower than the totals of the children that did not improve, indicating less neuro-motor problems. This confirms the hypotheses that underlying neuro-motor problems could be the cause why certain children in the experimental group did not improve after the intervention programme. The effect of an intervention programme can, therefore, be influenced by underlying neuro-motor problems.

It further seems as if maturity could have played a role in the children in the control group who improved without any intervention.

It is, therefore, recommended that children should be tested using an extensive neurological test battery after they have been classified with DCD. It would make the compilation of an intervention programme more meaningful and also provide insight into the underlying problems that are associated with DCD. It is also recommended that in the compilation of future intervention programmes, neuro-motor activities as well as visual therapy ought to form part of the programme.

Certain limitations that came to the fore in this study that could have influenced the results, were that a time limit when testing the children, led to the fact that only some of the subtests of the QNST could be conducted and it is recommended that in order to obtain a better picture of the child's neurology, the complete form of the QNST should be conducted in future research. Notwithstanding the above, it is clear that children with neuro-motor problems did not show the same amount of improvement after an intervention programme compared to children without any neuro-motor problems.

References

American Psychiatric Association. (1994). *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) (4th ed).* Washington, DC: Author.

Auxter, D., Pyfer, J. & Huettig, C. (1997). *Principles and methods of adapted physical education and recreation. (8th ed.).* Chicago : Brown and Benchmark Publisher.

Beery, K.E. (1997). *The Beery-Buktenica developmental test of visual-motor integration (4th ed.).* USA, NJ: Modern Curriculum Press.

Bruininks, R.H. (1978). *Bruininks-Oseretsky Test of Motor Proficiency – Examiner's Manual.* Minnesota: American guidance service.

Cheatum, B.A. & Hammond, A.A. (2000). *Physical Activities for Improving Children's Learning and Behavior.* Champaign, IL: Human Kinetics.

Coleman, R., Piek, J.P. & Livesay, D.J. (2001). A longitudinal study of motor ability and kinaesthetic acuity in young children at risk of developmental coordination disorder. *Human Movement Science,* 20, 95-110.

Fox, A.M. (2000). *Clumsiness in Children.* Retrieved August 28, 2000, from http://www.ahs.uwo.ca/orcn/orgs.

Geuze, R. & Börger, H. (1993). Children who are clumsy: five years later. *Adapted Physical Activity Quarterly,* 10, 10-21.

Gurlanick, M.J. (1991). The next decade of research on the effectiveness of early intervention. *Exceptional Children,* 58, 174-183.

Henderson, S.E., May, D.S. & Umney, M. (1989). An exploratory study of goal-setting behavior, self-concept and locus of control in children with movement difficulties. *European Journal of Special Needs Education,* 4, 1-14.

Henderson, L., Rose, P. & Henderson, S. (1992). Reaction time and movement time in children with a developmental coordination disorder. *Journal of Child Psychology and Psychiatry and Allied Disciplines,* 33, 895-905.

Henderson, S.E. & Sugden, D.A. (1992). *Movement Assessment Battery for Children.* London: The Psychological Corporation.

Hoare, D. (1994). Subtypes of developmental coordination disorder. *Adapted Physical Activity Quarterly,* 11, 158-169.

Hoare, K. & Larkin, D. (1991). Coordination problems in children. *National Sports Researcher Centre,* 18, 1-15.

Huh, J., Williams, H.G. & Burke, J.R. (1998). Development of bilateral motor control in children with developmental coordination disorder. *Developmental Medicine and Child Neurology,* 40, 474-484.

Hulme, C., Biggerstaff, A., Moran, G. & Mckinlay, I. (1982). Visual, kinaesthetic and cross-modal judgments of length by normal and clumsy children. *Developmental Medicine and Child Neurology,* 24, 461-471.

Lord, R. & Hulme, C. (1987). Kinaesthetic sensitivity of normal and clumsy children. *Developmental Medicine and Child Neurology,* 29, 720-725.

Losse, A., Henderson, S.E., Elliman, D., Hall, D., Knight, E. & Jongmans, M. (1991). Clumsiness in children – do they grow out of it? A 10-year follow-up study. *Developmental Medicine and Child Neurology,* 33, 55-68.

Malina, RM., Bouchard, C. & Bar-Or, O. (2004). *Growth, Maturation, and Physical Activity (2nd ed.).* Champaign, IL: Human Kinetics.

Mandich, A.D., Polatajko, H.J. & Rodger, S. (2003). Rites of passage: understanding participation of children with developmental coordination disorder. *Human Movement Science,* 22, 583-595.

Maruff, P., Wilson, P., Trebilcock, M. & Currie, J. (1999). Abnormalities of imagined motor sequences in children with developmental coordination disorder. *Neuropsychologia,* 37, 1317-1324.

Mon-Williams, M.A., Mackie, R.T., Mcculloch, D.L. & Pascal, E. (1996). Visual evoked

potentials in children with developmental coordination disorder. *Pathological Physiology of Optometrics,* 6, 178-183.

Mutti, M.C., Martin, N.A., Sterling, H.M. & Spalding, N.V. (1998). *Quick Neurological Screening Test (Rev. ed.).* Novato, California: Academic Therapy Publications.

O'Hare, A. & Khalid, S. (2002). The association of abnormal cerebellar function in children with developmental coordination disorder and reading difficulties. *Dylsexia,* 8, 234-248.

Peens, A., Pienaar, A.E. & Nienaber, A.W. (2005). The effect of different intervention programmes on the self-concept and motor proficiency of 7-10 year old DCD-children. *Manuscript submitted for publication.*

Peters, J.M. & Wright, A.M. (1999). Development and evaluation of a group physical activity programme for children with developmental coordination disorder: an interdisciplinary approach. *Physiotherapy Theory and Practice,* 15, 203-216.

Piek, J.P. & Coleman-Carman, R. (1995). Kinaesthetic sensitivity and motor performance of children with developmental do-ordination disorder. *Developmental Medicine and Child Neurology,* 37, 976-984.

Pless, M., Carlsson, M., Sundelin, C. & Persson, K. (2000). Effects of group motor skill intervention of five- to six-year-old children with developmental coordination disorder. *Pediatric Physical Therapy,* 12, 183-189.

Revie, G. & Larkin, D. (1993). Task-specific intervention with children reduces movement problems. *Adapted Physical Activity Quarterly,* 10, 29-41.

Rodger, S., Ziviani, J., Watter, J., Ozanne, A. Woodyatt, G. & Springfield, E. (2003). Motor and functional skills of children with developmental coordination disorder: a pilot investigation of measurement issues. *Human Movement Science,* 22, 461-478.

Schoemaker, M.M., Hijlkema, M.G.J. & Kalverboer, A.F. (1994). Physiotherapy for clumsy

children: an evaluation study. *Developmental Medicine and Child Neurology,* 36, 143-155.

Schoemaker, M.M. & Kalverboer, A.F. (1994). Social and affective problems of children who are clumsy: How early do they begin? *Adapted Physical Activity Quarterly,* 11, 130-140.

Sigmundsson, H. & Hopkins, B. (2005). Do 'clumsy' children have visual recognition problems? *Child Care, Health and Development,* 31, 155-158.

Sims, K., Henderson, S.E., Hulme, C. & Morton, J. (1996). The remediation of clumsiness I: an evaluation of Laszlo's kinaesthetic approach. *Developmental Medicine and Child Neurology,* 38, 976-987.

Smits-Engelsman, B.C.M., Niemeijer, A.S. & Van Galen, G.P. (2001). Fine motor deficiencies in children diagnosed as DCD based on poor grapho-motor ability. *Human Movement Science,* 20, 161-182.

StatSoft. (2005). *Statistica for Windows: General Conventions and Statistics.* Tilsa, OK: StatSoft.

Sugden, D.A. & Chambers, M.E. (2003). Intervention in children with developmental coordination disorder: the role of parents and teachers. *British Journal of Educational Psychology,* 73, 545-561.

Sugden, D.A. & Sugden, L. (1991). The assessment of movement skill problems in 7- 9-year old children. *British Journal of Educational Psychology,* 61, 329-345.

Thomas, J.R. & Nelson, J.K. (1996). *Research methods in physical activity (3rd ed.).* Champaign, IL: Human Kinetics.

Van der Meulen, J.H.P., Denier van der Gon, J.J.D., Gielen, C.C.A.M., Gooskens, R.H.J.M. & Willemse, J. (1991). Visuomotor performance of normal and clumsy children. I: fast goal-directed arm-movements with and without visual feedback. *Developmental Medicine and Child Neurology,* 33, 40-54.

Van Waalvelde, H., De Weerdt, W., De Cook, P. & Smits-Engelsman, B.C.M. (2004). Association between visual perceptual deficits and motor deficits in children with developmental coordination disorder. *Developmental Medicine and Child Neurology,* 46, 661-666.

Wright, H.C. & Sugden, D.A. (1996). The nature of developmental coordination disorder: inter- and intragroup differences. *Adapted Physical Activity Quarterly,* 13, 457-371.

Zittel, L.L. & McCubbin, J.A. (1996). Effect of an integrated physical education setting on motor performance of preschool children with developmental delays. *Adapted Physical Activity Quarterly,* 13, 316-333.

Author note

We acknowledge the Focus area of the Department of Health Sciences at the North-West University (Potchefstroom Campus) as well as the NRF for funds supporting this study. This article is part of a doctoral thesis.

Table 1

Number and percentage of children showing improvement and no improvement after a motor intervention programme

	Experimental group			**Control group**			**Total**
	Initial Group 1	**Initial Group 3**	**Total (*n*)**	**Initial Group 2**	**Initial Group 4**	**Total (*n*)**	***N***
	17	8	**25**	1	12	**13**	**38**
IG	85%	73%	**81%**	10%	71%	**48%**	**76%**
	3	3	**6**	9	5	**14**	**20**
NIG	15%	27%	**19%**	90%	29%	**52%**	**34%**
Total	**20**	**11**	**31**	**10**	**17**	**27**	**58**

Note: Initial Group 1: Motor intervention group; Initial Group 3: Psycho-motor intervention group; Initial Group 2: Psychological intervention group; Initial Group 4: Control group, *n/N* = total of participants

Table 2

Significance of differences between the experimental and control group for the MABC-total

	Mean Experimental group	**Mean Control group**	***t*-value**	***df***	***p*-value**	***d*-value**
MABC-total	-9.16	-3.93	-3.25	56	.00***	.85***

Note: *$p \leq .10$; **$p \leq .05$; ***$p \leq .01$, *$d = .2$ small practical significance; **$d = .5$ moderate practical significance; ***$d = .8$ large practical significance, Mean = MABC-total of first testing session subtracted from the MABC-total of the last testing session

Table 3

Co-variance of analysis of the MABC-total corrected for the SIM and QNST total

Component corrected for	**Corrected MABC mean Experimental group**	**Corrected MABC mean Control group**	***MSE***	***p*-value**	***d*-value**
SIM-total	-9.44	-3.61	36.01	.00***	.97***
QNST-total	-9.02	-4.08	37.45	.00***	.81***

Note: *MSE* – Mean Square Error, *$p \leq .10$; **$p \leq .05$; ***$p \leq .01$, *$d = .2$ small practical significance; **$d = .5$ moderate practical significance; ***$d = .8$ large practical significance

Table 4

Significance of differences between the improvement and non-improvement group for the neuro-motor test totals

	Mean IG	Mean NIG	*t*-value	*df*	*p*-value	*d*-value
All groups						
SIM-total	29.71	31.50	-1.66	56	.10*	.41*
QNST-total	11.13	13.90	-2.88	56	.01***	.72**
Experimental group						
SIM-total	30.72	32.67	-1.06	29	.30	
QNST-total	11.16	12.50	-0.92	29	.37	
Control group						
SIM-total	27.77	31.00	-2.44	25	.02**	.80***
QNST-total	11.08	14.50	-2.33	25	.03**	.84***

Note: *$p \leq .10$; **$p \leq .05$; ***$p \leq .01$, *$d = .2$ small practical significance; **$d = .5$ moderate practical significance; ***$d = .8$ large practical significance

Table 5

Significance of differences between scores of the improvement and non-improvement groups for the neuro-motor subtests

	Mean IG (n=38)	**Mean NIG (n=20)**	***t*-value**	***df***	***p*-value**	***d*-value**
			Subtests of the BOTMP			
Copying pencils	1.53	1.95	-3.55	56	.00***	.84***
Drawing line	1.37	1.70	-2.49	56	.02**	.68**
Reaction speed	49.11	27.85	2.84	56	.01***	.72**
			Subtests of the SIM			
Fixation right eye	1.21	1.60	-3.16	56	.00***	.77**
Tracking both eyes	1.24	1.60	-2.88	56	.01***	.72**
Tracking left eye	1.71	1.95	-2.19	56	.03**	.52**
Reflex total	4.55	4.95	-1.69	56	.10*	.45*
			Subtests of the QNST			
Visual perceptual memory	1.37	1.60	-1.70	56	.10*	.50**

Note: n = total of participants, *$p \leq .10$; **$p \leq .05$; ***$p \leq .01$, *d = .2 small practical significance; **d = .5 moderate practical significance; ***d = .8 large practical significance

Table 6

Percentages of children in the different groups with or without problems in neuro-motor subtests

Group	No problems (%)	*n*	Problems (%)	*n*	Total
Subtests of BOTMP					
Copying overlapping pencils					
EIG	48.0	12	52.0	13	25
CIG	46.2	6	53.9	7	13
ENIG	0.0	0	100.0	6	6
CNIG	7.1	1	92.9	14	14
Drawing line between two lines					
EIG	56.0	14	44.0	11	25
CIG	76.7	10	23.1	3	13
ENIG	50.0	3	50.0	3	6
CNIG	21.4	3	78.6	11	14
Subtests of the SIM					
Fixation-Right					
EIG	72.0	18	28.0	7	25
CIG	92.3	12	7.7	1	13
ENIG	16.7	1	83.3	5	6
CNIG	50.0	7	50.0	7	14
Tracking-Both eyes					
EIG	72.0	18	28.0	7	25
CIG	84.6	11	15.4	2	13
ENIG	33.3	2	66.7	4	6

CNIG	42.9	6	57.1	8	14
		Tracking-Left eye			
EIG	32.0	8	68.0	17	25
CIG	23.1	3	76.9	10	13
ENIG	0.0	0	100.0	6	6
CNIG	7.1	1	92.9	13	14
		Subtests of the QNST			
		Visual perceptual memory			
EIG	68.0	17	32.0	8	25
CIG	53.9	7	46.2	6	13
ENIG	83.3	5	16.7	1	6
CNIG	21.4	3	78.6	11	14

Note: EIG: Experimental improvement group; ENIG: Experimental non-improvement group; CIG: Control improvement group; CNIG: Control non-improvement group, *n* = total of participants

Table 7

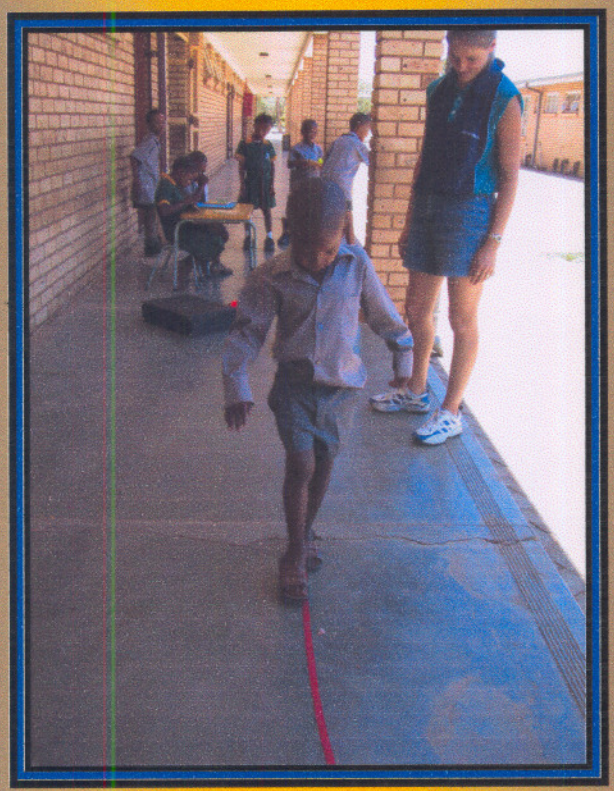
Factorial ANOVA to determine differences between groups for reaction speed and reflex total

	Reaction speed			
Different groups	***M*(1)=44.5**	***M*(2)=31.5**	***M*(3)=58.0**	***M*(4)=26.3**
	p	***p***	***p***	***p***
EIG (1)		.84	.58	.29
ENIG (2)	.84		.34	.99
CIG (3)	.59	.34		.02**
CNIG (4)	.29	.99	.02**	
	Reflex total			
	***M*(1)=4.48**	***M*(2)=5.17**	***M*(3)=4.69**	***M*(4)=4.86**
	p	***p***	***p***	***p***
EIG (1)		.51	.92	.65
ENIG (2)	.51		.77	.92
CIG (3)	.92	.77		.96
CNIG (4)	.65	.92	.96	

Note: EIG: Experimental improvement group; ENIG: Experimental non-improvement group; CIG: Control improvement group; CNIG: Control non-improvement group, *df* for this analysis = 54, *M* = Mean total, *$p \leq .10$; **$p \leq .05$; ***$p \leq .01$

CHAPTER 7

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS OF THE STUDY



7.1 Summary

Developmental Coordination Disorder is seen as a condition that is present when a child has motor problems that interfere with their daily living, although they have normal intelligence and no known neurological condition. This condition has a negative influence on 5%—15% of children worldwide. Research indicates that these motor problems have a negative influence on children's social skills, academic skills and their self-concept.

The aims of this study were firstly (Article 1 – Chapter 3), to determine whether DCD has an influence on the self-concept and anxiety of 7—9 year old children living in the Potchefstroom district. This aim was further explored by analyzing whether children with severe DCD will have a lower self-concept and higher anxiety than children with moderate DCD, and gender differences were also analyzed. In this regard, the second aim (Article 2 – Chapter 4) was to determine the effect of various intervention programmes on the self-concept, anxiety and motor proficiency of 7—9 year old DCD children in the Potchefstroom district. The third aim (Article 3 – Chapter 5) was to determine whether ethnic and gender differences have an influence on the effect of the different intervention programmes that aimed at improving motor proficiency and self-concept of the 7—9 year old DCD children. The fourth aim was to determine the effect of various neuro-motor difficulties on the success of the motor intervention for the 7—9 year old DCD children. The problem, aims and hypotheses of the study are stated in Chapter 1.

Chapter 2 comprises of a literature overview of motor problems associated with Developmental Coordination Disorder. In this regard problems associated with DCD that influence a child's well-being were described. Furthermore, self-concept development, anxiety and associations between self-concept, anxiety and motor problems were analysed and described. Different intervention methods for children with DCD were explored and guidelines for enhancing self-concept were included. Literature with regard to differences between genders with regard to DCD, anxiety and self-concept was also analysed. From this literature overview it became clear that children who suffer from DCD have a variety of problems that could be linked to their motor problems. These problems include a low self-concept, anxiety, socialization problems, academic problems and neuro-motor problems. Literature also indicates gender differences with regard to motor problems as well as self-concept problems.

From the literature overview it is, however, clear that children's motor proficiency as well as their self-concept can be enhanced through intervention programmes, although controversy still exist concerning which intervention programme will have the best effect.

Chapter 3 contains an article regarding results of the effect that DCD has on the self-concept and anxiety of a 7—9 year old child. This article is submitted to the African Journal for Physical, Health Education, Recreation and Dance. In this article possible differences between children with severe and moderate DCD were analysed. In addition, gender differences with regard to the influence of DCD on the self-concept and anxiety of the children were also analyzed. The test batteries that were used are the MABC to determine DCD, TSCS-CF to determine self-concept and CAS to determine anxiety. A correlation matrix was conducted to determine correlations between the different test batteries and their different subcomponents. Independent t-testing ($p \leq 0.05$) was conducted to determine differences between the children with moderate DCD and severe DCD, regarding their anxiety and self-concept. This analysis was also performed on the girls because of the possible relationships that were found between the MABC-total and self-concept. These results indicated that DCD does have a negative influence on the self-concept of children, seeing that the results indicated that children with DCD have a lower than normal self-concept. This was true for the total self-concept as well as all the subscales of the TSCS-CF. With regard to anxiety, it was found that DCD does not significantly affect the anxiety of 7—9 year old children, although it was established that children with more severe DCD have slightly higher anxiety ($p>0.05$) than those with moderate DCD. No statistically significant differences were found between the self-concept and anxiety of children with severe DCD compared to children with moderate DCD. However, a tendency that girls with severe DCD have a lower self-concept and higher anxiety than girls with moderate DCD was evident. This difference was significant for the moral subscale of self-concept where the girls with severe DCD had a moderately significantly lower moral self-concept score compared to girls with moderate DCD. However, this difference was not of practical significance.

In Chapter 4 the effect of different intervention programmes on the self-concept and motor proficiency of 7—9 year old DCD children was determined and described. This article is submitted to the journal Child: Care, Health and Development. This aim involves measurements taken over a period of a year of the 58 remaining DCD children who were

divided into four groups. One group followed a motor based intervention programme, one a self-concept enhancement programme, one an integrated psycho-motor intervention programme and the fourth was the control group without intervention. The children were tested before the intervention programme started, shortly after the intervention programme (8 weeks later), two months after the intervention programme was conducted and then a year following this testing opportunity. A repeated measures ANOVA followed by a Bonferroni post hoc analysis was conducted to determine to what extent the different groups differed between the four testing periods (within group differences). A one-way ANOVA followed by a Tukey post-hoc analysis was also conducted to determine between-group differences at the pre-, post- and re-test. The results of this study indicated that the motor based intervention programme had the largest effect in enhancing the motor proficiency of DCD children. While motor proficiency benefited most from the motor based intervention, the self-concept of the DCD children benefits most from the psycho-motor intervention programme followed by the self-concept enhancing intervention programme. The psycho-motor intervention programme also led to improvement in the motor proficiency, but to a lesser degree than what was found when the motor based intervention programme was conducted separately.

Chapter 5 analyzed the results with regard to the effect of gender and ethnic differences on the success of the three different intervention programmes that were conducted on the motor proficiency, anxiety and self-concept of 7—9 year old DCD children. This article is submitted to the journal Child: Care, Health and Development. The results of this study analyzed by means of a repeated measures analysis of variance, an independent t-test as well as a one-way ANOVA followed by an Unequal N HSD post-hoc analysis, showed two moderate significant differences. It indicated that the self-concept of girls in the self-concept enhancement intervention group improved moderately significantly ($p=0.09$) more than that of the boys from the first to the last testing session. It further indicated that in the motor based intervention group, the white children's motor proficiency improved significantly ($p=0.05$) more than that of the black children from the first to the last testing opportunity. These differences were, however, not considered to be significant to such a degree to recommend that intervention programmes be adapted for gender and ethnic differences in order to improve motor proficiency and self-concept.

In Chapter 6 the effect of various neuro-motor difficulties on the success of motor intervention on 7—9 year old DCD children was determined. This article is submitted to the Adapted Physical Activity Quarterly. Children who had shown improvement (improvement group) after the intervention period (n=38) were compared with those who did not show motor proficiency improvement (n=20) after this period (non-improvement group). This comparison was made to determine whether those who did not improve showed more neuro-motor problems than those who did improve. The results were analyzed by means of independent t-testing and co-variance of analysis, adjusting for the neuro-motor tests. This was done to determine what role the neuro-motor problems have in statistically significant differences between the improvement group and the non-improvement group. These results indicate that children without any neuro-motor problems improved significantly more after they had followed the intervention programme than children with neuro-motor problems. It was concluded from the results that the effect of an intervention programme can be negatively influenced by underlying neuro-motor problems.

7.2 Conclusions

The conclusions of the study are based on the results as summarized above.

7.2.1 Conclusion 1

Hypothesis 1 states that DCD has a negative influence on the self-concept and anxiety of 7–9 year old children in the Potchefstroom district. From the study it was clear that children with DCD have a lower than normal global self-concept and scored lower in all the subscales of the TSCS-CF. The anxiety of the DCD children in this study were, however, not higher than the range indicated for normal anxiety, although a non-significant tendency was found in that children with more severe DCD showed higher anxiety levels than children with moderate DCD. In addition, it was found that girls with severe DCD scored significantly lower on moral self-concept than girls with moderate DCD. Therefore, hypothesis one is accepted for self-concept but only partially accepted for anxiety.

7.2.2 Conclusion 2

Hypothesis 2 states that an intervention programme based on psycho-motor intervention will have the best effect in enhancing the self-concept and motor proficiency of 7–9 year old DCD children in the Potchefstroom district. However, from the results it was clear that the motor based intervention had the biggest effect in enhancing children's motor proficiency while their self-concept also improved, but to a lesser degree. The self-concept enhancement programme improved the children's self-concept, although no significant improvement was found in their motor proficiency. It was, however, also seen that DCD children who followed the psycho-motor intervention programme did indeed show an improvement in their motor proficiency as well as in their self-concept. This improvement for the motor proficiency was to a lesser degree compared to those who followed the motor based intervention programme. Thus, because the psycho-motor intervention programme did show the best effect in enhancing self-concept but not for the motor proficiency, hypothesis 1 is accepted for self-concept but rejected for motor proficiency.

7.2.3 Conclusion 3

Hypothesis 3 states that gender and ethnic differences will have no influence on the success of different intervention programmes that are aimed at improving the motor proficiency and self-concept of 7–9 year old DCD children in the Potchefstroom district. Only two significant differences were found (one gender and one ethnic group related), of which one was only at a moderate level. These differences were considered to be too small and insignificant to justify the use of different intervention programmes for children from different ethnic groups and genders. Therefore hypothesis 3 is accepted.

7.2.4 Conclusion 4

Hypothesis 4 states that underlying neuro-motor problems will have a negative effect on the success of motor intervention for 7-9 year old DCD children in the Potchefstroom district.

The results indicated that children with DCD without any neuro-motor problems improved significantly more after they participated in an intervention programme than children with DCD with neuro-motor problems, indicating that the effect of an intervention programme can be negatively influenced by underlying neuro-motor problems. Hypothesis 4 is therefore accepted.

7.3 Recommendations

From the results of the above-mentioned study, it is clear that the intervention programmes that were used in this study could be implemented in schools in order to improve both the motor proficiency and the self-concept of children with DCD. Although it was seen that the motor based intervention programme showed the best improvement in the children's motor proficiency, it is recommended that an integrated psycho-motor intervention programme be used in order to obtain the best effect on the child's overall well-being. However, it is recommended that the programmes should ideally be conducted by professionals in their specialized fields. For the motor enhancement programme it would therefore be in the child's best interest to use a kinderkineticist to conduct the programme and in the case of the self-concept enhancement programme it would be best if a psychologist conducted the programme. It is further recommended that it is not necessary to distinguish between the different genders and ethnic groups while conducting such programmes. However, it is recommended that the children's neuro-motor status should be determined beforehand to establish what kind of intervention would be most appropriate for them. This study indicated that children with neuro-motor problems did not improve as much as children without neuro-motor problems, therefore it is recommended that intervention programmes should be adapted in accordance with children's neuro-motor problems.

Although this study was thoroughly planned, certain limitations were found that should be addressed by researchers who want to conduct similar research studies in the future. In order to improve the generalization of the results, as well as to improve the outcomes of further studies of this nature, the following recommendations can be made:

7.3.1 Recommendation 1

This study, aiming at determining the effect of different intervention programmes, was influenced by the fact that children with moderate and severe DCD were both included in the study. It is recommended that for future studies where both children from the severe and moderate groups are included, the children should be separated with regard to their severity of motor problems and therefore be in different groups while following the intervention programme.

7.3.2 Recommendation 2

A further problem that was experienced by the researchers was the diversity of the motor problems the children experienced. This was found due to the fact that the motor problems they suffered from differed, for example some had ball skill problems, others had balance problems while yet others had manual dexterity problems. It is therefore recommended that, in future research, children with the same kind of motor problems should ideally be grouped together. This could help the researcher to better construct the intervention programme for each group.

7.3.3 Recommendation 3

In this study it was found that neuro-motor problems might have influenced the success of intervention programmes for DCD children. This finding needs more in depth research. A limitation of this study was that the neuro-motor abilities of the children were not determined during pretesting, which could have enabled the researcher to determine whether the specific intervention programme had the expected effect on these problems. It is therefore recommended for future research that the neuro-motor abilities of the children should be determined during pretesting, as this information will not only enable the researcher to

conduct a more appropriate intervention programme, but also to conduct purposeful statistical analyses.

7.3.4 Recommendation 4

Some confounding factors might have influenced the success of the intervention programmes. Factors such as distractions during the programme, environmental factors such as the hot weather and the language differences of the children are some of these factors. Thus, it is recommended that, when similar intervention studies are conducted in future, it should be done in a classroom or some sheltered environment where the other children could not influence those participating in the programme. It is further recommended that there should be a translator to translate the instructions of the intervention programme, as it was found that children do not understand the language in which the instructions are given.

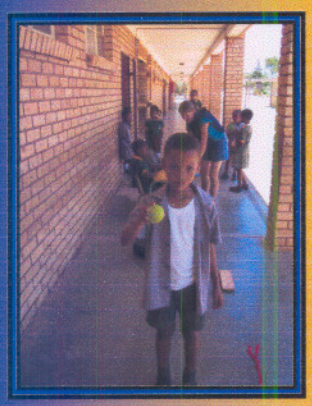
7.3.5 Recommendation 5

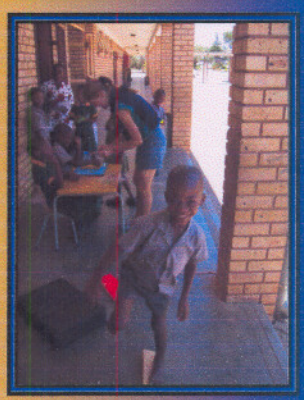
The school term restricted the duration of the intervention programme in that the researcher could only conduct the intervention programmes for eight weeks. The school day also allowed the researcher to only conduct the programme twice a week. It is possible that a longer duration and higher frequency in conduction the programme could have led to better improvement. It is thus recommended for future research that the intervention programme be conducted three times a week and if possible for a longer period.

7.3.6 Recommendation 6

The control group also seemed to have an influence on the results of this study. It is recommended that the control group should take part in another form of activity (for example watching a video) while the other children participate in the intervention programme. This would be done to try and minimize the influence of the control group on the results of the study.

APPENDIXES





APPENDIX A

GUIDELINES FOR AUTHORS: THE AFRICAN JOURNAL FOR PHYSICAL, HEALTH EDUCATION, RECREATION AND DANCE

The African Journal for Physical, Health Education, Recreation and Dance (AJPHERD) is a peer-reviewed journal established to:

i) provide a forum for physical educators, health educators, specialists in human movement studies and dance, as well as other sport-related professionals in Africa, the opportunity to report their research findings based on African settings and experiences, and also to exchange ideas among themselves.

ii) afford the professionals and other interested individuals in these disciplines the opportunity to learn more about the practice of the disciplines in different parts of the continent.

iii) create an awareness in the rest of the world about the professional practice in the disciplines in Africa.

GENERAL POLICY

AJPHERD publishes research papers that contribute to knowledge and practice, and also develops theory either as new information, reviews, confirmation of previous findings, application of new teaching/coaching techniques and research notes. Letters to the editor relating to the materials previously published in AJPHERD could be submitted within 3 months after publication of the article in question. Such letter will be referred to the corresponding author and both the letter and response will be published concurrently in a subsequent issue of the journal.

Manuscripts are considered for publication in AJPHERD based on the understanding that they have not been published or submitted for publication in any other journal. In submitting papers for publication, corresponding authors should make such declarations. Where part of a paper ha been published or presented at congresses, seminars or symposia, reference to that publication should be made in the acknowledgement section of the manuscript.

AJPHERD is published quarterly, i.e. in March, June, September and December. Supplements/Special editions are also published periodically.

SUBMISSION OF MANUSCRIPT

Three copies of original manuscript and all correspondence should be addressed to the Editor-In-Chief:

Professor L.O. Amusa
Centre for Biokinetics, Recreation
And Sport Science, University of Venda for
Science and Technology, P.Bag X5050,
Thohoyandou 0950
Republic of South Africa

Tel: +27 15 9628076
Fax: +27 15 9628647

Articles can also be submitted electronically, i.e. via e-mail attachment. However, the corresponding author should ensure that such articles are virus free. AJPHERD reviewing process normally takes 4-6 weeks and authors will be advised about the decision on submitted manuscripts within 60 days. In order to ensure anonymity during the reviewing process authors are requested to avoid self-referencing or keep it to the barest minimum.

PREPARATION OF MANUSCRIPT

Manuscripts should be type written n fluent English (using 12-point Times New Roman font and 1½ line spacing) on one side of white A4-sized paper justified fully with 3cm margin on all sides. In preparing manuscripts, MS-Word, Office 98 or Office 2000 for Windows should be used. Length of manuscripts should not normally exceed 12 printed pages (including tables, figures, references, etc.). For articles exceeding 12 typed pages US$ 10.0 is charged per every extra page. Longer manuscripts may be accepted for publication as supplements or special research reviews. Authors will be requested to pay a publication charge of US$ 150.0 to defray the very high cost of publication.

Title page:

The title page of the manuscript should contain the following information:

Concise and informative title.

Author(s') name(s) with first and middle initials. Authors' highest qualifications and main area of research specialization should be provided.

Author(s') institutional addresses, including telephone and fax numbers.

Corresponding author's contact details, including e-mail address.

A short running title of not more than 6 words.

Abstract:

An abstract of 200-250 words is required with up to a maximum of 5 words provided below the abstract. Abstract must be typed on a separate page using single line spacing, with the purpose of the study, methods, major results and conclusions concisely presented. Abbreviations should either be defined or excluded.

Text:

Text should carry the following designated headings: Introduction, materials and methods, results, discussion, acknowledgement, references and appendices (if appropriate).

Introduction

The introduction should start on a new page and in addition to comprehensively giving the background of the study should clearly state the problem and purpose of the study. Authors should cite relevant references to support the basis of the study. A concise but informative and critical literature review is required.

Materials and Methods

This section should provide sufficient and relevant information regarding study participants, instrumentation, research design, validity and reliability estimates, data collection procedures, statistical methods and data analysis techniques used. Qualitative research techniques are also acceptable.

Results

Findings should be presented precisely and clearly. Tables and figures must be presented separately or at the end o the manuscript and their appropriate locations in the text indicated. The results section should not contain materials that are appropriate for presentation under the discussion section. Formulas, units and quantities should be expressed in the *systeme internationale (SI)* units. Colour printing of figures and tables is expensive and could be done upon request authors' expense.

Discussion

The discussion section should reflect only important aspects of the study and its major conclusions. Information presented in the results section should not be repeated under the

discussion. Relevant references should be cited in order to justify the findings of the study. Overall, the discussion should be critical and tactfully written.

References

The American Psychological Association (APA) format should be used for referencing. Only references cited in the text should be alphabetically listed in the reference section at the end of the article. References should not be numbered either in the text or in the reference list. Authors are advised to consider the following examples in referencing:

Examples of citations in body of the text:-

For one or two authors; Kruger (2003) and Travill and Lloyd (1998). These references should be cited as follows when indicated at the end of a statement: (Kruger, 2003); (Travill & Loyd, 1998).

For three or more authors cited for the fist time in the text; Monyeke, Brits, Mantsena and Toriola (2002) or when cited at the end of a statement as in the preceding example; (Monyeki, Brits, Mantsena & Toriola, 2002). For subsequent citations of the same reference it suffices to cite this particular reference as: Monyeki et al. (2002).

Multiple references when cited in the body of the text should be listed chronologically in ascending order, i.e. starting with the oldest reference. These should be separated with semi colons. For example, (Tom, 1982; McDaniels & Jooste, 1990; van Heerden, 2001; de Ridder et al., 2003).

Reference List

In compiling the reference list at the end of the text the following exmples for journal references chapter from a book, book publication and electronic citations should be considered:

Examples of journal references:

Journal references should include the surname and initials of the author(s), year of publication, title of paper, name of the journal in which the paper has been published, volume and number of journal issue and page numbers.

For one author: McDonald, A.K. (1999). Youth sports in Africa: A review of programmes in selected countries. *International Journal of Youth Sports*, 1(4), 102-117.
For two authors: Johnson, A.G. & O'Kefee, L.M. (2003). Analysis of performance factors in provincial table tennis players. *Journal of Sport Performance*, 2(3), 12-31.
For multiple authors: Kemper, G.A., McPherson, A.B., Toledo, I. & Abdullah, I.I. (1996). Kinematic analysis of forehand smash in badminton. *Science of Racket Sports*, 24(2), 99-112.

Examples of book references:
Book references should specify the surname and initials of the author(s), year of publication of the book, title, edition, page numbers written in brackets, city where book was published and name of publishers. Chapter references should include the name(s) of the editor(s) and other specific information provided in the third example below:

For authored references: Amusa, L.O. & Toriola, A.L. (2003). *Foundations of Sport Science* (1st ed.) (pp. 39-45). Mokopane, South Africa: Dynasty Printers.
For edited references: Amusa, L.O. and Toriola, A.L. (Eds.) (2003). *Contemporary Issues in Physical Education and Sports* (2nd ed.) (pp. 20-24). Mokopane, South Africa: Dynasty Printers.
For chapter references in a book: Adams, L.L. & Neveling, I.A. (2004). Body fat characteristics of sumo wrestlers. In J.K. Manny and F.O. Boyd (Eds.), *Advances in Kinanthropometry* (pp. 21-29). Johannesburg, South Africa: The Publishers Company Ltd.

Examples of electronic references:
Electronic sources should be easily accessible. Details of Internet website links should also be provided fully. Consider the following example:

Wilson, G.A. (1997). Does sport sponsorship have a direct effect on product sales? *The Cyber-Journal of Sport Marketing (online)*, October, 1(4), at http://www.cad.gu.au/cjsm/wilson.html. February 1997.

PROOFREADING

Manuscript accepted for publication may be returned to the author(s) for final correction and proofreading. Corrected proofs should be returned to the Editor-In-Chief within one week of receipt. Minor editorial corrections are handled by AJPHERD.

COPYRIGHT AGREEMENT

The Africa Association for Health, Physical Education, Recreation, Sport and Dance (AFAHPER-SD) holds the copyright for AJPHERD. In keeping with copyright laws, authors will be required to assign copyright of accepted manuscripts to AFAHPER-SD. This ensures that both the publishers and the authors are protected from misuse of copyright information. Requests for permission to use copyright materials should be addressed to the Editor-in-Chief.

COMPLIMENTARY COPY OF AJPHERD AND REPRINTS

Principal authors will receive ten (10) complimentary copies of the relevant pages in which their article has been published. In case of two or more joint authors the principal author distributes the copies to the co-authors. Reprints of published papers can be ordered using a reprint order form that will be sent to the corresponding author before publication. Bound copies of the journal may be ordered from: Dynasty Printers, 26 Pretorius Street, Mokopane 0600, South Africa. Tel: +27 15 4914873; Fax: +27 15 4916411; E-mail: Ahmed@dynastyprinters.com; website: www.dynastyprinters.com.

APPENDIX B

GUIDELINES FOR AUTHORS: CHILD: CARE, HEALTH AND DEVELOPMENT

Submission

Manuscripts should be submitted online at http://mc.manuscriptcentral.com/cch. Full instructions and support are available on the site and a user ID and password can be obtained on the first visit. Support can be contacted by phone (+1 434 817 2040 ext. 167), e-mail (support@scholarone.com) or at http://blackwellsupport.cushelp.com. if you cannot submit online, please contact the Editorial Assistant in the Editorial Office by e-mail CCHofice@oxon.blackwellpublishing.com.

A covering letter must be submitted as part of the online submission process, stating on behalf of all the authors that the work has not been published and is not being considered for publication elsewhere. All accepted papers should be accompanied by a copyright assignment form. Copyright of accepted manuscripts and all published material becomes the property of the Journal.

For guidance on ethical aspects, authors are recommended to consult the porposals of the MR. Report 1963/3 on human invistigations published in the *British Medical Journal* (1964) B, 178-180.

Preparation of the manuscript

The following checklist should be used to check the manuscript before submission. Articles are accepted for publication at the discretion of the Editor. A manuscript, which ideally will be between 2000 and 3000 words, should consist of the sections listed below.

Manuscript style

Manuscripts must be submitted online at http://mc.manuscriptcentral.com/cch. All parts of the manuscript must be available in an electronic format and it is recommended that, where possible, figures be embedded into a single Microsoft Word document.

Manuscripts should be typed using double spacing and size 12pt. No identifying details of the authors or their institutions must appear in the submitted manuscript. Author details will be inputted as part of the online submission process.

Title page

The title page should give both a descriptive title and short title. The title should be concise and should give a brief indication of what is in the paper.

Main text

Generally, all papers should be divided into the following sections and appear in this order: Abstract (structured abstracts, not more thatn 300 words, including background, methods, results and conclusions are preferred); Introduction; Methods; Results; Discussion; Acknowledgements; References; Tables; Figures. Authors must provide a word count for the main body of the text.

Units and spellings

Sytème International (SI) units should be used, as given in *Units, Symbols and Abbreviations* (4th edition, 1988), published by the Toyal Society of Medicing Services Ltd, 1 Wimpole Street, London W1M 8AE, UK. Spelling should conform to that used in *The Concise Oxford Dictionary*, published by Oxford University Press.

References

References cited in the text should list the authors names followed by the date of their publication, unless there are three or more authors when only the first author's name is quoted followed by *et al.* References listed at the end of the paper should include all authors' names and initials, and should be listed in alphabetical order with the title or the article or book, and the title of the Journal given in full as shown:

Havermans, T. & Eiser, C. (1994) Siblings of a child with cancer. *Chils: care, health and development,* **20**, 309-322.

Cart, P. (1984) Observation. In: *The Research Process in Nursing* (ed. D.F.S. Cormack), pp.XX-XX. Blackwell Publishing, Oxford, UK.

Work that has not been accepted for publication and personal communications should not appear in the reference list, but may be referred to in the text (eg. 'A. Author, unpubl. Observ.' Or 'B. Author, per. Comm.'). It is the authors' responsibility to obtain permission

from colleagues to include their work as a personal communication. A letter of permission should accompany the manuscript.

Figures and tables:

Always include a citation in the text for each figure and table. Artwork should be submitted online in electronic form. Detailed information on our digital illustration standards is available on the Blackwell Publishing website at http://www.blackwellpublishin.com/authors/submit_illust.asp. Any abbreviations used in figures and tables should be defined in a footnote.

Approval for reproduction/modification of any material (including figures and tables) published elsewhere should be obtained by the authors/copyright holders before submission of the manuscript. Contributors are responsible for any copyright fee involved.

Acknowledgements

These should be brief and must include references to sources of financial and logistical support.

Page proofs

Proofs will be sent via e-mail as an Acrobat PDF (portable document format) file. The e-mail server must be able to accept attachments up to 4 MB in size. Acrobat Reader will be requered in order to read this file. This software can be downloaded (free of charge) from the following web site www.Adobe.com/products/acrobat/readstep2.html. This will enable the file to be opened, read on screen, and printed out in order for any corrections to be added. Further instructions will be sent with the proof. Proofs will be posted if no e-mail address is avilable; in your absence, please arrange for a colleague to access your e-mail to retrieve the proofs.

Proofs must be returned to the production office within 3 days of receipt. Only typographical errors can be corrected at this stage. Major alterations to the text cannot be accepted.

Offprints

Authors will be provided with electronic offprints of their article. Paper offprints may be ordered at prices quoted on the order form, which accompanies proofs. Note that this form

should not be returned with your proofs, but to the address at the bottom of the form. The cost is more if the order form arrives too late for the main print run. Offprints are normally dispatched within 3 weeks of publication of the issue in which the paper appears. Please contact the publisher if offprints do not arrive: however, please note that offprints are sent by surface mail, so overseas orders may take u to 6 weeks to arrive. Electronic offprints are sent to the corresponding author at his or her first e-mail address.

Copyright

Authors will be required to assign copyright in their paper to Blackwell Publishing Ltd. Copyright assignment is a condition of publication and papers will not be passed to the publisher for production unless copyright has been assigned. To assist authors, an appropriate copyright assignment form will be supplied to you by the editorial office (Government employees in both the US and the UK need to complete the Author Warranty sections, although copyright in such cases does not need to be assigned).

Correspondence to the Journal is accepted on the understanding that the contributing author licences the publisher to publish the letter as part of the Journal or separately from it, in the exercise of any subsidiary rights relating to the Journal and its contents.

Author material archive policy

Please note that unless specifically requested, Blackwell Publishing will dispose of all hardcopy or electronic material submitted 2 months after publication. If you require the return of any material submitted, please informe the editorial office or production editor as soon as possible if you have not yet done so.

APPENDIX C

GUIDELINES FOR AUTHORS: CHILD: CARE, HEALTH AND DEVELOPMENT

See Appendix B for guidelines

APPENDIX D

GUIDELINES FOR AUTHORS: ADAPTED PHYSICAL ACTIVITY QUARTERLY

Submission guidelines, *Adapted Physical Activity Quarterly*

When preparing manuscripts for publication in the *Adapted Physical Activity Quarterly*, please adhere to the guidelines in the *Publication Manual of the American Psychological Association* (5th edition, 2001). Copies of the IAP manual are available n most university libraries or may be obtained through the APA Order Dept., P.O. Box 92984, Washinton, DC 20090-2984. (www.apa.org/books). Tel: 800-374-2721.

Submit four copies of the manuscript to David L. Porretta, The Ohio State University, 202 Pomerene Hall, 1760 Neil Avenue, Columbus, OH 43210. Include a cover letter stating that the manuscript is not being submitted to another journal. Send a title page with the following information: page header; running head; title; each author's name, affiliation, and full mailing address; phone, fax, and email information for the author who will review page proofs; and submission date. Each manuscript should contain the following: a full title page; an additional title page listing only the title; a separate page with an abstract of no more than 150 words; the text; references; author note, including any acknowledgements; tables and figures.

Using the APA Manual as a guide, pay particular attention to manuscript content and organization (pp1-22), APA editorial style (pp. 61-234), and manuscript preparation (pp.235-272). Format papers with a 1-in.margin, 12-pint font, and double spacing, including quotes. Papers should not exceed 30 pages including tables and figures. Check format against the APA sample paper (pp. 258-268). Note that *Method* is singular, and the heading, *Participants*, is preferred over *Subjects.* Insert line number 1-27 on the left margin of each page, beginning with the abstract page. This facilitates providing line-by-line feedback.

Indicate relevance by referring to theories, paradigms, or conceptual frameworks and briefly reviewing the existing knowledge base. Use person-first, non-sexist language in your writing, according to APA standards (pp. 46-60). Refer to disabled citizens as *individuals with disabilities.* Avoid using *characteristic* and *attribute.* Instead, use demographic data, diagnostic criteria met, behaviours, or indicators. Do not assume commonalties; base language on individual assessment. Avoid creating groups for statistical analysis that combine individuals representing different etiologies (e.g., people with and without Down syndrome), genders, or a wide range of age groups. *APA Manual* requires reporting both statistical significance and effect size. Carefully check the accuracy of citations and

references. To enable blind reviews, verify that your manuscript does not indicate the author's identity.

Art must be professionally prepared and camera ready. Freehand and typewritten lettering will not be accepted. Dot patterns do not reproduce well during the printing process and should not be used to create shading in figures. You may submit figures on disk if they are created in Pagemaker, Freehand or Illustrator on the Macintosh Illustrator or saved in eps, tiff, or pict format.

You will receive a letter within 2 weeks indicating receipt of your manuscript. Manuscripts are reviewed by at least two editorial board members and other experts. This process requires at least 2 months. Inquire about manuscript status if you have not received reviews within 3 months.

Checklist for Manuscript Submission (Publication Manual of the American Psychological Association)

Listed in this appendix are questions concerning the most common oversights in manuscript preparation. Authors should review these items especially carefully before submitting their manuscripts to an editor. Numbers following entries refer to relevant section numbers in the Publication Manual.

Format

- Is the original manuscript typed or printed on 8½ x 11 in. (22 x 28 cm) white bond paper (5.01)?
- Is the entire manuscript – including quotations, references, author note, content footnotes, figure captions, and all parts of tables – double-spaced (5.03): Is the manuscript neatly prepared (5.07)?
- Are the margins at least 1 in. (2.54 cm; 5.04)?
- Are the title page, abstract, references, appendixes, author note, content footnotes, tables, figure captions, and figures on separate pages (with only one table or figure per page)? Are they ordered in sequence, with the text pages between the abstract and the references (5.05):
- If the manuscript is to receive masked review, is the author note typed on the title page, which is removed by the journal editor before review (5.15)?
- Are all pages (except figure pages) numbered in sequence, starting with the title page (5.06)?

Title Page and Abstract

- Is the title 10 to 12 words (1.06)?
- Does the byline reflect the institution or institutions where the work was conducted (1.06)?
- Is the abstract no longer than 120 words (1.07)?

Paragraphs and Headings

- Is each paragraph longer than a single sentence but not longer than one manuscript page (2.03)?
- Do the levels of headings accurately reflect the organization of the paper (1.05, 3.30)?

- Do all headings of the same level appear in the same format (3.30)?

Abbreviations

- Are any unnecessary abbreviations eliminated and any necessary ones explained (3.20, 3.21)?
- Are abbreviations in tables and figures explained in the table notes and figure captions or legends (3.21)?

Mathematics and Statistics

- Are Greek letters and all but the most common mathematical symbols identified on the manuscript (3.58, 5.14)?
- Are all non-Greek letters that are used as statistical symbols for algebraic variables in italics (3.58)?

Units of Measurement

- Are metric equivalents for all nonmetric units (except measurements of time, which have no metric equivalents) provided (3.50)?
- Are all metric and nonmetric units with numeric values (except some measurements of time) abbreviated (3.25, 3.51)?

References

- Are references cited both in text and in the references list (4.01)?
- Do the text citations and reference list entries agree both in spelling and in date (4.01)?
- Are text citations to nonempirical work distinguished from citations to empirical work (1.13)?
- Are journal titles in the reference list spelled out fully (4.11)?
- Are the references (both in the parenthetical text citations and in the reference list) ordered alphabetically by the authors' surnames (3.99, 4.04)?
- Are inclusive page numbers for all articles or chapters in books provided in the reference list (4.11, 4.13)?
- Are references to studies included in your meta-analysis preceded by an asterisk (4.05)?

Notes and Footnotes

- Is the departmental affiliation given for each author in the author note (3.89)?
- Does the author note include both the author's current affiliation if it is different from the byline affiliation and a current address for correspondence (3.89)?
- Does the author note disclose special circumstances about the article (portions presented at a meeting, student paper as basis for the article, report of a longitudinal study, relationship that may be perceived as a conflict of interest (3.89)?
- In the text, are all footnotes indicated, and are footnote numbers correctly located (3.87)?

Tables and Figures

- Does every table column, including the stub column, have a heading (3.67)?
- Have all vertical table rules been omitted (3.71)?
- Are the elements in the figures large enough to remain legible after the figure has been reduced to the width of a journal column or page (3.80)?
- Does lettering in a figure vary by no more than 4 point sizes of type (3.80)?
- Are glossy or high-quality laser prints of all figures included, and are the prints no larger than 8½ x 11 in. (22 x 28 cm; 3.80, 3.85)?
- Is each figure labeled with the correct figure number and short article title (3.83)?
- Are all figures and tables mentioned in the text and numbered in the order in which they are mentioned (3.63, 3.83)?

Copyright and Quotations

- Is written permission to use previously published text, tests or portions of tests, tables, or figures enclosed with the manuscript (8.08)?
- Are page or paragraph numbers provided in text for all quotations (3.39)?

Submitting the Manuscript

- Have you provided the required number of copies of the manuscript (in English), including the original (5.25)?
- Are the journal editor's name and address current (5.27)?
- Is a cover letter included with the manuscript? Does the letter (a) include the author's postal address, e-mail address, telephone number, fax number for future correspondence and (b) state that the manuscript is original, not previously published,

and not under concurrent consideration elsewhere? Does the letter inform the journal editor of the existence of any similar published manuscripts written by the author (5.26, Appendix E)?

Note to Students

Many psychology departments require that student papers, theses, and dissertations be prepared according to the *Publication Manual.* Of course, where departmental requirements differ from those in the *Publication Manual*, the departmental requirements take precedence. Familiarity with both departmental and *Publication Manual* requirements will enable students to prepare papers efficiently. The following sections of the *Publication Manual* are especially useful to students:

- Quotations (sections 3.34-3.41)
- Examples of Reference Citations (chap. 4)
- Manuscript Preparation Instructions (chap. 5)
- Sample Paper and Outlines (Figures 5.1-5.3, chap. 5)
- Bibliography (section 9.03, Student Papers)
- Theses, Dissertations, and Student Papers (chap. 6)
- Manuscript Checklists (Appendixes A and B)

APPENDIX E

INFORMATION LETTER TO THE HEADMASTERS (Afrikaans)

19 Februarie 2003

Insake: Hulp met die identifisering van kinders met groot motoriese ontwikkelingsagterstande

Geagte Skoolhoof

Graag vra ons u samewerking met die seleksie van kinders vir 'n navorsingsprojek wat uitgevoer moet word en waarby kinders betrek wil word wat ontwikkelingsagterstande het. Die navorsingsprojek word gesteun deur die NRF (National Research Foundation) en die Onderwysdepartement en is multidissiplinêr van aard in die sin dat die Skool vir Biokinetika, Rekreasie en Sportwetenskap en die Skool vir Psigologie van die PU vir CHO daarby betrokke is.

Die navorsing fokus op 7-9-jarige kinders in die Potchefstroom distrik. Elke leerder wat hierby betrek word, sal baat vind daarby, aangesien dit intervensieprogramme behels wat naskools aangebied sal word met die fokus op die opheffing van motoriese ontwikkelingsagterstande sowel as selfbeeldverryking. Die toegevoegde waarde van die program is dat dit veral kan bydra tot skoolvaardighede wat daardeur belemmer kan word, en wat ook 'n belangrike uitkoms van die navorsing is.

Aangesien die intervensieprogram op kinders uitgevoer moet word wat gekenmerk word aan motoriese ontwikkelingsagterstande, het ons die onderwyseres se kundigheid nodig om sodanige kinders vir ons te help identifiseer. 'n Lys van kriteria wat sy kan gebruik sal aan haar verskaf word. Sodra sy moontlike leerders aan ons uitgewys het, sal ons die proses verder voer om toetstemming van ouers te verkry. Die skool het geen verpligtinge mbt die navorsing nie.

Anquanette Peens (Kinderkinetikus) en Lucille Hugo (Sielkunde student in Opleiding) sal die programme as deel van onderskeidelik 'n doktors- en meestersgraad aanbied, en sal ook die spreekbuis na die skole toe wees. Die navorsing staan onder leiding van Prof Anita Pienaar en Dr Alida Nienaber, wat enige tyd gekontak kan word sou daar enige verdere navrae wees.

Kontaknommers

Me Anquanette Peens
072 159 7536
Prof Anita Pienaar
299 1796

Dr Alida Nienaber
299 1731
Me Lucille Hugo
082 564 2481

By voorbaat hartlike dank vir u vriendelike samewerking in die verband. Dit word hoog op prys gestel.
Vriendelike groete

Anita Pienaar
Skool vir Biokinetika, Rekreasie en Sportwetenskap

APPENDIX F

GUIDELINES FOR TEACHERS TO IDENTIFY POSSIBLE DCD CANDIDATES (Afrikaans and English)

20 Februarie 2003

Geagte Onderwyser(es)

Die hoof van u skool het toestemming verleen dat u my behuplsaam kan wees in die identifisering van leerders met spesifieke ontwikkelingsagterstande. Baie dankie vir die tyd wat u daaraan sal moet afstaan. Wees verseker dat die studie tot voordeel van elke leerder sal wees wat daaraan sal deelneem.

Agtergrond van die studie

Die leerders wat deur u geïdentifiseer is sal aan 'n verdere wetenskaplike siftingstoets onderwerp word wat sal bevestig of hulle wel DCD het al dan nie. Indien wel sal hulle selfkonsep ook geëvalueer word. Dan sal die geïdentifiseerde leerders in vier groepe verdeel word. Een groep kinders sal aan 'n motoriese intervensieprogram onderwerp word (aangebied deur 'n Kinderkinetikus), nog 'n groep aan 'n psigologiese intervensieprogram (aangebied deur 'n opgeleide sielkundige), nog 'n groep aan 'n gekombineerde psigo-motoriese program en die laaste groep sal as 'n kontrole groep dien wat aan geen intervensieprogram blootgestel sal word nie. Nadat die die intervensieprogramme vir ongeveer ses na agt weke gevolg is, sal 'n herevaluasie uitgevoer word om moontlike verbetering te monitor. Sodoende kan vasgestel word watter intervensieprogram die grootste impak op motoriese agterstande sowel as selfkonsep het. Na 'n verloop van 'n verdere twee maande sal 'n derde evaluasie uitgevoer word om die blywende effek van die intervensieprogramme te bepaal.

Leerders wat aan geen van die intervensieprogramme deelgeneem het nie (kontrolegroep), sal na afhandeling van die onderskeie intervensieprogramme die geleentheid gegee word om ook te kan deelneem. Al die bogenoemde programme en evaluasies sal kosteloos wees. Hiermee vra ons slegs dat u vir ons moontlike gevalle in u klaskamer identifiseer wat ons by die navorsing kan betrek. Die ondergenoemde riglyne kan daarvoor gebruik word.

Om dit vir u makliker te maak volg hier 'n volledige definisie sowel as sekere kenmerke van kinders met ontwikkelingskoördinasieversteurings (DCD).

- Die term "Developmental Coordination Disorder" (DCD) is deur die "Diagnostic and Statistical Manual" (DSM-IV) van die "American Psychiatric Association" (APA, 1994) goedgekeur om kinders met motoriese lompheid, of beperkings in die ontwikkeling van motoriese koördinasie, te identifiseer. Probleme manifesteer dikwels in fynspier-, grootspier- en perseptueel motoriese agterstande, alhoewel psigo-sosiale agterstande ook daarmee verband hou.

- Wanneer 'n kind met normale intelligensie en vry van neurologiese kondisies of 'n bekende fisieke versteuring 'n gebrek aan motoriese koördinasie ervaar om 'n taak uit te voer, word hy geïdentifiseer met DCD (APA, 1994). (Vroeër is ook na hierdie kinders as lomp verwys) (Henderson *et al.*, 1989; Hoare & Larkin, 1991; Dussart, 1994), en dit is dikwels kinders wat sukkel met die bemeestering van sportvaardighede.

- Die diagnose van DCD word net gemaak as die beperking inmeng met die roetine van aktiwiteite gedurende die daaglikse lewe (aan en uittrek, knope en veters vasmaak ens), of met akademiese prestasies (sukkel met skryf, lees, wiskunde ens) (APA, 1994).

- Dit wil voorkom of meer as een vlak van interaksie tussen die sentrale senuweestelsel en die muskuloskeletale sisteem versteur is wanneer DCD voorkom en dat dit tot

bewegings wat oneffektief en gedisorganiseerd in tyd en ruimte is, aanleiding kan gee (Fox, A.M., 2000).

- Kinders met DCD vaar volgens studies ook swakker as maats tydens metings van noodsaaklike motoriese vaardighede en reageer en beweeg stadiger by elke vlak van taakuitvoering (Missiuna, 1994).
- Hulle vind dit ook moeilik om nuwe komplekse motoriese vaardighede aan te leer (Hoare & Larkin, 1991; Missiuna, 1994), alhoewel daar nie verskille in die tempo van leer, of die vermoë om die geleerde bewegings te veralgemeen, gevind word nie (Missiuna, 1994).
- 'n Opvallende onderskeidende kenmerk van kinders met DCD vergeleke met chronologiese ouderdommaats, is spoed van bewegingsuitvoering (Henderson, Rose & Henderson, 1992; Missiuna, 1994; Smyth, 1994; Maruff, Wilson, Trebilcock & Currie, 1999) wat volgens Smyth (1994) moontlik toegeskryf kan word aan 'n perseptuele afwyking.
- Volgens Fox, A.M. (2000) konsentreer kinders met DCD baie hard om take uit te voer, alhoewel met minder sukses. Dit gee aanleiding daartoe dat hulle dikwels stadiger as maats werk en nie altyd betyds klaarkry nie. Aandagafleibaarheid kan ook 'n verdere beperkende faktor wees.
- By sommige DCD-kinders kan die probleme net in sekere areas teenwoordig wees (Hoare & Larkin, 1991), alhoewel dit nie te sê is dat lompheid 'n geïsoleerde probleem is nie (Geuze & Börger, 1993; Schoemaker & Kalverboer, 1994). Die probleme van DCD-kinders kan teenwoordig wees in verskillende perseptuele afdelings (visueel, kinesteties en taktiel) van die beweging. Die perseptueel motoriese profiel van die kinders verskil dus, sowel as hulle stadige tempo van motoriese leer (Hoare & Larkin, 1991).
- Die meeste kinders wie se swak koördinasie hulle afsonder van vriende, vind dit moeilik om aan omgewingseise te probeer voldoen, soos byvoorbeeld in die skool waar hulle uitvoering van take soos hardloop, spring, hop, en vang van 'n bal vir vriende by die gimnasium en speelgrond baie snaaks voorkom (Dussart, 1994). Hierdie kinders het dikwels die beeld van die 'nar' in die klas, om sodoende sy beperkinge te probeer verdoesel.
- In die klaskamer word hulle dikwels as onbevoeg beskou in take wat akkuraatheid vereis, aangesien hulle maklik in voorwerpe vasloop,voorwerpe laat val en stadig werk (Dussart, 1994).
- Waarneming van lomp kinders deur navorsers (Hoare & Larkin, 1991) onderskei twee tipes probleme wat aan lompheid gekoppel kan word. Hiervolgens is daar lomp kinders wie se vermoëns bloot aan die einde van die normale ontwikkelingskontinuum val en dan die ware lomp kind. Die kind aan die einde van die normale kontinuum van ontwikkeling reageer goed op intervensie, terwyl die ware lomp kind minder suksesvol met intervensie behandel kan word. Daar is veral verskille in die profiele op die perseptueel motoriese vlak (Hoare & Larkin, 1991). Dussart (1994) steun die mening dat alle lomp kinders nie dieselfde bewegingsprobleme het nie en dit ook nie op dieselfde manier hanteer nie.
- Volgens Hoare en Larkin (1991) word daar dikwels aanvaar dat koördinasieprobleme by kinders die resultaat is van vertraagde ontwikkeling in motoriese vaardighede, wat die kind later sal ontgroei of sal inhaal. Koördinasieprobleme duur egter tot in adolessensie, en selfs baie volwassenes toon nog probleme met gekoördineerde

bewegings. Alhoewel 'n hoeveelheid DCD kinders wel aanpas by hulle bewegingsprobleme en adolessensie relatief ongeskonde bereik, is hulle in die minderheid (Losse *et al.*, 1991; Geuze & Börger, 1993; Cantell, Smyth & Ahonen, 1994). Daar is byvoorbeeld deur navorsers gevind dat kinders met motoriese probleme 'n lae selfkonsep het (Henderson *et al.*, 1989; Losse *et al.*, 1991; Skinner & Piek, 2001) en dat na in 'n opvolgstudie na 10 jaar die kinders nog steeds swak motoriese vaardighede en 'n swak selfkonsep toon asook 'n verskeidenheid probleme by die skool (Losse *et al.*, 1991; Cantell *et al.*, 1994). Dit blyk dus dat kinders oor die algemeen nie koördinasieprobleme ontgroei, soos dikwels geglo word nie (Geuze & Börger, 1993; Barnett & Henderson, 1992; Barnett & Henderson, 1994; Cantell *et al.*, 1994; Missiuna, 1994; Fox, A.M., 2000).

Indien u enige verdere navrae het kan u ons gerus kontak by

Anquanette Peens (Kinderkinetikus, Doktorsgraadstudent Tel. 072 159 75 36 / 018-297 7213

Lucille Hugo (Psigologie student in opleiding besig met MA) 082 564 2481

20 February 2003

Teachers

The headmaster of the school gave us permission that you can help us in the identifying of children with specific developmental delays. Thank you for the time that you will put into this. Please be sure that this study would be to the benefit of each of the children that will take part in this study.

Background of the study

The identified children will be scientifically tested with a test that will determine if they have DCD or not. If they have DCD their self-concept will be evaluated as well. Then the identified children will be divided into four different groups. One of the groups take part in a motor intervention programme (presented by a Kinderkineticist), another group will take part in a psychological intervention programme (presented by a trained psychologist), another group will take part in a combined psycho-motor intervention programme and the last group will be the control group who will take part in no intervention programme. After the study is finalized after about six to eight weeks, a re-evaluation will take part to see if there is any positive change. Then it could be determined which intervention programme had the biggest impact on the motor development delays as well as self-concept. After a further two months a third evaluation will determine the lasting effect of the intervention programmes. Children that didn't take part in the intervention programmes (control group), will then be given the opportunity to take part in the different intervention programmes. All the programmes and evaluations will be free of cost. With this we ask if you could please identify possible children in your classroom that could take part in the research. The following guidelines can be used.

To make it easier for you, a definition as well as certain trademarks of children with Developmental Cordination Disorder, follow:

- The term Developmental Coordination Disorder (DCD) is approved by the Diagnostic and Statistical Manual (DSM-IV) of the American Psychiatric Association (APA, 1994) to identify children with motor clumsiness, or restriction in the development of motor coordination. Problems usually appear in fine motor-, gross motor and perceptual motor delays, although psycho-social delays can also form part of this.
- When a child with normal intelligence and free of any neurological condition or any known physical disorder, experience a lack of motor coordination to take part in a motor coordination task, they are identified with DCD (APA, 1994). Earlier there were referred to these children as clumsy (Henderson *et al.*, 1989; Hoare & Larkin, 1991; Dussart, 1994), and often it is the children that suffer in the mastering of sport skills.
- The children are identified with DCD if the delay interferes with the routine of activities during their daily lives. (for example dressing and undressing, tying of buttons and shoelaces ect.), or with academic achievement (suffer with writing, read, mathematics ect.) (APA, 1994).
- It seems like more than one stage of interaction between the central nerve system and the musculoskeletal system is disturbed when DCD is present and that this lead to movements that are unorganized and ineffective in time and space (Fox, A.M., 2000).
- According to studies children with DCD also do worse than their peers during testing of important motor skills and react and move slower in each stage of task (Missiuna, 1994).

- They find it difficult to learn new complex motor skills (Hoare & Larkin, 1991; Missiuna, 1994), although no differences are found in the tempo of learn and the ability to generalize learned movements (Missiuna, 1994).
- An outstanding of these children with DCD according to there chronological age peers, is speed of movement tasks (Henderson, Rose & Henderson, 1992; Missiuna, 1994; Smyth, 1994; Maruff, Wilson, Trebilcock & Currie, 1999) which could according to Smyth (1994) be an outcome of a perceptual disorder.
- According to Fox, A.M. (2000) children with DCD concentrate very hard to do a task, although with less success. This results in that they work slower than their peers and doesn't always finish on time. Attention deficit can also be a restricting factor.
- In some DCD-children the problems can just be present in some areas (Hoare & Larkin, 1991), although it isn't to say that clumsiness is an isolated problem (Geuze & Börger, 1993; Schoemaker & Kalverboer, 1994). The problems of DCD-children can be present in different perceptual sections (visual, kinestetics, touch) of the movement. The perceptual motor profile of these children differ, as well as the slow tempo of motor learning (Hoare & Larkin, 1991).
- The most children whose poor coordination separate them from friends, find it difficult to try and measure up to the environmental claims for example in school where tasks as run, jump, hop, and catch of a ball is very funny for friends in the gymnasium and on the playground. (Dussart, 1994). These children mostly seems to be the clown in the class, to try and hide their problems.
- In the classroom they are seen as incompetent in tasks that need accuracy, because they easily bump into objects, let objects fall and work slowly (Dussart, 1994).
- According to Hoare and Larkin (1991) it is often believed that coordination problems in children are the result of delayed development in motor skills, that will be outgrown in later years. Coordination problems continue till adolescence, and even some adults still show problems with coordinated movements. Although some DCD-children adapt to their movement problems and reach adolescence without problems, it seems unlikely (Losse *et al.*, 1991; Geuze & Börger, 1993; Cantell, Smyth & Ahonen, 1994). Researchers found that children with motor problems have a low self-concept (Henderson *et al.*, 1989; Losse *et al.*, 1991; Skinner & Piek, 2001) and that after a recall study of 10 years they still had poor motor skills and a low self-concept as well as a variety of problems at school (Losse *et al.*, 1991; Cantell *et al.*, 1994). It look like children don't outgrow their coordination problems, as was the believe (Geuze & Börger, 1993; Barnett & Henderson, 1992; Barnett & Henderson, 1994; Cantell *et al.*, 1994; Missiuna, 1994; Fox, A.M., 2000).

For any questions please call me
Anquanette Peens (Kinderkineticist, Doctoral grade student Tel. 072 159 75 36 / 018-297 7213 or
Lucille Hugo (Psychology student in training busy with her MA) 082 564 2481

APPENDIX G

INFORMED CONSENT DOCUMENTS (Afrikaans and English)

NAVORSINGSPROJEK – MOTORIESE ONTWIKKELING EN SELFKONSEP ONDERSOEK VAN KINDERS 7-9 JAAR

Hierdie projek is goedgekeur deur die Etiese komitee (in proses) van die Potchefstroomse Universiteit vir Christelike Hoër Onderwys. Toestemming is ook by die onderskeie skoolhoofde verkry om voort te gaan met die projek.

U kind is deur die klasonderwyseres geïdentifiseer as 'n moontlike kandidaat om aan die volgende navorsingsprojek deel te neem.

Die doel van die navorsingsprojek:

- Om inligting in te samel oor 7-9-jarige kinders se motoriese ontwikkeling (fynmotorisese-, bal- en balansvaardighede).
- Om die geïdentifiseerde kinders se selfkonsep te evalueer.
- Om die kinders bloot te stel aan een van die volgende intervensieprogramme: Psigologiese intervensieprogram, Motoriese intervensieprogram, Psigo-motoriese intervensieprogram. Die intervensieprogram sal tussen 6 en 8 weke duur. Die programme word onderskeidelik aangebied deur 'n gekwalifiseerde Kinderkinetikus en Sielkundige.
- Om die kinders te herevalueer na die verskillende intervensieprogramme voltooi is en vas te stel of die motoriese intervensieprogram, die psigologiese intervensieprogram of 'n gesamentlike psigo-motoriese program die kinders se motoriese vaardighede en veral selfkonsep die beste verbeter het.
- Om die kinders na 2 maande weer te evalueer en te bepaal wat die blywende effek van die programme is.

Deur u kind aan die bogenoemde navorsingsprojek te laat deelneem kan dit vir ouers, onderwysers en kundiges inligting verleen oor watter tipe intervensieprogramme die beste is om kinders se ontwikkelingsagterstande te elimineer en verdere ontwikkeling te optimaliseer. Daar kan selfs later in skole soortgelyke programme geïmplimenteer word om aan kinders met probleme hulp te verleen. Ons vra dus dat, omdat u kind geïdentifiseer is u dit sterk sal oorweeg om hom/haar te laat deelneem aan die program. Ons vra ook dat indien u kind deelneem u hom/haar nie sal onttrek voor die beëindiging van die studie nie.

Ek as ouer verstaan hiermee dat ek onder geen verpligting is om my kind aan die navorsingsprojek te laat deelneem nie. Ek verstaan dat daar geen skade aan my kind berokken gaan word, hetsy fisies of geestelik nie.

Ek verstaan dat daar geen koste verbonde is aan die aanbieding van die evaluering of oefenprogramme nie. Ek verstaan dat ek my kind self by die betrokke fasiliteite moet besorg vir aanbieding van die intervensieprogramme, indien dit nie by die skool self aangebied kan word nie.

Prof. A.E. Pienaar (Skool vir Biokinetika)	**Dr. A.W. Nienaber (Skool vir Psigologie)**
Anquanette Peens (Kinderkineticist)	**Lucille Hugo (MA sielkunde student in opleiding)**

Stuur asseblief hierdie vorm binne die volgende twee dae terug skool toe, of dit ingevul is al dan nie.

✂ ✂ ✂

Vul asseblief afdeling 1 en 5 van die aangehegde vorm in.

Dui asseblief aan, aan watter buitemuurse aktiwiteite of terapie u kind tans deelneem (bv. KDP, tennis, netbal, krieket, arbeidsterapie ens.):_____

Hiermee gee ek _____

ouer/voog van _____ (Geboortedatum _____) toestemming dat hy/sy mag deelneem aan die navorsingsprogram.

_____ _____

Handtekening Datum

RESEARCH PROJECT – ENHANCEMENT OF MOTOR DEVELOPMENT AND SELF-CONCEPT OF CHILDREN 7-9 YEARS

This project is approved by the Ethics committee (in process) of the Potchefstroom University for Christian Higher Education. The headmaster of you school also agreed that we could continue with the project.

Your child was identified by the class teacher as a possible candidate to participate in the following research project.

The aim of this research project:

- To gain information regarding the motor development of the child (fine motor-, ball- and balance skills) of children 7-9 years.
- To evaluate the identified childrens' self-concept.
- To expose the children to one of the following intervention programmes: Self concept enhancing intervention program, Motor intervention program, Psycho-motor intervention program. The intervention program will last between 6 and 8 weeks. The program will be presented by a qualified Kinderkeniticist and Psychologist respectively.
- To re-evaluate the children after the various intervention programmes are completed to determine which of the different approaches provided the best outcome with regards to the child's motor ability and self-concept.
- To evaluate the children 2 months after the programs were completed to determine what the lasting effect of the programs are.

By letting your child take part in this research project, know that he/she can only gain from it. Secondly, information about which intervention program is the most relevant to eliminate developmental delays and optimize further development, can be given to parents, teachers and specialists. Later on, these programs could even be implemented in schools to help children with such problems. Because your child is identified as a child who can benefit from such programs, we would like to ask you to consider it strongly to let your child participate in the study. Furthermore we would want to ask that if you decide that your child can participate, that you would not withdraw him/her before the termination of the study.

I as the parent understand that I am under no obligation to let my child participate in this research project. I understand that my child wouldn't be harmed in any way, physically or spiritually. I understand that there would be no costs involved in the evaluation or the programs that are conducted. I understand that I am responsible to take my child to the facilities for the intervention program, in the case where it is not possible to conduct it at the school.

Prof. A.E. Pienaar (School for Biokinetics)

Dr. A.W. Nienaber (School for Psychology)

Anquanette Peens (Kinderkineticist)

Lucille Hugo (MA psychology student in training)

Please send this form back to school within the next two days.

Please complete section 1 and 5 of the attached form.

Please indicate in what sport related activities or therapy your child is participating at this moment (eg. KDP, tennis, netball, cricket, occupational therapy ect.):_____

Hereby I _____ parent/caregiver of _____ (Date of birth _____) give permission that he/she may participate in the research project.

_____ _____

Signature Date

APPENDIX H

MOTOR INTERVENTION PROGRAMME

Lesson 1

Fundamental skills (Vestibular and kinesthesis)

- Two legged jumps.
- One legged jumps.
- Egg rolls (from sit to back and up again).

Balance

- Heel-to-toe stance.
- Heel-to-toe, walk forward and backward on rope.
- Toe stance.

Ball skills (eye-hand coordination)

- Throw ball, let ball bounce then catch.
- Throw and catch big (20cm) ball.
- Bounce and catch big ball.

Fine motor skills (Manual dexterity)

- Finger tapping on table (tap the same fingers as what the teachers says, as fast as you can).
- Thumb-finger circles.

Eye control

- Tracking of picture with eyes (horizontal movement).
- Tracking of picture with eyes (vertical movement).

Lesson 2

Fundamental skills (Vestibular and kinesthesis)

- Jump hop-scotch in hula hoops.
- Log rolls in tunnel.

Balance

- One leg stance.
- Walk on different objects (bricks, bean bags).

Ball skills (eye-hand coordination)

- Bounce and kick big ball.
- Throw big ball through hula hoop.

Fine motor skills (Manual dexterity)

- Take A4 paper and roll it into ball with one hand.
- Roll the paper ball with fingers.

Eye control

- Tracking of ball in frisbee (circular movement).
- Tracking of ball in frisbee (horizontal movement).

Lesson 3

Fundamental skills (Vestibular and kinesthesis)

- Glide sideways.
- Stand like a star and turn around.
- Skipping.

Balance

- One legged stance on low, broad balance beam.
- Walk forward and backward on balance beam.

Ball skills (eye-hand coordination)

- Bounce and catch big ball with a friend.
- Throw and catch big ball with a friend.

Fine motor skills (Manual dexterity)

- Complete connect the dot pictures (two pictures).

Eye control

- Convergence and divergence tracking (look at picture that teacher move closer and further away from the eyes).

Lesson 4

Fundamental skills (Vestibular and kinesthesis)

- Baboon walk forward and backwards.
- Baboon walk while turning around – then make forward roll.
- Log rolls in tunnel.

Balance

- Hold balance while sitting on 55cm gymnic ball.
- Heel-to-toe stance while ducking for a pom-pom.

Ball skills (eye-hand coordination)

- Throw and catch big ball ten times.
- Play hand tennis with big balls.

Fine motor skills (Manual dexterity)

- Paper folding (quacker).

Eye control

- Tracking of quacker with eyes (horizontal movement).
- Tracking of quacker with eyes (vertical movement).
- Convergence and divergence movement with quacker.

Lesson 5

Fundamental skills (Vestibular and kinesthesis)

- One legged jumps.
- Walk on toes.
- Walk on heels.
- Walk on sides of feet
- Egg rolls (from sit to back, left, right and up again).

Balance

- One legged stance.
- One legged stance on toes.
- Heel-to-toe walk forward and backward on rope.

Ball skills (eye-hand coordination)

- Throw big ball, clap hands and catch.
- Throw big ball, touch body part (nose, shoulder ext.) and catch.

Fine motor skills (Manual dexterity)

- Take a stick with a piece of string attached in the middle with a small sandbag attached to the end. Roll this string up the stick making use of both hand's fingers.
- Draw a picture.

Eye control

- Swing sandbag slowly around child's head and he/she must follow with eyes.

Lesson 6

Fundamental skills (Vestibular and kinesthesis)

- Crab walk.
- Egg rolls (from sit to back and up again).
- Forward rolls.

Balance

- Walk backwards on balance beam.
- Walk sideways on balance beam.

Ball skills (eye-hand coordination)

- Throw big ball to friend, friend touch body part then catch.
- Throw big ball to friend, friend clap hands then catch.

Fine motor skills (Manual dexterity)

- Put washing pins on friend's clothes (Do with both hands).

Eye control

- Blow bubbles, follow with eyes and pop with fingers.

Lesson 7

Fundamental skills (Vestibular and kinesthesis)

- Two legged jumps.
- One legged jumps.
- Tonic labyrinthine prone (airplane hold).
- The airplane rolls over (log rolls).

Balance

- Two legged jumps in hoops – freeze in last hoop – to hold balance.
- Stand on toes with eyes open and closed.
- One legged stance.

Ball skills (eye-hand coordination)

- Throw and catch tennis ball.
- Bounce and catch tennis ball.
- Throw ball, clap hands, catch ball.

Fine motor skills (Manual dexterity)

- Draw a circle path on paper and walk with left and right hand's thumb and forefinger on the path (this path forms an elephant's ears).
- Pinch washing pins on elephants head.

Eye control

- Take the elephant they drew, move it closer and further from the child's face. Child must focus on the elephant's eyes.

Lesson 8

Fundamental skills (Vestibular and kinesthesis)

- Glide (sideways).
- Run backwards.
- Baboons walk (while turning around).

Balance

- Walk heel-to-toe over balancing board.
- Walk over bridge built with balancing boards.
- Stand on one leg on bridge.

Ball skills (eye-hand coordination)

- Roll tennis ball through hoop.
- Throw ball into hoop on the ground.
- Throw ball in air, touch nose, catch ball.

Fine motor skills (Manual dexterity)

- Cut out pictures with scissors.
- Take a stick with a piece of string attached in the middle with a small sandbag attached to the end. Roll this string up the stick making use of both hand's fingers.

Eye control

- The child must follow the beam of a flashlight against the wall. The child is only allowed to use his eyes.

Lesson 9

Fundamental skills (Vestibular and kinesthesis)

- Baboon walk (forward, backward and while turning).
- Crap walk (forward, backward and while turning).
- Frog jumps (forward and while turning).

Balance

- Walk on stilts over bean bags and inside hoops.
- Stand on one leg with eyes open and closed.
- Walk over bridge.

Ball skills (eye-hand coordination)

- Hit tennis ball with cricket bat.
- Throw ball against wall and catch.
- Throw and catch ball.

Fine motor skills (Manual dexterity)

- Copy small figures.
- Finger tapping.

Eye control

- Follow bubbles with eyes.
- Follow ball on rope with eyes.

Lesson 10

Fundamental skills (Vestibular and kinesthesis)

- Glide (sideways).
- Leap.
- Galloping.
- Animal walks from lesson 9 backwards and turning.

Balance

- Walk heel-to-toe forward and backwards over balancing beam.
- Skipping with a hoop.
- Balance on different body parts (ex. hand and knee, hand and foot).

Ball skills (eye-hand coordination)

- Throw and catch bean bag.
- Throw bean bag in hoop.
- Two-two friends throw and catch bean bag.

Fine motor skills (Manual dexterity)

- Walk on path with fingers.
- Put two-two washing pins together.

Eye control

- Hold little object and child focus with both eyes, then left and right eye separately.
- Tracking with both eyes around a square and triangle.

Lesson 11

Fundamental skills (Vestibular and kinesthesis)

- Stand in hoop and do two legged jumps.
- Stand in hoop and do one legged jumps.
- Skipping forward and while turning around.

Balance

- Walk forward and backward on high balance beam.
- Walk on beam and climb through hoop while on beam.

Ball skills (eye-hand coordination)

- Kick ball against wall.
- Put target against wall – through ball at target.
- Kick ball through cones.

Fine motor skills (Manual dexterity)

- Put washing pins together and take them off again.
- Pick up matches and put them in box.

Eye control

- Lie on back and follow ball on string with eyes (horizontal movement).
- Lie on back and follow ball on string with eyes (vertical movement).
- Lie on back and follow ball on string with eyes (circular movement).

Lesson 12

Fundamental skills (Vestibular and kinesthesis)

- Two legged jumps in hoops.
- One legged alternative jumps in hoops.
- Play rotten egg with bean bag while sitting in circle.

Balance

- Walk heel-to-toe over balance beam with bean bag on head.
- Place bean bags on floor and walk on toes over bean bags.

Ball skills (eye-hand coordination)

- Bounce ball with one hand – ten times.
- Throw and catch tennis ball.
- Try to balance tennis ball on racket.
- Hit bounced ball with racket,

Fine motor skills (Manual dexterity)

- Cut out figures with scissors.

Eye control

- Make figures with flash light against the wall.
- Roll golf ball in hula hoop and around body.

Lesson 13

Fundamental skills (Vestibular and kinesthesis)

- Two friends chase each other and try and tag each others shadow.
- Wheelbarrow walk.
- Galloping.

Balance

- Heel-to-toe stance on balance beam and duck for the pom-pom.
- One legged stance on balance beam and duck for the pom-pom.
- Climb through hoop while on balance beam.

Ball skills (eye-hand coordination)

- Put bean bag on different body parts like elbow – through it off and catch.
- Bounce big ball continuously.

Fine motor skills (Manual dexterity)

- Complete connect the dot pictures (complete three pictures).
- Color the pictures that they completed.

Eye control

- Follow bubbles with both eyes and pop them with fingers.
- Follow bubbles with each eye separately and pop them with fingers.

Lesson 14

Fundamental skills (Vestibular and kinesthesis)

- Play follow the leader with activities such as run, jump and glide.
- Crab walk forward, backward and while turning.
- Bear walk forward, backward and while turning.

Balance

- Balance on different body parts (hand and knee ext.).
- Balance on balancing board.
- Walk over bridge build with balancing boards.

Ball skills (eye-hand coordination)

- Roll ball through cones (zig-zag).
- Hit golf ball through path into hole.

Fine motor skills (Manual dexterity)

- Roll toilet roll in path.

Eye control

- Tracking with eyes around square.
- Tracking with eyes around circle.
- Tracking with eyes around triangle.

Lesson 15

Fundamental skills (Vestibular and kinesthesis)

- Skipping with hula hoop.
- Leap.
- Standing long jump.

Balance

- Walk forward on low balance beam.
- Walk on toes on low balance beam.
- Walk backward on low balance beam.

Ball skills (eye-hand coordination)

- All children stand in circle, when teacher throw ball teacher call child's name that child must go in circle and catch the ball.
- Kick tennis ball in circle (ball is not allowed to go out the circle).

Fine motor skills (Manual dexterity)

- Color pictures.

Eye control

- Name different pictures on eye cards.

Lesson 16

Fundamental skills (Vestibular and kinesthesis)

- Run forward and backwards and while turning.
- Glide.
- Animal walks (baboon, crab, frog) while turning.

Balance

- Bunny hand stand.
- One-legged stance with eyes closed.

Ball skills (eye-hand coordination)

- Catch small balls with catchers.
- One child rolls ball the other hit the ball with cricket bat.

Fine motor skills (Manual dexterity)

- Complete connect the dot pictures.
- Color the picture.

Eye control

- Put balls in the parachute and children must pull on the handles so that the balls pop up into the air. Children must follow balls with their eyes.
- This was also for a fun activity as this was the children last lesson of the intervention programme.

APPENDIX I

SUBMISSION CONFIRMATION

Prof. Amusa
I would hereby like to submit our article for your review process.
I herewith attach the article with the title: "The influence of DCD on the self-concept and anxiety of 7-9 year old children"
I hereby also state that this article has not been submitted to any other journal.
This article is also part of a doctoral thesis.
Would it be possible for you to let me know if you received the article and if everything is in order.
Kind regards
Anquanette Peens

Mail Envelope Properties (4386E831.BCC : 13 : 15048)

Subject:	Article-submission
Creation Date	2005/11/25 12:32:17
From:	Anquanette Peens
Created By:	MBWAP@puknet.puk.ac.za

Recipients	**Action**	**Date & Time**
yahoo.com 12:32:44 amusalbw (amusalbw@yahoo.com)	Transferred	2005/11/25

Post Office	**Delivered**	**Route**
		yahoo.com

Files	**Size**	**Date & Time**
MESSAGE	898	2005/11/25 12:32:17
Effect of DCD on self-concept.doc	4027392	2005/11/25 12:24:43

Options

Auto Delete:	No
Expiration Date:	None
Notify Recipients:	Yes
Priority:	Standard
ReplyRequested:	No
Return Notification:	None
Concealed Subject:	No
Security:	Standard
To Be Delivered:	Immediate
Status Tracking:	All Information

APPENDIX J

SUBMISSION CONFIRMATION

08-Sep-2005

Dear Mrs. Peens,

Your manuscript entitled "The effect of different intervention programmes on the self-concept and motor proficiency of 7-9 year old DCD children" has been successfully submitted online and is presently being given full consideration for publication in Child: Care, Health & Development.

Your manuscript ID is CCH-2005-0154.

Before we can begin to process your manuscript, we must receive a copy of the Exclusive Licence Form. This can be found via the following link:

http://www.blackwellpublishing.com/pdf/cch_exclusive.pdf

I would be very grateful if you could please download and complete the form and return a hard copy to me at the address below. This will help to speed up the processing of your paper.

Please mention the above manuscript ID in all future correspondence or when calling the Editorial Office with queries. If there are any changes to your mailing address or e-mail address, please log in to Manuscript Central at http://mc.manuscriptcentral.com/cch and edit your user information accordingly.

You can also view the status of your manuscript at any time by checking your Author Centre after logging in to http://mc.manuscriptcentral.com/cch

Thank you very much for submitting your manuscript to Child: Care, Health & Development.

Yours sincerely,

Catherine Cary
Editorial Office, Child: Care, Health & Development
Professional Journals
Blackwell Publishing
9600 Garsington Road
Oxford OX4 2DQ
UK

Tel: 44 (0) 1865 476518
Fax: 44 (0) 1865 471518

Catherine.Cary@oxon.blackwellpublishing.com

APPENDIX K

SUBMISSION CONFIRMATION

10-Nov-2005

Dear Mrs. Peens,

Your manuscript entitled "The effect of gender and ethnic differences on the success of intervention programmes for the motor proficiency and self-concept of 7-9 year old DCD children" has been successfully submitted online and is presently being given full consideration for publication in Child: Care, Health & Development.

Your manuscript ID is CCH-2005-0229.

Before we can begin to process your manuscript, we must receive a copy of the Exclusive Licence Form. This can be found via the following link:

http://www.blackwellpublishing.com/pdf/cch_exclusive.pdf

I would be very grateful if you could please download and complete the form and return a hard copy to me at the address below. This will help to speed up the processing of your paper.

Please mention the above manuscript ID in all future correspondence or when calling the Editorial Office with queries. If there are any changes to your mailing address or e-mail address, please log in to Manuscript Central at http://mc.manuscriptcentral.com/cch and edit your user information accordingly.

You can also view the status of your manuscript at any time by checking your Author Centre after logging in to http://mc.manuscriptcentral.com/cch

Thank you very much for submitting your manuscript to Child: Care, Health & Development.

Yours sincerely,

Tracey Baker
Editorial Office, Child: Care, Health & Development
Professional Journals
Blackwell Publishing
9600 Garsington Road
Oxford OX4 2DQ
UK

Tel: 44 (0) 1865 476540
Fax: 44 (0) 1865 471540

Tracey.Baker@oxon.blackwellpublishing.com

APPENDIX L

SUBMISSION CONFIRMATION

This memo is to let you know we will be sending your paper out for review shortly. The manuscript number is 100305-56 should you have any questions, thanks!

At 02:55 AM 10/03/2005, you wrote:
>David
>Sorry, that I only reply now. I was on holiday. I hope that you receive
>my e-mail in time.
>Thank you
>Anquanette
>
> >>> <apaq@osu.edu> 2005/09/26 23:21 >>>
>Anquanette,
>I have safely received the hard copy of your manuscript, however we are
>now taking all submissions by email so we can send them to the reviewers
>faster, could you please send us an electronic copy? Thanks!
>
>David Porretta, PhD
>Editor, Adapted Physical Activity Quarterly
>Pomerene Hall
>1760 Neil Ave.
>The Ohio State University
>Columbus, OH 43210
>phone: 614 292-0849
>fax: 614 292-7229
>
>