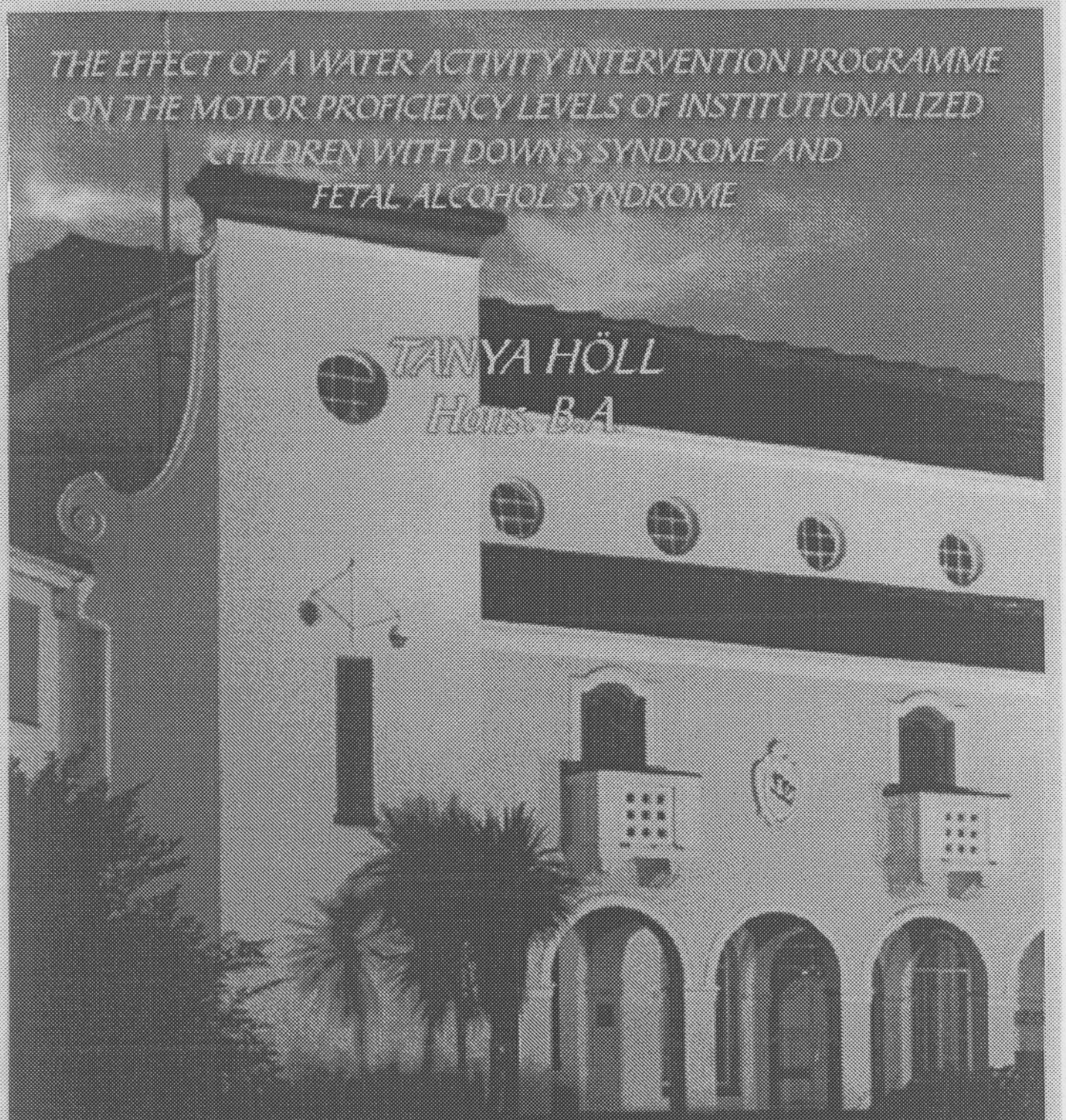
THE EFFECT OF A WATER ACTIVITY INTERVENTION PROGRAMME ON THE MOTOR PROFICIENCY LEVELS OF INSTITUTIONALIZED CHILDREN WITH DOWN'S SYNDROME AND FETAL ALCOHOL SYNDROME



TANYA HÖLL
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Supervisor: Dr M Coetzee
Assistant Supervisor: Prof A.E. Pienaar
Potchefstroom
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DECLARATION

We hereby as supervisors/co-authors give permission to Miss Tanya Höll to use the research articles, as presented in this dissertation, for her study. We as supervisors/ co-authors only acted in a supervisory capapacity regarding the research and the writing of the research articles

Dr M Coetzee

Prof A.E. Pienaar

15 November 2003

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If I had my child to raise over again – Diane Loomas

If I had my child to raise all over again
I'd build self-esteem first, and the house later
I'd finger-paint more, and point the finger less
I would do less correcting, and more connecting
I'd take my eyes off my watch, and watch with my eyes
I would care to know less, and know to care more
I'd take more hikes, fly more kites
I'd stop playing serious, and seriously play
I would run through fields, and gaze at more stars
I'd do more hugging and less tugging
I'd see the oak tree in the acorn more often
I would be firm less, and affirm much more
I'd model less about the lover of power, and more about the power of love

SUMMARY

THE EFFECT OF A WATER ACTIVITY INTERVENTION PROGRAMME ON THE MOTOR PROFICIENCY LEVELS OF INSTITUTIONALIZED CHILDREN WITH DOWN'S SYNDROME AND FETAL ALCOHOL SYNDROME

Mental retardation is a heterogeneous group of disorders with countless causes. It is characterised by cognitive and functional limitations in everyday skills, for example social skills, communication skills and motor skills and can be classified in behavioural, etiological and educational systems. Down's syndrome and Fetal Alcohol Syndrome are two of the many syndromes defined under mental retardation. The goal of this dissertation was to determine the effect of a water activity intervention programme on the motor proficiency levels of children with Down's syndrome and Fetal Alcohol Syndrome. These aims were addressed by structuring the dissertation in five chapters: Chapter one constituting the introduction and statement of the problem, Chapter 2 presenting a review of relevant literature, Chapters 3 and 4 consisting of two research articles, addressing the spesific aims of the study, and Chapter 5 including the summary, conclusions and recommendations.

All the children who participated in the study were instutionalized in a school for the mentally and physically handicapped. The MABC-test was used as the main evaluation instrument, and components of the Charlop-Atwell test were used to evaluate the coordination skills of the children with Down's syndrome.

The first aim of this study was to determine the effect of a specially designed water activity intervention programme on the motor proficiency levels of children with Down's syndrome. Six children classified as having Down's syndrome, formed part of the research group. Their chronological age ranged between 9 and 14 years while their mental age classification was that of a 4 to 5 year old. The data was analysed by means

of descriptive statistics, and effect sizes were determined. The second aim of the study was to determine the effect of a water activity intervention programme on the motor proficiency levels of children with Fetal Alcohol Syndrome. Six children participated in the programme. Their chronological age ranged between 7 and 17 years while their mental age classification was that of a 4 to 11 year old. Reporting the results were in the form of case studies, and effect sizes of differences were determined.

With regard to the first aim of the study the results indicated that the motor proficiency levels of the experimental group with Down's syndrome improved, especially regarding the MABC-total, balance- and total body coordination skills.

With reference to the second aim of the study, the results indicated that improvement in the motor proficiency levels of the children with Fetal Alcohol Syndrome had a lasting effect. The MABC total, ball skills and manual dexterity were the components that showed the best improvement.

It can be concluded that a water activity intervention programme is a suitable method for rectifying motor deficiencies among children with Down's syndrome and Fetal Alcohol Syndrome.

Recommendations for the improvement of the water activity programme were presented, as well as suggestions for further studies.

Keywords: Water activity, Movement ABC, DCD (Developmental Coordination Disorder), FAS (Fetal Alcohol Syndrome), Motor development, Mental retardation, motor proficiency, Down's syndrome, Physical activity, Children.

OPSOMMING

DIE EFFEK VAN 'N WATERAKTIWITEIT-INTERVENSIE-PROGRAM OP DIE MOTORIESE BEHENDIGHEIDSVLAKKE VAN KINDERS MET DOWNSINDROOM EN FETALE ALKOHOLSINDROOM

Verstandelike gestemdheid is 'n heterogene groep afwykings wat veroorsaak word deur 'n verskeidenheid oorsake. Dit word gekenmerk deur kognitiewe en funksionele beperkinge in alledaagse aktiwiteite, soos onder andere sosiale, kommunikasie- en motoriese vaardighede. Downsindroom en Fetale Alkoholsindroom word geklassifiseer as twee van die tipes verstandelik gestremdhede wat die mees algemeenste voorkom.

Die doel van hierdie verhandeling was om die effek van 'n wateraktiwiteit-intervensie-program op die motoriese behendigheidsvlakke van kinders met Downsindroom en Fetale Alkoholsindroom te bepaal. Hierdie doelwitte is aangespreek in die vorm van vyf hoofstukke, met Hoofstuk 1 wat die inleiding en doelstellings aanbied, Hoofstuk 2 wat die literatuuroorsig bevat en Hoofstukke 3 en 4 wat in die vorm van twee navorsings-artikels, die spesifieke doelstellings van die studie onder die loep neem. Hoofstuk 5 sluit die samevatting, gevolgtrekking en aanbevelings in.

Al die kinders wat aan die studie deelgeneem het is uit 'n skool vir verstandelik en fisiek gestremde leerlinge gekies. Die MABC-toetsbattery is gebruik as meetinstrument, terwyl enkele komponente van die Charlop-Atwell-toets gebruik is vir die evaluering van koördinasie by die kinders met Downsindroom.

Die eerste doel van die studie was om die effek van 'n wateraktiwiteit-intervensieprogram op die motoriese behendigheidsvlakke van kinders met Downsindroom te bepaal. Ses kinders wat met Downsindroom gediagnoseer is, het deel uitgemaak van die proefgroep. Hulle chronologiese ouderdom het gewissel van 9 tot 14 jaar, terwyl hulle verstandelike ouderdom geklassifiseer is as dié van 'n 4- tot 5-jarige

kind. Om die resultate te verwerk is gebruik gemaak van beskrywende statistiek en effekgroottes is ook bepaal. Die tweede doel van die studie was om die effek van 'n wateraktiwiteit-intervensieprogram op die motoriese behendigheidsvlakke van kinders met Fetale Alkoholsindroom te bepaal. Ses kinders wat gediagnoseer is met Fetale Alkoholsindroom het deel uitgemaak van die proefgroep. Hulle chronologiese ouderdom het gewissel van 7 tot 17 jaar, terwyl hulle verstandelike ouderdom geklassifiseer is as dié van kinders tussen 4 en 11 jaar. Die rapportering van die resultate was grootliks in die vorm van gevallestudies. Met die verwerking van die resultate is gebruik gemaak van beskrywende statistiek, en effekgroottes van resultate is ook bepaal.

Met verwysing na die eerste doelstelling, het die resultate daarop gedui dat die motoriese behendigheidsvlakke van die eksperimentele groep met Downsindroom verbeter het. Die MABC-totaal, balans- en algehele liggaamskoördinasiekomponent het die grootste verbeteringe getoon.

Met verwysing na die tweede doelstelling, het die resultate getoon dat die motoriese behendigheidsvlakke van die kinders met Fetale Alkohol Sindroom ook verbeter het. Die resultate het ook getoon dat die wateraktiwiteit-intervensieprogram 'n blywende effek op die motoriese behendigheidsvlakke van die proefgroep gehad het. Die MABC-totaal, bal- en fynspiervaardighede het die grootste verbetering getoon.

Daar kan dus tot die gevolgrekking gekom word dat 'n wateraktiwiteit-intervensie-program wel kan bydra tot die verbetering van motoriese agterstande by kinders met Downsindroom en Fetale Alkoholsindroom.

Aanbevelings vir die verbetering van die wateraktiwiteit-intervensieprogram asook voorstelle vir opvolgstudies, is in Hoofstuk 5 voorgelê.

Sleutelterme: Wateraktiwiteit, Movement ABC, DCD (Developmental Coordination Disorder), FAS (Fetale Alkoholsindroom), Motoriese ontwikkeling, Verstandelike gestremdheid, Motoriese behedigheid, Downsindroom, Physical activity, Fisieke aktiwiteit, Kinders.

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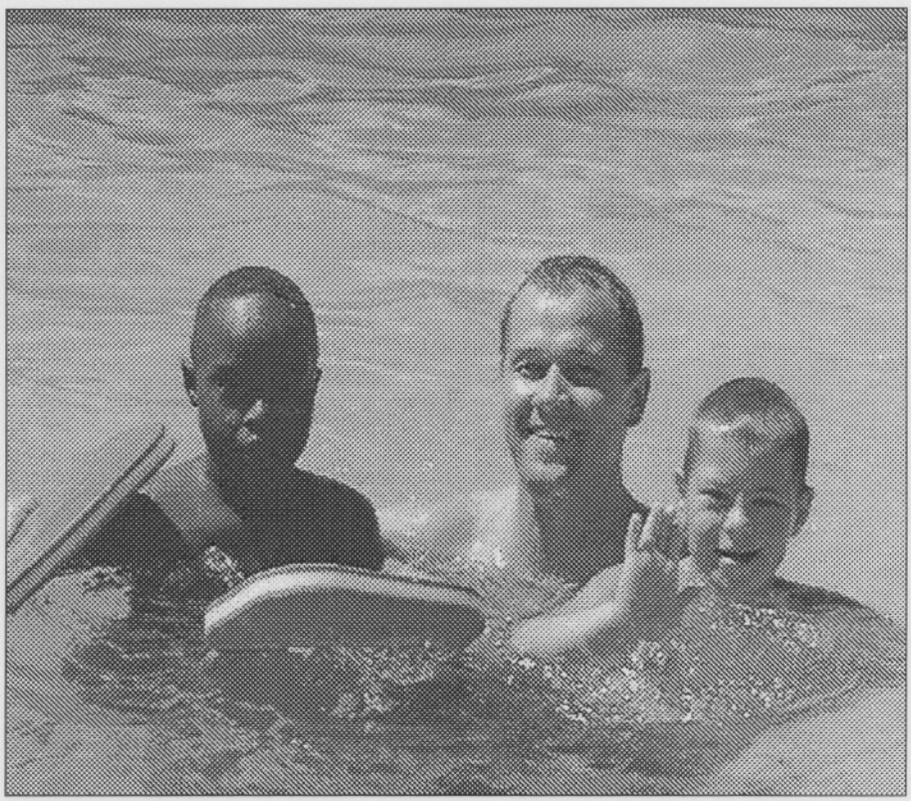
LIST OF ABBREVIATIONS

ADD	–	Attention Deficit Disorder
ADHD	–	Attention Deficit Hyperactive Disorder
d	–	Practical significance
DCD	–	Developmental Coordination Disorder
DS	–	Down's syndrome
FAE	–	Fetal Alcohol Effect
FAS	–	Fetal Alcohol Syndrome
FASD	–	Fetal Alcohol Spectrum Disorder
M	–	Mean
MABC	–	Movement Assesment Battery for Children
n	–	number
sd	–	Standard Deviaion

CHAPTER 1

PROBLEM AND AIM



Chapter 1

Problem and aim

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1.1 INTRODUCTION AND PROBLEM STATEMENT

Water has been used as a healing medium, dating back many centuries (Myburgh, 2000 :27). It is considered as an effective medium for physical and mental therapy, relaxation, perceptual-motor remediation, fitness, fun, competition and selfconcept enhancement (Braun, 1997:37). The researcher further states that water can change mental states and help management of behaviour. The therapeutic effects of swimming and aquatic exercises on physical fitness and well being have been recognised for people with mental and physical disabilities (Yilmaz *et al.*, 2002:108).

Mental retardation is a heterogeneous group of disorders with countless causes (Krebs, 2000:112) which can be classified in behavioural, etiological and educational categories (Krebs, 2000:113). It is characterised by functional limitations in everyday skills, for example social skills, communication skills and motor skills (Krebs, 2000:112) and plays a momentous role in a child's physical fitness and cognitive abilities (Yilmaz *et al.*, 2002:A-108).

This study focussed on the improvement of the motor development of both children with Down's syndrome and Fetal Alcohol Syndrome through water activities. According to available literature, mentally retarded children have definite drawbacks with regard to

motor development (Chun *et al.*, 2000:104). Delayed milestone development is associated in children with psychological deflection, although it doesn't have a direct link with the development of the fundamental movement skills (Chun *et al.*, 2000:104). Cremers and Bol (1993:511-514) did a classification of different sports suitable for children with mental retardation, classifying the following sports as high risk sports, namely wrestling, gymnastics, trampoline jumping and horse riding. Low risk sports are swimming, athletics, rowing and cycling. Due to the fact that many of the children with Down's syndrome and with Fetal Alcohol Syndrome are accommodated in different institutions, they do participate in athletics, but swimming, rowing and cycling do not receive much attention as it requires more individualized attention from the trainer.

Down's syndrome is one of the most recognisable chromosomal abnormalities which causes mental retardation (Krebs, 2000:118) and is caused by the presence of an extra chromosome in the human body (Louw *et al.*, 1998:115). There are some apparent characteristics typical of Down's syndrome, namely a flattened face, coarse straight hair and a rough tongue (Elliot *et al.*, 1992:345). Other physical characteristics are hypermobility of the joints, moderate obesity, short legs and arms in comparison with the torso, short neck and small ears, poor balance, poor muscle tone, poor visual and auditive capabilities, a small head, a small mouth and thin small lips, a small nose and a flattened nose bridge, prominent folds on the handpalms, an underdeveloped respiratoric and cardiovascular system and white dots in the iris of the eye (Krebs, 2000:119). Cognitive as well as functional limitations in everyday life and social skills are distinguishing characteristics of children with Down's syndrome (Krebs, 2000:119). Psychological disorders like depression, eating disorders, sleep disorders, aggression and moodswings, frequently occur (Pary *et al.*, 1996:148).

Literature on the motor development of children with Down's syndrome, is not readily available (Jobling, 1998:284). According to Winders (1999:3) there are four factors that play an important role in the overall motor development of the child with Down's syndrome, namely muscle hipotonia, ligament laxity (joint hypermobility), unsatisfactory strength and short limbs. Nilholm (1996:52) states that early intervention is very

important for children with Down's syndrome; they should receive regular physical therapy or alternative movement therapy in order to promote the entire motor development and to prevent the acquiring of compensating movement patterns (Winders, 1999:3). Examples of compensating movement patterns are the extreme rotation of the hips when walking, flat feet, bad posture and lordosis (Winders, 1999:3). There are other factors that can also influence the acquisition process of the motor skills, namely short attention span and problematic motor planning during the execution of a skill (Alton, 1997:2). In order to lead a normal life a child with Down's syndrome should be exposed to relative normal activities (Alton, 1997:2). Sufficient motor skills development must take place, as in the case of a normal child (Jobling, 1998:284). However, participation in physical activities and some sports may cause injuries because of the increased flexibility of joints. Atlantoaxial instability, which is also a characteristic of Down's syndrome, is a major factor when choosing the right sport as this instability will put the spinal cord at risk (Krebs, 2000:119).

Fetal Alcohol Syndrome (FAS) is another form of mental retardation. According to Surburg (2000:248) it is the most prevalent known cause of mental retardation. FAS is recognised as a combination of problems present in a child that are provoked when a mother takes alcohol during pregnancy. Martini (1998:1120) defines FAS as a neonatal condition resulting from maternal alcohol consumption, characterised by developmental defects typically involving the skeletal, nervous and cardiovascular system. These problems include cognitive deficits, fetal growth retardation, learning difficulties and behaviour problems (Barlow & Durand, 1999:345). FAS is marked by characteristic facial abnormalities, a small head, slow growth and mental retardation (Martini, 1998:949). Children, prenatally exposed to alcohol, are affected in two ways.

Firstly there is an increased incidence of neurological impairment, causing chemical dependency, congenital aberrations, neurobehavioural abnormalities and intra-uterine growth retardation (Surburg, 2000:248). Secondly, the family and social environment of these children are in disarray most of the time; therefore their social structure is precarious (Surburg, 2000:249). In the early school years the effects of in utero exposure

to alcohol are gross motor deficit, fine motor deficit, attention deficit disorder, hyperactivity, delay in spoken language, difficulty with verbal comprehension, poor impulse control, poor visual motor memory, difficulty with social skills and aggresive behaviour (Auxter *et al.*, 2001:322). More than 80 percent of all children with FAS have pre- and postnatal growth deficiencies, microcephaly, saddle shape nose and a gap between the two front teeth (Auxter *et al.*, 2001:436).

The question that will be adressed in this study is whether a water intervention programme will improve the motor proficiency levels of both children with Down's syndrome and those with FAS. Answers to this question can be of great significance to teachers and institutions that deal with these children. Furthermore, this study can contribute to literature on the motor development of children with Down's syndrome and Fetal Alcohol Syndrome and the effect of water activity programmes on the motor proficiency levels.

1.2 AIM OF THE STUDY

The aim of this study was :

- To determine whether an eight week water activity intervention programme could improve the motor proficiency levels of children with Down's Syndrome.
- To determine whether an eight week water activity intervention programme could improve the motor proficiency levels of children with FAS.

1.3 HYPOTHESES

This study was based on the following hypotheses:

- The motor proficiency levels of children with Down's Syndrome will improve after having participated in an eight week water activity intervention programme.
- The motor proficiency levels of children with FAS will improve after having participated in an eight week water activity intervention programme.

1.4 STRUCTURE OF DISSERTATION

The dissertation is presented according to the article model. Each article is submitted for publication in an accredited scientific journal. This type of dissertation differs from the standard dissertation in the following ways:

1.4.1 The problem statement, purpose and hypotheses of the study are presented in Chapter 1. The text references as well as the references at the end of this chapter are according to the guidelines of the PU for CHE (Harvard-method).

1.4.2 In Chapter 2, an overview of the literature regarding mental retardation, Down' syndrome and Fetal Alcohol Syndrome are discussed. The text references as well as the references at the end of this chapter are according to the guidelines of the PU for CHE (Harvard-method).

1.4.3 Chapter 3 and 4 are presented in article format and consist of an explanation of methodology used, as well as the discussion of results. The text references, as well as the references at the end of these chapters, are according to the spesifications of the journal, *Pediatric Exercise Science (PES)*. The spesifications of this Journal are included in Appendix C. The MABC-test is copyright protected and therefore not included in the appendix.

1.4.4 Chapter 5 gives a summary, conclusion and recommendations for further research.

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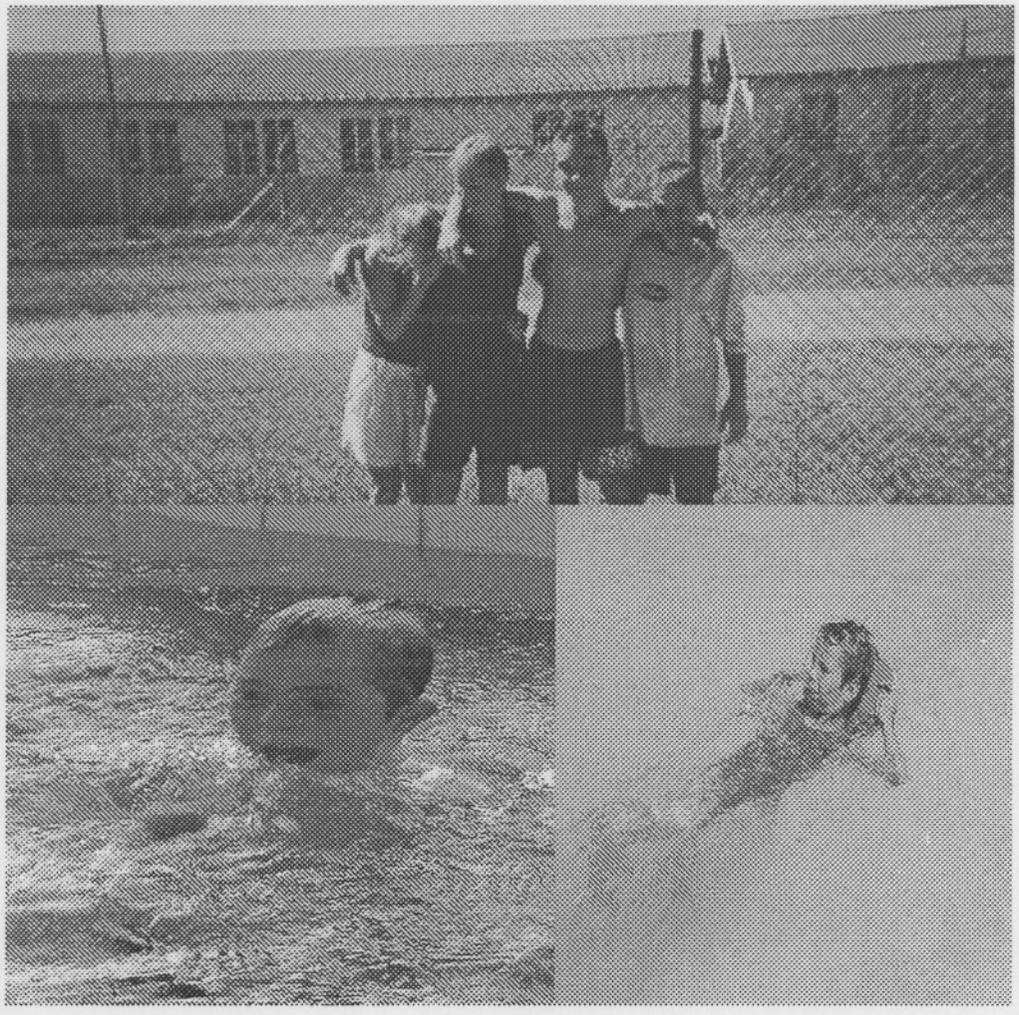
CHAPTER 2

A LITERATURE OVERVIEW ON DOWN'S SYNDROME AND FETAL ALCOHOL SYNDROME



Chapter 2

A literature overview of Down's syndrome and Fetal Alcohol Syndrome

2.1 INTRODUCTION

Down's syndrome and Fetal Alcohol Syndrome are just two of the many subtypes of mental retardation. Mental retardation is a heterogeneous group of disorders with countless causes (Krebs, 2000:112). It is characterised by cognitive and functional limitations in everyday skills, for example social skills, communication skills and motor skills (Krebs, 2000:112) and can be classified in behavioural, etiological and educational systems (Krebs, 2000:113). Barlow and Durand (1999:7) defined mental retardation as a significant below-average intellectual functioning combined with deficits in adaptive functioning such as self-care or occupational activities, observed prior to the age of 18 years.

There are more than 500 disorders in which mental retardation may occour as a spesific manifesation (Krebs, 2000:113). These disorders are categorised according to the phase, in the gestational period, in which they manifest prenatally or postnatally (Krebs, 2000:113). According to Fernhall (2003:304) there are numerous potential causes of mental retardation, namely maternal and genetic disorders, infectious diseases and birth trauma. Other factors like malnutrition, drug use, poverty, Fetal Alcohol Syndrome as well as stimulus deprivation, can contribute to mental retardation (Fernhall, 2003:304). According to Fernhall (2003:304) mental retardation has an estimated prevalence of 3% in Western society and is divided into 4 groups, and levels of support are determined according to these different divisions, namely:

- Intermitted: Short-term support is required during lifespan transition.
- Limited: Support on a regular basis for a short period of time.
- Extensive: Ongoing support with regular involvement.
- Pervasive**:** Constant and highly intense; potentially life sustaining support.

According to Louw and Edwards (1998:327) a person whose IQ-score is below 70 is usually classified as mentally retarded. However, Louw and Edwards (1998:328) also state that IQ-score can't be used as the only criterium to define mental retardation. Other

factors, for instance, are social compatibility, educationability and whether they are careerwise, must be taken in account before a classification can be made (Louw & Edwards, 1998:328). Mental retardation plays a momentous role in a child's physical fitness and cognitive abilities (Yilmaz *et al.*, 2002:A-108).

The focus of this study will be on Down's syndrome and Fetal Alcohol Syndrome as subtypes of mental retardation. The first part of the literature overview will focus on Down's syndrome and the second part on Fetal Alcohol Syndrome.

2. 2 DOWN'S SYNDROME.

The term Down's syndrome is named after J.L.H Down (1828-1860) who first acknowledged the syndrome, giving it a scientific definition and named it "Mongolism" which was later substituted with the term Down's syndrome (Selikowitz, 1990:24). Down's syndrome is one of the most recognizable chromosomal abnormalities which causes mental retardation (Krebs, 2000:118) and is caused by the presence of an extra chromosome in the human body (Louw *et al.*, 1998:115).

2.2.1 Definition

Barlow and Durand (1999:G-7) define Down's syndrome as a type of mental retardation caused by a chromosomal aberration and involves specific characteristics in physical appearance. Down's syndrome is defined as a condition caused by an extra chromosome in the 21st pair of chromosomes, which means that the zygote has 47 instead of the normal 46 chromosomes (Gabbard, 2000:128). Each cell has two parts – the nucleus and the cytoplasm (Cunningham, 1997:71). The nucleus is the control centre of the cell. Chromosomes can be found in the nucleus and look like tiny threads that consist of DNA and protein (Cunningham, 1997:71). Genes are small units and are encoded in the DNA. A normal human body has 46 chromosomes which are divided in 23 pairs. When meiosis occurs the pairs are divided and move to different parts of the cell (Selikowitz, 1990:33-34). It can thus be stated that Down's syndrome is a chromosomal abnormality which concludes spesific characteristics in the individual.

Down's syndrome can be categorized in three groups, namely Trisomy 21, Translocation and Mosaic (Selikowitz, 1990:37). Trisomy 21 occurs when one pair doesn't divide and moves to the other part of the cell as one unit. This means that part of the cell has 24 chromosomes and the other has 22. There are now three of the 21st chromosome instead of two (Leshin, 1997a). Ninety-five percent of all Down's syndrome cases can be classified as Trisomy 21 (Leshin, 1997a) and 3-4% of all cases are due to Robertsonian Translocation where two breaks occur in seperate chromosomes, usually in the 14th and 21st chromosomes (Leshin, 1997a). The remaining cases are due to mosaicism. Where a mixture of cell lines can be found, some of them may have Trisomy 21 and others a normal set of chromosomes (Leshin, 1997b).

Down's syndrome is mainly transferred or inherited from the father, but the occurrence can be increased by 25% if the mother is over 25 years (Krebs, 2000:118). Other factors that play a role in the occurrence of Down's syndrome is natural selection (Smith & Berg, 1976:9) and environmental factors (Mikkelsen, 1977:129).

2.2.2 Characteristics typical to Down's syndrome

2.2.2.1 Physical and physiological characteristics

There are some apparent characteristics typical to Down's syndrome, namely a flattened face, coarse straight hair and a rough tongue (Elliot *et al.*, 1992:345). Other physical characteristics are hypermobility of the joints, moderate obesity, short legs and arms in comparison to the torso, short neck and small ears, poor balance, poor muscle tone, poor visual and auditive capabilities, a small head, a small mouth and thin small lips, a small nose and a flattened nose bridge, prominent folds on the handpalms, an underdeveloped respiratoric and cardiovascular system and white dots in the iris of the eye (Krebs, 2000: 119). There is limited room for the tongue, because of the small-mouth, which means that the tongue will protrude because the tongue and jaw muscles are weak and underdeveloped (Clark, 2000:3).

Eye infections in some cases with Down's syndrome are very common because of the absence of antiseptic enzyme-lizone in their tears (Cunningham, 1997:103). Their

eyeslits are narrow and short and they have high cheek bones (Cunningham, 1997:103). The roof of the mouth is flat with a high arch in the middle (Cunningham, 1997:103). In the young baby the neck appears very short with loose skin at the back and sides. The baby's reflexes tend to be weaker and the baby's cry is weaker, being shorter in lenght and in pitch (Cunningham, 1997:103).

They cry very little, even when they are uncomfortable or hungry (Cunningham, 1997: 103). The absence or poor development of the air sinuses contribute to difficulty in breathing and restless sleeping, because they breath through the mouth (Cunningham, 1997:109). Their tonsils and adenoids can be relatively large, which means that breathing can be difficult (Cunningham, 1997:109). The ear chambers and channels are small, because of the small skull (Cunningham, 1997:110). The skin appears to have less elasticity and tends to be dry and rough in places, including the scalp (Cunningham, 1997:118).

2.2.2.2 Motor development

There are four factors that play an important role in the entire motor development of the child with Down's syndrome, namely muscle hipotonia, ligament laxity (joint hyper-mobility), unsatisfactory strenght and short limbs (Winders, 1999:3). Nilholm (1996:52) states that early intervention is very important. A child with Down's syndrome should receive regular physical therapy or alternative movement therapy in order to promote motor development and to prevent the acquiring of compensating movement patterns (Winders, 1999:3). Examples of compensating movement patterns are the extreme rotation of the hips when walking, flat feet, bad posture and lordosis (Winders, 1999:3). The participating in physical activities and some sports may cause injuries, because of increased flexibility of the joints. Atlantoaxial instability is a major factor when choosing the right sport because this instability will put the spinal cord at risk (Krebs, 2000:119).

According to Almeida *et al.*, (2000:162) people with Down's syndrome have slower reaction time and higher incidence of muscle co-activation. Down's syndrome exhibits a widespread neuro-pathological change such as dedritic pruning, apoptotic death of

cortical neurons and abnormal development of the cortex (Miller, 2002:275). Persons with Down's syndrome commonly develop Alzheimer-like symptoms and neuropathological changes in their fourth decade of life (Miller, 2002:276).

Sayers *et al.*, (1996:247) state that infants with Down's syndrome have delayed acquisition of motor skills, reduced brain weight, delayed primitive reflexes, delayed postural reactions, heart and respiratory problems, obesity, hypertonia and joint laxity. Neuro-motor delays, hypotonia, low energy levels, primitive reflexes, low energy levels and congenital heart disease are prominent characteristics of Down's syndrome (Sayers *et al.*, 1996:248). There are other factors that can influence the acquiring process of the motor skills, namely short attention span and problematic motor planning during the execution of a skill (Alton, 1997:2). Ebernhard *et al.*, (1989:167) state that people with Down's syndrome are ussually characterised by apathy towards physical exercise. In order to lead a normal life a child with Down's syndrome should be exposed to relatively normal activities (Alton, 1997:2). Sufficient motor skills development must take place, as in the case of a normal child (Jobling, 1998:284).

According to Braun (1997:1) the development of skilled movement is a fundamental component of a normal child's growth and maturation, but the child with Down's syndrome cannot accomplish, much less master, many of the elementary movements required of him or her. This apparent inability to fully control the movements makes coping with even the simplest of daily tasks awkward, and hinder participation in playground games. Futhermore, problems in gaining control of motor skills interfere with the children's ability to interact effectively with their physical and social enviroment (Braun, 1997:1). Over the past few years, educationalists, therapists and medical professionals have been studying the causes and effects of problems with motor proficiency on the physical, educational, social, psychological, and behavioural dimention of children's lives. Recently the emphasis has been shifting from identification and assesment of motor problems to providing adequate motor coordination and control (Henderson & Hall, 1982:450, Hulme & Lord, 1986:258).

The American Psychiatry Association (APA, 1994) and the World Health Organisation recognised the concept of a separate group of developmental movement skills disorders that did not appear to be associated with pathologies such as cerebral palsy etcetera, yet were sufficiently disruptive to a child's coordination to require diagnostic, etiological and remedial attention (Braun, 1997:2). Developmental Coordination Disorder (DCD) was adopted as a term to decribe what is currently considered to be a collection of developmental disorders that impact upon the performance of movement skills. DCD is thus an identification of motor coordination problems. The motor problems the child experiences interfere with his/her daily activities and academic achievements (APA, 1994). Emotional problems and low-selfesteem have also been associated with DCD (Braun, 1997:17).

Certain variables in motor performance have been identified to be associated with DCD. Variables that can be affected are: visual processing, kinaesthesis, motor programming and processing, timing and force control, physical attributes and social and environmental influences (Braun, 1997:22-28). By determining which variables are affected, possible areas for special emphasis in remedial programmes could be isolated.

Children with Down's syndrome have deficits in more than three of the above mentioned subtypes of DCD. One of the general indications of DCD is how the child attempts the movement and not being able to perform the movement adequately (Braun, 1997:31). According to Dewey and Wilson (2001:5) DCD can be described under various labels, namely: cerebral palsy, brain dysfunction, developmental dyspraxia, mild motor problems, clumsy child syndrome and sensory integrative dysfunction.

One of the most frequently used test batteries to determine the levels of DCD, is the Movement Assessment Battery for Children (MABC). Sheila Henderson and David Sugden designed the MABC as a culmination of 30 years of research in the field of early childhood development, to address the problem of accurately assessing and identifying children with motor difficulties (Henderson & Sugden, 1992:9).

2.2.2.3 Cognitive characteristics

Cognitive as well as functional limitations in everyday life and social skills is a distinguishing characteristic of the child with Down's syndrome (Krebs, 2000:118). Speech therapy is usually needed to correct pronunciation (Buckley, 1993:1). Their vocabulary is also very limited, which makes communication very difficult (Buckley, 1993:1). According to Cunningham (1997:168), learning difficulty and slow development is common for people with Down's syndrome. Gabbard (2000:437) states that children with Down's syndrome are less capable of making decisions and experience difficulty in goal-directed planning, which relates to their motor control (Gabbard, 2000:437). Reading is difficult because of various eye problems (Mon-Williams *et al.*, 2000:101) and their cognitive development is greatly impaired (Pitcairn & Wishart, 2002:124).

2.2.2.4 Affective characteristics

Psychological disorders like depression, eating disorders, sleep disorders, aggression and moodswings frequently occur (Pary *et al.*, 1996:148). They are pleasant, gentle, outwardgoing and affectionate and also mischievous, sullen and stubborn (Cunningham, 1997:142). According to Cunningham (1997:145) personality traits and changes can be associated with diet, drug treatment and illness. Futhermore Cunningham (1997:145) states that, because of continuing failure, they have a low self-esteem, they are inactive and they turn their frustrations on themselves and others.

The Down's syndrome baby is quiet and unlikely to be difficult (Cunningham, 1997:146) . The 3-4 month baby is alert, active and responsive just like a normal baby (Cunningham, 1997:146). A young child with Down's syndrome is less emotional, less aggressive, less bossy, less moody, more likeable and affectionate and outgoing (Cunningham, 1997:147). The older child and adult with Down's syndrome is pleasant, outgoing, active, affectionate and sociable with a sense of humor (Cunningham, 1997:158).

2.2.2.5 Social behavioural characteristics

According to Pitcairn and Wishart (2002:126), the social development of children with Down's syndrome seem to be somehow relatively intact. It is seen that to some degree their social behaviour compensate for the child's other weaknesses in other areas of development and they seem to be inherently sociable for children whose social understanding exceeds their cognitive ability (Pitcairn & Wishart, 2000:126). People with Down's syndrome possess the power of imitation (Cunningham, 1997:142). According to Pitcairn and Wishart (2000:126) they must, as any normal child, be seen and treated as individuals.

As mentioned, children with Down's syndrome are outgoing with a tremendous sense of humor (Cunningham, 1997:145). According to Fernhall (2003:104) people with Down's syndrome can be occasionally stubborn. Recent research, using discrete unimanual tasks, indicated that individuals with Down's syndome experience more difficulty performing verbal-motor tasks as compared to visual-motor tasks (Robertson *et al.*, 2002:213).

2.2.3 Incidence of Down's syndrome

According to Cunningham (1997:91) the number of Down's syndrome births per total number of live births depends on the mother's age. He stated that if a mother is under the age of 20 the probability is less than 1 in 2000 live births, 20-30 years is less than 1 to 1500, 30-34 years between 1 in 750 to 880, 35-40 years about 1 in 280-290, 40-44 years about 1 in 130 to 150 and in the case of a mother over the age of 45 years the probability is 1 in 20 to 65 live births.

Cunningham (1997:48) states that the estimated number of incidence with Down's syndrome varies between 1 in 500 and 1 in over 900 births. According to Krebs (2000:118) 1 in 700 children is born with Down's syndrome. Barlow and Durand (1999:461) stated the number of incidence is on the rise and the reasons are not clearly understood. Chiarenza and Stagi (2000:322) reported 1.6 per 1000 live births. Louw and Edwards (1998:108) state that 90% of these cases are contributed to Trisomy 21, and the

remainder are because of addisional chromosomal material present in other chromosome pairs.

2.2.4 Controversial therapies available

Selikowitz (1990:181) describes some of the controversial treatment programmes, for example cell therapy, which involves injecting dried brain cells of lamb and calf fetuses into children with Down's syndrome. Plastic surgery can be used to change the appearance of these children (Selikowitz,1990:182). Sensory integration therapy, massive vitamin and mineral therapy, allergy and gluten-free diets, the Feingold diet, the Doman-Delacato method, developmental optometry, chiropractic and medicine are used (Selikowitz, 1990:182-186).

2.2.5 Summary

As mentioned, Down's syndrome is one of the most recognizable chromosomal abnormalities which causes mental retardation (Krebs, 2000:118). Some physical characteristics are, hypermobility of the joints, moderate obesity, short legs and arms in comparisson to the torso, short neck and small ears, poor balance, poor muscle tone, poor visual and auditive capabilities, a small head, a small mouth and thin small lips, a small nose and a flattened nose bridge, prominent folds on the handpalms, an underdeveloped respiratoric and cardiovascular system and white dots in the iris of the eye (Krebs, 2000: 118). Children with Down's syndrome have many physiological drawbacks that can inhibit them to live and function in a normal society. It is clear that their motor functioning is under developed and their motor milestone development is much slower than that of a normal child.

Four factors that play a major role in their motor development are muscle hipotonia, ligament laxity (joint hyper mobility), unsatisfactory strenght and short limbs. It is also of great importance that special therapies are needed to bridge this gap, and early intervention is greatly stressed. Through physical activities and encouragement the process to better functioning can be speeded up. Psychological disorders include depression, eating disorders, sleep disorders, aggression, and moodswings frequently

occur (Pary *et al.*, 1996:148). Children with Down's syndrome are inherently sociable for children whose social understanding exceeds their cognitive ability.

2.2. FETAL ALCOHOL SYNDROME

Since 1968 the teratogenic effects of alcohol on the developing fetus have been recognized (O'Malley *et al.*, 2002:350). In 1973 Jones and Smith named this effect Fetal Alcohol Syndrome (O'Malley *et al.*,2002:350). Fetal Alcohol Syndrome (FAS), Fetal Alcohol Effect (FAE) and alcohol-related neurodevelopment disorder are part of Fetal Alcohol Spectrum Disorder (FASD) (O'Malley *et al.*, 2002:350). They are chronic neuro-developmental and neuropsychiatric conditions (O'Malley *et al.*, 2002:350).

Fetal Alcohol Syndrome was first identified amongst babies born of heavily drinking pregnant mothers (Gabbard, 2000:130). The question arose how much is too much? Louw *et al.*, (1998:138) stated that the boundaries of the amount of alcohol usage while being pregnant can't be definitely defined. Futhermore, they stated that 2-4 sips of alcohol daily can increase the risk of Fetal Alcohol Syndrome by 11% and 10 sips of alcohol and more increase the risk by 100% (Louw *et al.*, 1998:138).

2.3.1 Definition and description

According to Surburg (2000:112) Fetal Alochol Syndrome is referred to when a combination of mental and physical defects occurs because of a mother that ingested excessive amounts of alcohol during pregnancy. Fetal Alcohol Effect describes a child who has been exposed to alcohol in utero but doesn't manifest all the symptoms of a individual with Fetal Alcohol Syndrome (Surburg, 2000:112). According to Barlow and Durand (1999:7) Fetal Alcohol Syndrome are patterns of problems that include behavioral deficits, learning difficulties and characteristic physical abnormalities resulting from alcohol misusage by a mother during pregnancy. According to Streissguth *et al.* (2002:28) Fetal Alcohol Syndrome is diagnosed by three primary characteristics: CNS disfunctioning, characteristic pattern of abnormality, especially in the face, and growth deficiency. Gabbard (2000:130) defined Fetal Alcohol Syndrome as a condition some infants suffer from when exposed to alcohol during the prenatal period.

Fetal Alcohol Syndrome is defined by Martini (1998:1120) as a neonatal condition resulting from maternal alcohol consumption, characterized by developmental defects typically involving the skeletal, nervous and cardiovascular system. According to Auxter *et al.*, (2001:690) Fetal Alcohol Syndrome can be defined as an extreme case of mental retardation because of impaired brain development as a result of maternal use of alcohol during pregnancy. Fetal Alcohol Syndrome is the most prevalent known cause of mental retardation according to Surburg (2000:112). Fetal Alcohol Syndrome may be viewed as a repercussion of the internal physiological enviroment of the developing fetus (Caleekal, 2001). According to Caleekal (2001) Fetal Alcohol Syndrome is at the extreme end of the continuum of alcohol effects on the fetus, with persistent maternal alcohol use during pregnancy contributing to the full-blown syndrome.

Children, prenatally exposed to alcohol, are affected in two ways. Firstly, there is an increased incidence of neurological impairment, causing chemical dependency, congenital aberrations, neurobehavioural abnormalities and intra-uterine growth retardation (Surburg, 2000:112). Secondly, these children's social environment and family situation are mostly chaotic; therefore their social structure is precarious (Surburg, 2000:112).

2.3.2 Characteristics of Fetal Alcohol Syndrome

2.3.2.1 Physical characteristics

Fetal Alcohol Syndrome is marked by characteristic facial abnormalities, a small head, slow growth and mental retardation (Martini, 1998:949). More than 80 percent of all children with Fetal Alcohol Syndrome have pre- and postnatal growth deficiencies, microcephaly, a saddle shape nose and a gap between the two front teeth (Auxter *et al.*, 2001:436). Barlow and Durand (1999:345) state that the problem includes fetal growth retardation, small eye openings and a small midface.

According to Streissguth *et al.*, (2002:28) their weight and height are below the tenth percentile of normal growth. Cardiac, renal or skeletal problems are likely to be present

(O'Malley *et al.*, 2002:353). According to O'Malley *et al.* (2002:353) alcohol-related birth defects include congenital anomalies, including malformation and sysplasias of the cardiac, skeletal, renal, ocular and auditory systems. This includes atrial septal and ventricular septal defects, aberrant great vessels and tetralogy of Fallot, present in the cardiac (O'Malley *et al.*, 2002:353).

Defects in the skeletal system include hypoplastic nails, shortened fifth digit, radioulnar syntosis, flexion contractures, camptodactyly, pectus excavatum and carinatum, Klippel-Fell syndrome, hemivertebrae and scoliosis (O'Malley *et al.*, 2002:353). Defects in the renal system that can occur is aplastic, dysplastic, hypoplastic kidneys, horseshoe kidneys, ureteral duplication and hydronephrosis (O'Malley *et al.*, 2002:353). Defects in the ocular area that can occur include strabismus and refractive problems secondary to small globes and defects involving the auditory system leading to conductive hearing loss and neurosensory hearing loss (O'Malley *et al.*, 2002:353).

Caleekal (2001) states that children with Fetal Alcohol Syndrome also sustain central nervous system damage such as permanent and irreversible brain damage, learning difficulty and behavioural disorders, deficits in memory and attention, hyperactivity, speech and language delays, and poor coordination. Louw *et al.*, (1998:138) stated the following defects are associated with Fetal Alcohol Syndrome, namely mental retardation, cardial deficits, Attention Deficit Disorder and a below average length, weight and skull largeness.

2.3.2.2 Motor development

According to Gabbard (2000:130) children with Fetal Alcohol Syndrome showed deficiencies in balance and fine motor control. It was noted that alcohol exposure is associated with weak grasp and poor motor coordination (Gabbard, 2000:131). Jones (1977:158) states that 50%, or more, of children with Fetal Alcohol Syndrome have prenatal onset growth deficiency, postnatal growth deficiency and fine motor dysfunction. One can thus conclude that children with Fetal Alcohol Syndrome have a backlog in their general motor development, and spesific problems regarding gross motor

coordination and fine motor skills. Children with Fetal Alcohol Syndrome will probably show signs of DCD, a collection of developmental disorders that impact on the performance of motor skills.

2.3.2.3 Cognitive characteristics

Children with Fetal Alcohol Syndrome also experience cognitive deficits, fetal growth retardation, learning difficulties and behaviour problems (Barlow & Durand, 1999:345). The effects of in-utero exposure to alcohol, in the early school years, are gross motor deficits, fine motor deficits, attention deficit disorder, hyperactivity, poor impulse control and poor visual and motor memory (Auxter *et al.*, 2001:322). ADHD have been associated with individuals with Fetal Alcohol Syndrome (Surburg, 2000:249), which means that they often fail to finish what they have started, are easily distracted, have difficulty concentrating and organising work, need motivation to finish a task, have motor restlessness and find it difficult to follow routines and wait turns (Braun, 1997:29-30). Individuals with Fetal Alcohol Syndrome have working memory problems and frequently a mathematics disorder (O'Malley *et al.*, 2002:350). Primary dissabilities refer to the brain damage that results in impaired mental function of persons with Fetal Alcohol Syndrome (Streissguth *et al.*, 1996). Primary disabilities are measured by general intelligence, mastery of reading, spelling, maths and a level of adaptive functioning, representing the CNS manifestation of Fetal Alcohol Syndrome (Streissguth *et al.*, 1996:)

In a study on 178 people with Fetal Alcohol Syndrome, between the age of 3 to 51 years, Streissguth *et al.*, (2002:33) state that the average IQ score of these individuals was 79, the average reading, spelling and arithmetic standard scores were 78, 75 and 70 and an average Adaptive Behaviour score of 61. According to Surburg (2000:112) their academic functioning is usually equivalent to a fourth grader, and maladaptive behaviour such as distractability and poor judgement, is evident.

2.3.2.4 Affective characteristics

Individuals with Fetal Alcohol Syndrome often have anxiety attacks and mood, conduct or explosive disorders (O'Malley *et al.*, 2002:349). Prenatal alcohol exposure disrups the neurochemical and structural environment of the brain on the developing fetus (O'Malley *et al.*, 2002:350). According to Streissguth *et al.*, (2002:34) people with Fetal Alcohol Syndrome often show signs of mental health problems. Several studies showed that children with Fetal Alcohol Syndrome have an increased risk for cognitive disorders, psychiatric illness or psychological dysfunction. Other psychiatric problems such as depression, psychotic episodes, anxiety disorders, eating disorders and post traumatic stress disorder, have been reported (Streissguth *et al.*, 1996:)

Affected infants have difficulty with state and mood regulations as well as irritability, hypersensitivity and hyperactivity (O'Malley *et al.*, 2002:350). Infants exposed to prenatal alcohol can also present primary regulatory disorder (O'Malley *et al.*, 2002: 350). They have difficulty to settle or slow-to-warm temperament, followed by on early onset of ADHD (O'Malley *et al.*, 2002:350).

2.3.2.5 Social behavioral characteristics

Auxter *et al.*, (2001:322) state that children with Fetal Alcohol Syndrome have difficulty with social skills and tend to be aggressive and that there is a delay in the spoken language as well as a difficulty with verbal comprehension. This means that they may find it difficult to express themselves and to communicate with others. Individuals with Fetal Alcohol Syndrome have mixed receptive-expressive language disorder with a deficit in social cognition and communication (O' Malley *et al.*, 2002:349). According to Surburg (2000:248) individuals with Fetal Alcohol Syndrome may have a problem perceiving social cues. According to Sterling *et al.*, (2000:1) if a child is of school age or older, secondary disabilities may occur because of frustration, failures and lack of acceptance by peers and adults. Futhermore, the full extent of the child's disability has not yet been recognized (Sterling *et al.*, 2000:1).

Sterling *et al.*, (2000:1) is of opinion that parents and teachers must realise that the child "can't" rather than "won't" behave in an acceptable manner. Children with Fetal Alcohol Syndrome may have difficulty in activities and sports that require teams (Burgess & Streissguth, 1990:2) and display a number of inappropriate or challenging behaviours (Streissguth *et al.*, 2002:34). According to Dyer *et al.*, (2002:52) children with Fetal Alcohol Syndrome may display high levels of sociability, out of context conversation and poor social judgement.

Parents and teachers reported problems like stealing, lying and inappropriate social interaction (Burgess & Streissguth, 1990:2). Children with Fetal Alcohol Syndrome are more prone to be aggressive and show delinquent behaviour (Sood *et al.*, 2001:34). According to Root (2001:34) teaching social skills to children with Fetal Alcohol Syndrome and the interrelationship between social skills and academic improvement, is highly important.

Ackerman (1998) stresses that educators should be urged to teach children with Fetal Alcohol Syndrome skills to survive and function in the real world and to manage inappropriate behaviour. Techniques for teaching social skills include: improving the skill of compliance by setting reasonable expectations, establishing clear expectations using visual and other cues, expressing expectations in positive terms, reducing competition, reducing opportunities for impulsive behaviour, preparing alternative tasks, limiting the number of choices, allowing talking time, changing rewards frequently, improving the skill of emotional or impulse control by teaching relaxation techniques, teaching anger management and teaching and improving self-esteem (Root, 2001:34).

According to Streissguth *et al.*, (2002:27) secondary conditions are problems that the child are not born with, but might be acquired as result of Fetal Alcohol Syndrome and can be improved by a better understanding and the right intervention. The following are some of the secondary conditions that have been found to be associated with Fetal Alcohol Syndrome, namely mental health problems, disrupted school experience, trouble with the law, inappropriate sexual behaviour, alcohol and drug problems, dependant

living, problems with employment and problems with parenting (Streissguth *et al.*, 2002:28).

Streissguth *et al.*, (2002:34) state that children with Fetal Alcohol Syndrome are more likely to be expelled, suspended or drop out of school. They have difficulty to get along with other children and have poor relationships with teachers and truancy are some of the reasons that lead to their removal from school (Streissguth *et al.*, 2002:34) because of their difficulty to control anger and frustration (Streissguth *et al.*, 2002:34). People with Fetal Alcohol Syndrome are very easy to persuade and manipulate, which can lead to their taking part in illegal acts without being aware of it. Secondary disabilities can be prevented or lessened by better understanding and appropriate intervention (Streissguth *et al.*, 2002:34)

2.3.3 Incidence of Fetal Alcohol Syndrome

According to Dyer *et al.*, (2002:35) Fetal Alcohol Syndrome is the leading cause of mental retardation in the United States. The incidence of Fetal Alcohol Syndrome is nearly twice that of Down's syndrome and nearly five times of spina bifida (Dyer *et al.*, 2002:35). According to the Department of Health (APA, 2001) the three "at risk" areas for Fetal Alcohol Syndrome in Gauteng of school-entry incidence were determined, namely: 22 in 1000 children in Soweto, 12 in 1000 in Lenasia South and 37 in 1000 in Westbury. One of 15 children suffers from Fetal Alcohol Syndrome in the Winelands of South Africa. That is 52 times more than that of the United States of America (Glasser, 2002:26). The incidence of Fetal Alcohol Syndrome in the poor communities of Johannesburgh is almost 1 per 55 births (Glasser, 2002:26). O'Malley *et al.* (2000:349) state that Fetal Alcohol Spectrum Disorder has a prevalence of 1 per 100 people. In France, Sweden and North America the prevalence of Fetal Alcohol Syndrome is 1 in 750 live births per year (O'Malley *et al.*, 2000:349).

According to Calleekal (2001) for every Case of Fetal Alcohol Syndrome there are several other cases affected by alcohol exposure. Fetal Alcohol Effect is 3 to 10 times more common than Fetal Alcohol Syndrome (Calleekal, 2001). Futhermore Calleekal

(2001) states that among alcoholic women the prevalence of Fetal Alcohol Syndrome is 21 to 29 per 1000 births.

2.3.4 Summary

Fetal Alcohol Effect describes a child who has been exposed to alcohol in utero but does not manifest all the symptoms of an individual with Fetal Alcohol Syndrome (Surburg, 2000:112). Alcohol has an irreversible effect on the unborn fetus; therefore the effect alcohol has on the fetus can only be altered and improved, but not cured. It is clear that ignorance of the alcohol effect is the primary cause in this syndrome and it is stressed that pregnant women should be educated in this matter. Special behavioural altering activities and behavioural management theraphy is needed to help the child and the parent to cope with this syndrome.

It is extremely important for the child to function in a normal and healthy society. More than 80 percent of Children with Fetal Alcohol Syndrome have the same physical characteristics, namely a small head, microcephaly, saddle shape nose and a gap between the two front teeth. Most of them often have anxiety attacks and mood-, conduct- or explosive disorders. They often have problems with comprehension of spoken language. They tend to have problems with social skills and can be aggresive at times. Early intervention is of great importance and can't be stressed enough.

2.4 PARTICIPATION IN PHYSICAL ACTIVITIES AND THE MENTALLY RETARDED

Cremers and Bol (1993:511-514) did a classification on different sports suitable for children with mental retardation. The following sports were classified as high risk sports, namely wrestling, gymnastics, trampoline jumping and horse riding. Low risk sports are swimming, athletics, rowing and cycling. Due to the fact that a lot of children with Down's syndrome are accommodated in different institutions, they do participate in athletics, but swimming, rowing and cycling do not get a lot of attention, as it requires attentiveness from the trainer. Exercising people with mental retardation can be

challenging because they find it difficult to comprehend the task specification (Fernhall, 2003:205).

The lack of motivation, ADD and disabilities can make the process more difficult (Fernhall, 2003:205). Draheim *et al.*, (2003:118) stated that the effect of physical activity on disease prevention for people with disabilities, is under-investigated and research is greatly needed. Draheim *et al.*, (2003:118) state that active special olimpians possessed lower diastolic blood pressures, body fat percentages, insulin, triglycerides and abdominal fat than inactive special olimpians. The researchers futher states that the benefits of the participation in regular physical activity includes, reduction of obesity level and in cardiovascular disease (Draheim *et al.*, 2003:118).

The reasons for using a water activity program are based upon the fact that water has bee n used as a healing medium, dating back to many centuries (Myburgh, 2000:27). Swimming and aquatic exercises' therapeutic effects on physical fitness and well being have been recognized for people with disabilities (Yilmaz *et al.*, 2002:108). Water activities are also highly beneficial and recommended as a recreational sport activity (Yilmaz *et al.*, 2002:108). Water activity intervention programmes were classified as safe activities by Cremers and Bol (1993:511). Water activities are frequently recommended as a remedial activity for the elderly and disabled people, because of floatation and the density of the water the excuting of movement could be made easier (Peterson, 2001:1049). Exercise in water reduces stress and the impact on the skeletal joints (Routi *et al.*, 1994:140). According to Surburg (2000:113) the key to providing these children with a successful physical educational program is to develop an individualised program. Futhermore, he states that each child must be seen as an individual (Krebs, 2000:119).

For young children with Fetal Alcohol Syndrome an early motor intervention program is of great importance for neuromuscular problems like delayed motor development, delayed postural reflex development, balance problems, coordination difficulties and walking abnormalities to be corrected (Surburg, 2000:113). Surburg (2000:113) states early motor intervention can counter developmental delays. Individuals with Down's

Syndrome require medical clearance because of their many medical problems before activity participation. Careful planning of the program is of great importance (Krebs, 2000:119).

2.5 SUMMARY

Although Down's syndrome and Fetal Alcohol Syndrome are both cases of mental retardation, they are caused by different factors. Down's syndrome is a genetic disorder while Fetal Alcohol Syndrome is induced by a mother that drank alcohol while being pregnant. Although the causes of the different syndromes are not similiar there are some characteristic similarities between them, namely both of the syndromes have distinct facial appearances, cardiac problems, ocular and auditory problems, below average height, IQ and skull largeness and mental health problems like depression. Both of the syndromes shows signs of language difficulty, pronunciation and comprehension and often require speech therapy. Both syndromes show delay in motor development and low levels of motor proficiency (Chun *et al.*, 2000:104).

Delayed milestone development can be associated with children with psycological deflection, but doesn't have a direct link with the development of the fundamental movement skills (Chun *et al.*, 2000:104). It is clear that physical activities can narrow the gap, improve the motor functioning and speed up the motor development . Each child must be seen as an individual with a different potential and temperament. These are special children who need special attention and programming.

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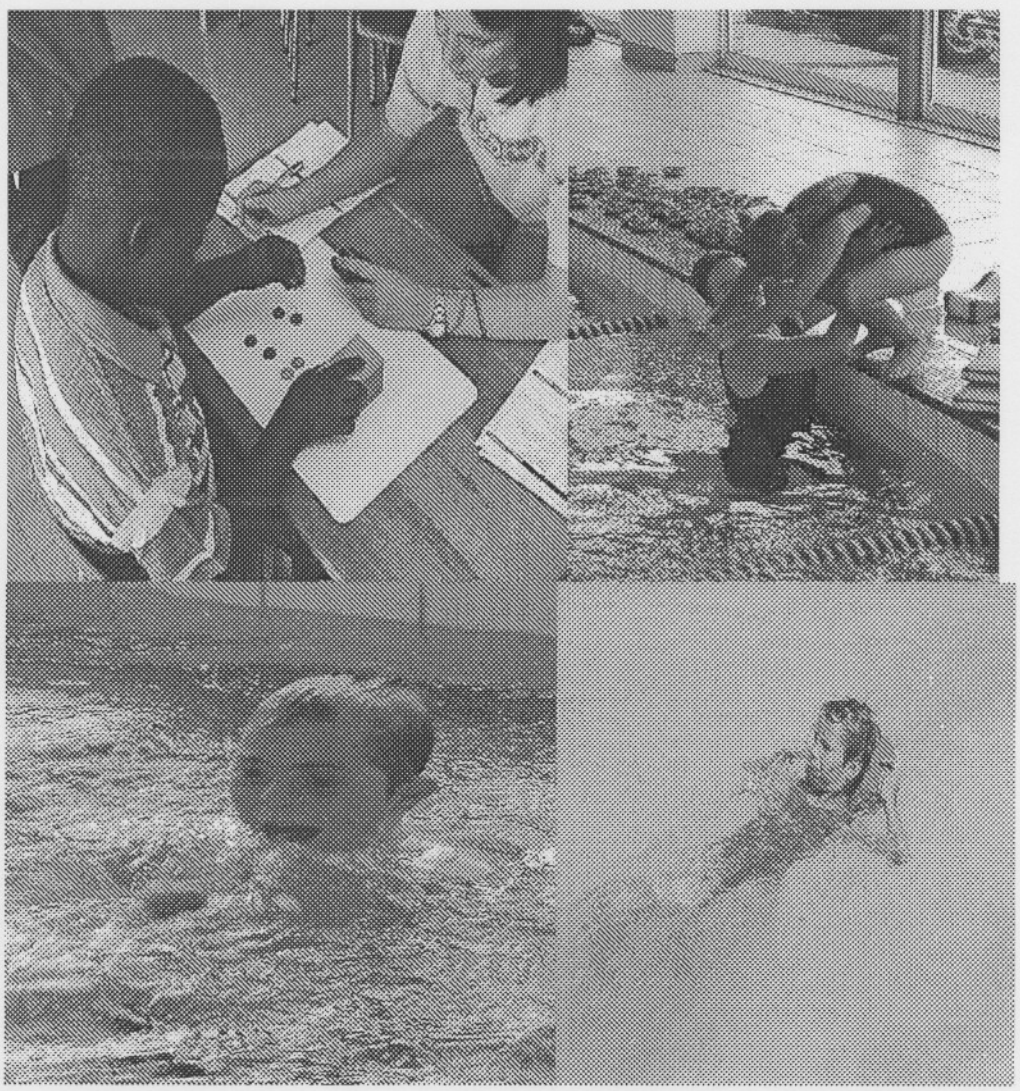
CHAPTER 3

THE EFFECT OF A WATER ACTIVITY INTERVENTION PROGRAMME ON THE MOTOR PROFICIENCY LEVELS OF CHILDREN WITH DOWN'S SYNDROME



Chapter 3

The effect of a water activity intervention programme on the motor proficiency levels of children with Down's syndrome.

Miss Tanya Höll, Tel: (016) 362 1429, Cell: 082 9214 881

Dr Mercia Coetzee, Tel: 018 290 6107 (h), 018 299 1792 (w), 082 825 4031 (cell),

Prof A.E. Pienaar, Tel: (018) 291 1377 (h), 018 299 1796 (w),

School for Biokinetics, Recreation and Sport Science
Potchefstroom University For CHE
Private Bag x2001 Potchefstroom 2531

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The effect of a water activity intervention programme on the motor proficiency levels of children with Down's syndrome.

The aim of this study was to investigate the effect of a specially designed water activity programme on the motor proficiency levels of children with Down's syndrome. Six institutionalized children classified as having Down's syndrome, from a school for the mentally retarded, took part in the study. The children's chronological ages ranged between 4 and 15 years, with a mean age of 11 years. Their mental age classification was that of a 4-6 year old. Pre-, post- and retention testing were conducted with the MABC (level 1, age band 4-6) and 2 items of the Charlop Atwell test. 4 Children were part of the experimental group which took part in the 8-week water activity program, while 2 children formed the control group. All the children were classified with DCD during the pre-test. The experimental group that took part in the water activity intervention program, showed great improvement in their motor proficiency levels, especially with regard to balance and coordination. Improvements were also found in the control group, but to a lesser degree.

3.1 INTRODUCTION AND PROBLEM STATEMENT

Down's syndrome is the most common chromosomal abnormality which leads to mental disability (13). This abnormality is caused by an extra chromosome in the body (9). Down's syndrome is usually transferred from the father, but there is a 25% chance that mothers who are older than 25 will have a child with Down's syndrome (8).

Literature indicates that mentally disabled children do have handicaps as regards motor development (4). According to Chun *et al.*, (4) retarded milestone development can be associated with children with psychic handicaps, but this is not directly related to the development of fundamental movement skills. There are, especially, four factors which play a role in the general motor development of the child with Down's syndrome. They are muscle hypotonia, ligament laxity (joint hypermobiltiy), unsatisfactory strength and short limbs (17). Other factors which may influence the learning of motor skills in children with Down's syndrome are, for example, a brief attention span and problems experienced during the planning of motor actions (1).

According to Nilholm (10) early intervention is essential. In this regard Winders (17) mentions that a child with Down's syndrome must receive regular physiotherapy in order to enhance general motor development and in this manner prevent the learning of movement patterns which compensate for the lack of motor development. Examples of the learning of compensating movement patterns are the extreme rotation of the hips during a walking action, incorrect sitting habits (the stomach is pushed forward and the pelvis is tilted to the rear) and also the incidence of lordosis (17).

In order to lead a normal life the child with Down's syndrome must be exposed to relatively normal activities (1). Thus they should, just as normal children, undergo sufficient motor skills development (7). As a result of the atlanto-axial-instability of the child with Down's syndrome, the participation of the child in physical activities and certain kinds of sport is fraught with the danger of injuries. Krebs (8) states that for this reason, exercises and physical activities which cause hyperflection, should be avoided and that the focus should rather fall on exercises and activities which strengthen the muscles and stabilises the joint circumference. These exercises decrease the stress factor on the body and can prevent dislocation, sprains and other injuries.

Cremers and Bol (5) examined different kinds of sport in which children with Down's syndrome can participate and classified them as either low or high-risk sports. Wrestling, gymnastics, trampoline and equestrian sports are examples of high-risk sport, whereas swimming, athletics, rowing and cycling are classified as low risk activities (5). Aquatic activities are especially recommended because the buoyant density of the water can facilitate movement in the water (11). Exercises done in water also lessen the stress and impact on the joints (12).

The purpose of this study was to determine whether a water activity intervention programme, lasting 8 weeks, could improve the motor proficiency levels of children with Down's syndrome. In order to determine the motor proficiency levels of children with Down's syndrome the Movement ABC (MABC), which measures the motor proficiency levels and the incidence of developmental coordination problems, was applied as a

screening tool. A water activity programme was chosen as the intervention programme because it has been classified as safe by Cremers and Bol (5).

3.2 METHOD

3.2.1 Subjects

The research group consisted of six children from a school in Potchefstroom. The mental age of the children was between 4 to 6 years. Four children, Case A an African boy, Case B a Caucasian Boy, Case C an Asian girl and Case D a Caucasian girl, formed part of the experimental group, and two children, Case E and Case F, both Caucasian girls, were part of the control group. The control group did not undergo any treatment. The children were chosen according to availability and their water safety level. The individual served as his/her own norm; thus the performance was compared with the self and not with the norms of the performance of other children.

According to Snyder-Mclean (14) it is common practice, where there is much divergence and where norms cannot be set (e.g. in the case of handicapped persons), to use the children's own personal achievement to measure the effect of intervention (case studies). This researcher furthermore states that normal growth and development must be taken into consideration as well as development which may have taken place as a result of other activities apart from the intervention programme. For this reason the data has been handled in terms of case studies as well as experimental grouping (experimental and control group).

3.2.2 Research design

The research design was a One-group Pre-Test, Post-Test plus Retention Test, Pre-experimental design (16). The water activity intervention programme took place twice a week in a heated swimming pool for a period of 8 weeks and was presented by 4 honor students and the researcher. The exercise sessions lasted from between 25-45 minutes depending on the degree of difficulty of the exercises.

3.2.3 Intervention programme

A water activity intervention programme was designed and implemented twice weekly over an eight week period. The water activity programme consisted of floating, gliding and motion skills, underwater activities, activities to promote coordination, balance and manual dexterity. A significant number of activities were aimed at the development of bilateral coordination, because swimming is a bilateral skill where the coordination of arms, legs and breathing is necessary.

3.2.4 Measuring instruments

The "MABC" test battery and components of the Charlop-Atwell Scale of Motor Coordination were used as measuring instruments in order to determine motor development as well as the progress made. The "MABC" test battery which was developed by Henderson and Sugden (6) for use with 4 to 12 year-olds and which shows good validity was implemented. It consists of 4 age-bands of which the 4 to 6 year-old band (Age-band 1) was used. The MABC measures manual dexterity (3 test items), balance (3 test items) and ball skills (2 test items) of children, all of which can be calculated separately in subsections as well as collectively in a total DCD-point. The test is a norm based measuring instrument which classifies children on and under the fifth percentile as a child with DCD of a serious degree (risk case) and in need of remedial treatment. When a child is evaluated as being between the 5^{th} and 15^{th} percentile, he/she is judged to be a possible risk case who may need remedial therapy (6).

Because the MABC does not include a total body coordination component, a component of the "Charlop-Atwell scale of Motor Coordination" was added in the study. The "Charlop-Atwell Scale Kunict of Motor Coordination" is an easily administered measuring instrument used to determine some large motor coordination components for 4 to 6 year-old children. The description of the test mentions that it is not recommended for handicapped persons; however, no other suitable test could be found with which to determine the bilateral coordination of children with Down's syndrome. As their handicap was not physically, the items were consequently included.

The 2 test elements of the "Charlop-Atwell Scale of Motor Coordination" which were used in this study are the "jumping jacks" and the "pre-historic animal walk" during which the bilateral coordination level can be classified according to the initial, elementary and mature phases (2).

3.2.5 Statistical analysis

The data was processed with the computer programme "Statistica 5.5 (2002) for Windows" (15). Means, standard deviations and maximum and minimum values were calculated for descriptive purposes, while effect sizes were calculated to determine practical significance of differences (3).

3.3 RESULTS

Results were analysed with regard to different testing and will be discussed in order to accomplish continuity and a logical sequence; background information on the respondents is given first, after which the results of the pre- and post-tests, as measured by the Movement ABC (MABC), are given.

Table 1 gives a summary of some background information of the subjects, relevant to this study.

TABLE 1: BACKGROUND INFORMATION OF SUBJECTS

Respondents	Gender	Chronological Age	Mental Age	Down's Syndrome Classification	State of Health
Case A	Male	10 years	4 years	Trisomy 21	Chronic sinusitis
Case B	Male	14 years	5 years	Trisomy 21	Reasonably healthy chronic sinusitis
Case C	Female	9 years	4 years	Trisomy 21	Diabetic
Case D	Female	11 years	5 years	Mosaic	Poor general health
Case E	Female	10 years	4 years	Trisomy 21	Heart problem
Case F	Female	9 years	4 years	Trisomy 21	Reasonably healthy

Subsequently the differences between the pre-tests and post-tests, as regards the various test elements, as well as the individual progress of the subjects, as measured by the MABC, will be presented.

TABLE 2: DESCRIPTIVE ANALYSIS OF THE MOTOR PROFICIENCY LEVELS OF THE SUBJECTS

Subjects	Test Elements	Pre-Test	Post-Test	Improve-ment	Retention Test	Improvement in the Retention test
Experimental Group						
Case A	MD (Manual dexterity)	15	4	-11	8	4
	BS (Ball skills)	6	0	-6	6	6
	BL (Balance)	13	8	-5	2.5	-5.5
	MABC Total	**34**	**12**	**-22**	**16.5**	**4.5**
Case B	MD (Manual dexterity)	10	11	1	2	-9
	BS (Ball skills)	0	0	0	0	0
	BL (Balance)	9	0	-9	0.5	0.5
	MABC Total	**19**	**11**	**-8**	**2.5**	**-8.5**
Case C	MD (Manual dexterity)	15	13	-2	3	-10
	BS (Ball skills)	1	0	-1	0	0
	BL (Balance)	6	6	0	3	-3
	MABC Total	**22**	**19**	**-3**	**6**	**-13**
Case D	MD (Manual dexterity)	8	5	-3	0.5	-4.5
	BS (Ball skills)	0	0	0	0	0
	BL (Balance)	2	0	-2	0	0
	MABC Total	**10**	**5**	**-5**	**0.5**	**-4.5**
Control Group						
Case E	MD (Manual dexterity)	15	12	-3	5.5	-6.5
	BS (Ball skills)	4	4	0	2	-2
	BL (Balance)	1	2	1	4	2
	MABC Total	**20**	**18**	**-2**	**11.5**	**-6.5**
Case F	MD (Manual dexterity)	15	14.5	-0.5	12	-2.5
	BS (Ball skills)	10	5	-5	2	-3
	BL (Balance)	13	13.5	0.5	10	-3.5
	MABC Total	**38**	**33**	**-5**	**24**	**-9**

* smaller scores in components as well as a minus value (-) indicate improvement

From Table 2 it is apparent that there was an improvement in both groups as regards the various sections of the MABC and the MABC-total. When the individual improvement of the subjects, as regards the pre-test and post-test, is analysed the following becomes apparent:

Experimental Group: Case A showed improvement in all three of the subtests with the largest improvement in manual dexterity. Case A revealed a positive attitude from the start of the water programme and also enjoyed the water activities very much.

Case B improved as regard to the balance skills, remained the same in the ball skills subtest, but weakened in the manual dexterity subtest. Case B's attention was easily diverted and consequently he did not pay much attention to the instructions of the swimming instructors. Furthermore, he was difficult to control and frequently disrupted the class. The fact that he was less "teachable" could possibly be the reason why he showed less development in the swimming programme.

Case C showed improvement in the manual dexterity and ball skills with the biggest improvement in the manual dexterity subtest. Balance skills remained at the same level and although Case C showed improvement, his achievement could have been influenced by mood swings, which made him precarious and temperamental. His achievement did improve towards the end of the water programme, and longer exposure to this programme could have resulted in a more favorable improvement.

Case D showed the largest improvement in the manual dexterity section, followed by the balance component, while ball skills remained at the same level of development. Case D showed the biggest improvement in the experimental group. Case D is classified as a Mosaic Down's syndrome child and, especially, was the best swimmer and could follow instructions best. The fact that she is a Mosaic Down's syndrome case which is a less serious form of Down's syndrome, possibly contributed to her better improvement.

Control Group: Cases E and F formed the control group. Case E improved in the manual dexterity subtest but weakened in the balance skills subtest, while the ball skills subtest remained the same (Table 2). Case F showed the greatest improvement in the ball skills subtest, followed by the manual dexterity section. The balance skills subtest weakened slightly.

The retention test followed 8 weeks after the post-test. As regard to the retention test, all the subjects in the experimental group, with the exception of one, improved. The average improvement of the experimental group in the post-test was –9.5, while the average improvement in the retention test was –5.38. Case A showed a poorer performance in the retention test even though she showed the best improvement during post-testing. It can be argued that in her case there was no stable effect on motor development level.

Although her Movement ABC total was less in the retention test than in the post-test, there was no DCD level shift (Table 3).

It can thus be argued that the water activity intervention programme did have an effect on motor proficiency levels of the children that took part in the water activity intervention programme. The post-test average of the control group's improvement was –3.5, while the average improvement for the retention test was –7.75. The average improvement of the post-test was, however, smaller compared to the retention test. It can be argued that the improvement of the control group can be attributed to maturation and growth. There were no DCD level shifts in this group (Table 3).

Because coordination is an important element of swimming and because the MABC does not have a test element for swimming coordination, the "jumping jack" and the "prehistoric animal walk" of the Charlop-Atwell test battery were included in the evaluation. Not one subject, in either the experimental or the control group, could correctly execute the test elements during the pre-test and were classified in the elementary phase. However, during the post-test all four of the subjects, in the experimental group, were successful in both coordination test items. In contrast, both of the subjects in the control group were still unsuccessful and in the elementary phase during the post-test.

Results of the Charlop-Atwell retention test with regard to coordination, showed that the experimental group could still perform the test items successfully, whilst the control group was still not able to execute the test items correctly. It can thus be argued that the water activity intervention programme had a long- term effect on the coordination ability.

Effect sizes were calculated to determine whether the changes within and between the groups were of practical significance. Practical significance can be understood as a large enough difference to have an effect in practice. According to Cohen (3) cut-off points are as follows: ≥ 0.3 indicates a small practical significance, ≥ 0.5 indicates a moderate significance and ≥ 0.8 indicates a large practical significance.

From Table 3 it is apparent that there is a large standard deviation between the scores of the experimental and control group with regard to all the components. This might be attributed to the fact that the groups were small. The larger differences in the scores of the experimental group can possibly be due to the big improvement of the one subject (Case C), who showed big improvements in all the components.

TABLE 3: MEANS, STANDARD DEVIATIONS AND PRACTICAL SIGNIFICANCE OF DIFFERENCES OF THE GROUPS

Test Group	M	sd	d
Experimental Group			
Fine muscle skills component (MD)	-3.75	5.123	0.7*
Ball skills component (BS)	-1.75	2.872	0.6*
Balance skills component (BL)	-4	3.915	1.0**
Total	-9.4	6.6	1.4**
Control Group			
Fine muscle skills component (MD)	-1.76	1.767	1.0**
Ball skills component (BS)	-2.5	3.535	0.7*
Balance skills component (BL)	0.75	0.353	2.1**
Total	-3	1.41	2.1**
Comparison of the d-value between the experimental group and the control group			
Fine muscle skills component (MD)			0.4
Ball skills component (BS)			0.3
Balance skills component (BL)			1.2**
Total			0.98**

≥0.5 (moderate practical significance)*, ≥0.8 (large practical significance) **
- indicates an improvement

From judging overall improvement, the balance subtest showed the largest improvement. There was a positive improvement in the experimental group, but a weakening in the balance skills subtest of the control group. The manual dexterity subtest showed the second largest improvement in both the experimental and control group. The water activity intervention programme included some exercises for manual dexterity development, but most of the activities were aimed at the development of larger muscle skills. The improvement of the manual dexterity subtest in both groups can possibly be attributed to exposure to other manual dexterity activities at school. Body control could have played a role in the improvement of the manual dexterity subtest in both groups. The ball skills subtest showed the smallest improvement in the experimental group, but in contrast, the largest improvement in the control group. No specific ball skill activities

were included in the water intervention programme, which could possibly be the reason why the ball catching skills component did not show any meaningful improvement in the experimental group. The reason for the omission of the ball skills was that the swimming pool was too deep for the children to stand comfortably. The small improvement of the ball catching skills component in the experimental and control group can possibly be attributed to the improvement of total body coordination.

TABLE 4: IMPROVEMENT OF DCD LEVELS

Research Group	Percentile Pre-test	DCD class Pre-test	Percentile Post-test	DCD Class Post-Test
Experimental Group: Case A	1	3	12	2
Case B	1	3	14	2
Case C	1	3	4	3
Case D	15	2	38	1
Control Group: Case E		3		3
Case F		3		3

≤5, serious DCD = classification 3; >5 + ≤15, borderline case/risk zone for DCD = classification 2; >15- non risk for DCD = classification 1

Using the classification of the MABC all the children in the research group (thus all the children in the experimental and the control group) were classified by means of the pre-test as DCD, which means that the whole group of Down syndrome children were identified as having development coordination disturbances. All the children (excluding Case D who fell between the 5 – 15th percentile and was classified with moderate DCD) can thus be placed under the 5th percentile and consequently fall into the 3rd level (serious DCD classification) of the "Movement ABC" classification.

In Table 5 it is apparent that in the post-test Case A and Case D moved from level 3 to level 2 after exposure to the water intervention programme. This means that they are now only risk cases for DCD and are no longer classified as children with serious DCD. Case C remained on level 3. Case D shifted from level 2 to level 1, which means that she can no longer be classified as a DCD case. In contrast no shifts in level took place in the control group and both respondents are still classified as being in the DCD group.

TABEL 5: DCD CLASSIFICATION LEVELS DURING THE PRE-TEST, POST-TEST AND RETENTION TEST

Respondents	Pre-Test	Post-Test	Retention Test
Experimental Group:			
Case A	3	2	2
Case B	3	2	1
Case C	3	3	2
Case D	2	1	1
Control Group:			
Case E	3	3	2
Case F	3	3	3

≤5, serious DCD = classification 3; >5 + ≤15, borderline case/risk zone for DCD = classification 2; >15-non risk for DCD = classification 1

Other improvements: The children's teachers also noted improvements in manual dexterity skills, like writing. Another interesting improvement noted was of self-confidence as well as the positive improvements in the children's social interaction and general behaviour at school. The fact that they were given extra exposure to a new movement medium, as well as the opportunity to practice new skills, could be the cause of the increase in performance.

3.4 SUMMARY AND CONCLUSION

It can be concluded that the 8-week water activity intervention programme had a definite effect on all the children in the experimental group. In the pre-test all the children were classified with DCD. The results of the post-test showed improvement in balance, coordination and the overall motor profile (MABC total). Two of the four children in the experimental group (case A and D) moved from level 3 to level 2 of the DCD classification, which means that they have moved from the category of serious DCD to moderate cases of DCD. One of the children (Case C) remained on level 3. The biggest improvement was in Case D who improved from level 2 to level 1, which means that she showed no signs of DCD. In contrast to the children in the experimental group, the two

children in the control group didn't show enough improvement to be classified in a higher level of performance

Three of the four children in the experimental group improved in the DCD levels, while none of the children in the control group improved in DCD levels. The deduction can thus be made that participation in a water activity intervention programme can improve the motor development levels of the subjects. There were also positive changes noted in the children's behaviour, fine motor skills and social interaction.

Although the findings of this study can't be generalized due to the small groups, the results of the study showed that exposure to a water activity intervention programme can enhance the motor proficiency levels of children with Down's syndrome.

3.5 RECOMMENDATIONS

In the course of the intervention programme unique difficulties were encountered and are put forward to serve as guidelines for future studies in this regard:

- Only candidates who are watersafe and possess elementary water skills should be included in such a programme because it is very time consuming to teach these skills. Furthermore, children with Down's syndrome require a lot of individual attention and lose their concentration easily. It is thus essential that there be a capable trainer as well as additional assistants and supervision.
- Children with Down's syndrome are susceptible to illness, especially lung illnesses which can in turn have an influence on the continuity and progress. It is recommended that the training of children with Down's syndrome takes place in an indoor swimming pool where the weather does not play such an important role and where there are facilities to ensure that the candidates remain warm and dry e.g. a facility to dry their hair.
- It is also recommended that follow-up studies be conducted with more participants so that the results can be verified for broader applicability.

- The use of other evaluation tools are recommended to determine the effect of water activity intervention programs, because the coordination component, which is an important element in swimming skills, could not be evaluated effectively by the MABC.

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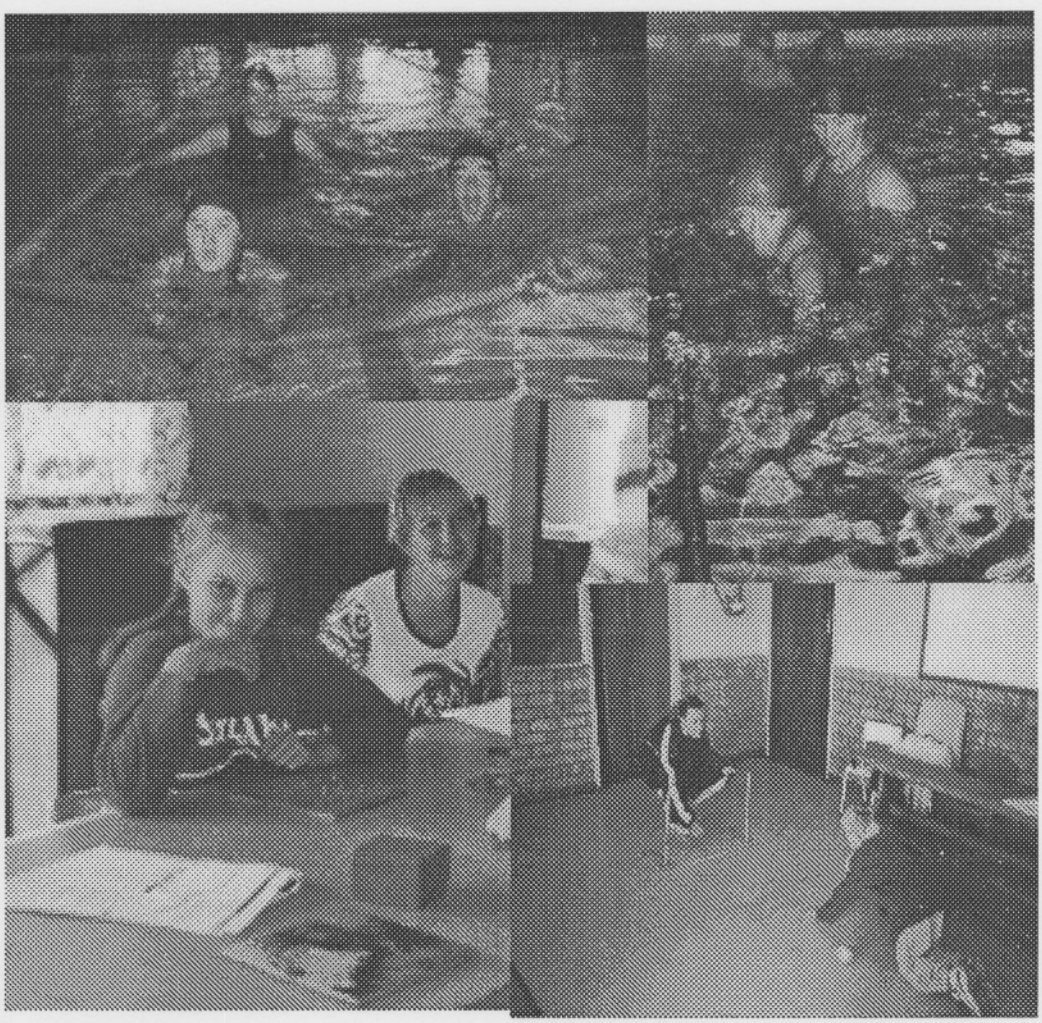
CHAPTER 4

THE EFFECT OF A WATER ACTIVITY INTERVENTION PROGRAMME ON THE MOTOR PROFICIENCY LEVELS OF CHILDREN WITH FETAL ALCOHOL SYNDROME



Chapter 4

The effect of a water activity intervention programme on the motor proficiency levels of children with Fetal Alcohol Syndrome

Miss Tanya Höll, Tel: (016) 362 1429, Cell: 082 9214 881

Dr Mercia Coetzee, Tel: 018 290 6107 (h), 018 299 1792 (w), 082 825 4031 (cell),

Prof A.E. Pienaar, Tel: (018) 291 1377 (h), 018 299 1796 (w),

School for Biokinetics, Recreation and Sport Science
Potchefstroom University For CHE
Private Bag x2001 Potchefstroom 2531

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The effect of a water activity intervention programme on the motor proficiency levels of children with Fetal Alcohol Syndrome

The aim of this study was to determine whether a water activity intervention programme can improve the motor proficiency levels of children with Fetal Alcohol Syndrome. Six institutionalized children classified as having Fetal Alcohol Syndrome, from a school for the mentally handicapped, took part in this study. The children's chronological ages ranged between 7 and 17 years, with the mean age of 11 years. Their mental age classification were between 4 to 11 years. Pre-, post and retention testing were conducted with the MABC (Age band 1, 2 and 4). The reporting of the results were in the form of a case study. All the children showed improvement in their motor proficiency levels, especially with regard to the total body coordination and manual dexterity. All the children had DCD. After participation in the intervention programme two children improved to the non-risk level for DCD, two children improved in percentile and two children stayed the same. The results of the study showed that exposure to a water activity intervention programme can enhance the motor proficiency levels of children with Fetal Alcohol Syndrome.

4.1 INTRODUCTION AND PROBLEM STATEMENT

Since 1968 the teratogenic effects of alcohol on the developing fetus have been recognized (14) and in 1973, Jones and Smith named this effect Fetal Alcohol Syndrome (14). Fetal Alcohol Syndrome (FAS), Fetal Alcohol Effect (FAE) and alcohol-related neurodevelopment disorders are chronic neuro-developmental and neuropsychiatric conditions and form part of Fetal Alcohol Spectrum Disorder (FASD) (14). Fetal Alcohol Syndrome is the most prevalent known cause of mental retardation according to Surburg (18)

Fetal Alcohol Syndrome is defined by Martini (12) as a neonatal condition resulting from maternal alcohol consumption; characterized by developmental defects typically involving the skeletal, nervous and cardiovascular system. Fetal Alcohol Syndrome is referred to when a combination of mental and physical defects occur because of a mother that ingested excessive amounts of alcohol during pregnancy (18). According to

Streissguth *et al.*, (17) Fetal Alcohol Syndrome is diagnosed by three primary characteristics: CNS disfunction, characteristic pattern of abnormality especially in the face and growth deficiency. Children prenatally exposed to alcohol are affected in two ways. Firstly, there is an increased incidence of neurological impairment, causing chemical dependency, congenital aberrations, neurobehavioral abnormalities and intrauterine growth retardation (18). Secondly, the social enviroment and family situation of these children, is mostly chaotic, therefore their social structure is precarious (18).

Fetal Alcohol Syndrome is marked by characteristic facial abnormalities, a small head, slow growth and metal retardation (12). More then 80 percent of all children with Fetal Alcohol Syndrome have pre- and postnatal growth deficiencies, microcephaly, saddle shape nose and a gap between the two front teeth (1), fetal growth retardation, small eye openings and a small midface (2). According to Streissguth *et al.*, (17) their weight and height are below the tenth percentile of normal growth and cardiac, renal or skeletal problems are likely to be present (14).

Caleekal (5) states that children with Fetal Alcohol Syndrome also sustain central nervous system damage such as permanent and irreversible brain damage, learning difficulty and behavioral disorders, deficits in memory and attention, hyperactivity, speech and language delays and poor total body coordination.

Gross motor and fine motor deficiencies, Attention Deficit Disorder, hyperactivity, poor visual and motor memory in the early school years are also the result of the effects of in-utero exposure to alcohol (1). Gabbard (9) indicates deficiencies in balance and fine motor control among them. Futhermore it was noted that alcohol exposure is associated with a weak grasp and poor motor coordination (9). Attention Deficit Hyperactive Disorder (ADHD) has been associated with individuals with Fetal Alcohol Syndrome (18) which means they often fail to finish what they start, are easily distracted, have difficulty concentrating and organising work, needs motivation to finish a task, have motor restlessness and find it difficult to follow routines or wait turns (3).

Individuals with Fetal Alcohol Syndrome often have anxiety attacks and mood-, conduct- or explosive disorders (14). Other psychiatric problems such as depression, psychotic episodes and anxiety disorders, eating disorders and post traumatic stress disorder have been reported (17). Affected infants have difficulty with regulation with state of mind and experience moodswings as well as irritability, hypersensitivity and hyperactivity (14). Children with Fetal Alcohol Syndrome may have difficulty in activities and sports that requires teams (4) and display a number of inappropriate or challenging behaviours (17). According to Dyer *et al.*, (8) children with Fetal Alcohol Syndrome may display high levels of sociability, out of context conversation and poor social judgement.

O'Malley *et al.*, (14) states that Fetal Alcohol Spectrum Disorder has a prevalence of 1 per 100 people in the USA. According to the statistics of the Department of Health (7): 22 in 1000 children in Soweto, 12 in1000 in Lenasia South and 37 in 1000 in Westbury suffers from Fetal Alcohol Syndrome. The incidence of Fetal Alcohol Syndrome in the poor communities of Johannesburgh is almost 1 per 55 births (10). One in fifteen children suffer from Fetal Alcohol Syndrome in the Winelands of South Africa, a prevalence that is fifty two times more than in the United States of America (10).

Regardless of the high prevalence rate of Fetal Alcohol Syndrome in Gauteng and the Cape province, the phenomena of Fetal Alcohol Syndrome has not yet received adequate attention from the health and medical professions in South Africa. The general public are also not well-informed regarding the causes and consequences of Fetal Alcohol Syndrome. The lack of information needs to be addressed to prevent a further increase of this syndrome, and to empower parents, teachers and related professionals to better understand children with Fetal Alcohol Syndrome, as well as to develop programmes to enhance their quality of life.

The aim of this study was to determine the effectiveness of a water activity intervention programme on the motor proficiency levels of children with Fetal Alcohol Syndrome. Literature on the motor development of the children with Fetal Alcohol Syndrome, is

limited and no documented intervention programmes could be found, that focused on the improvement of the motor proficiency of children with Fetal Alcohol Syndrome

4.2 METHOD

4.2.1 Subjects

The research group consisted of six institutionalized children, identified with Fetal Alcohol Syndrome at a school for the mentally handicapped in Potchefstroom. The mental ages of the children ranged from 4 to 11 years. Two Caucasian girls, one African girl and three Caucasian Boys, formed part of the research group.

4.2.2 Research design

The research design was a One-group Pre-Test, Post-Test plus Retention Test, Pre-experimental design (20). The water activity intervention programme took place twice a week in a heated swimming pool for a period of 8 weeks and was presented by five honor students and the researcher. The exercise sessions lasted from between 25-45 minutes depending on the degree of difficulty of the exercises. The children, in this study, were chosen according to availability and their water competence levels. The individual cases served as his/her own norm, thus the performance was compared with the self and not to the norms of the performance of other children.

4.2.3 Intervention programme

A water activity intervention programme was designed and implemented twice weekly over an eight week period. The water activity programme consisted of floating, gliding- and motion skills, underwater activities, activities to promote coordination, balance and manual dexterity. A significant number of activities were aimed at the development of bilateral coordination, because swimming is a bilateral skill where the coordination of arms, legs and breathing is necessary.

4.2.4 Measuring instruments

The "MABC" test battery was used as a measuring tool, in order to determine motor development as well as the progress made. The "MABC" test battery that was developed

by Henderson and Sugden (11) for use with 4 to 12 year-olds and which shows good validity was implemented. It consists of 4 age-bands of which Age band 1 and 4 was used and measures manual dexterity (3 test items), balance (3 test items) and ball skills (2 test items) of children, all of which can be calculated separately in subsections as well as collectively in a total DCD-point. The mental age of these children, who participated in the programme, was used instead of their chronological age. Therefore two children were tested with age band 2, one child was tested with age band 2 and three children were tested with age band 4. The test is a norm based measuring instrument which classifies children on and under the fifth percentile as a child with DCD of a serious degree (risk case) and in need of remedial treatment. When a child is evaluated as being between the 5^{th} and 15^{th} percentile, he/she is judged to be a possible risk case who may need remedial therapy (11).

4.2.5 Statistical analysis

The data was processed with the computer programme "Statistica 5.5 (2002) for Windows" (Statsoft, 2002). Means, standard deviations and maximum and minimum values were calculated for descriptive purposes, while effect sizes were calculated to determine practical significance of differences (6).

4.3 RESULTS

According to Snyder-Mclean (15) it is common practice, where there is much divergence and where norms cannot be set (e.g. in the case of handicapped persons), to use the children's own personal achievement to measure the effect of intervention (case studies). The case-study method is used as a basic form of scientific inquiry that underpin effective professional practice especially in relation to human problems (13). According to Naudé and Maree (13), the case-study method has more contextual interest and importance, because it emphasizes the differentiation and uniqueness of cases.

In order to accomplish continuity and a logical sequence, the results of this study are presented as follows: background information on the subjects is given first, and secondly the results of the pre-, post- and retention test, as measured by the Movement ABC

(MABC), will be presented. This will be followed by a more in depth discussion of the results of each child in the format of a case study. Table 1 gives a summary of some background information of the subjects, relevant to this study.

TABLE 1: BACKGROUND INFORMATION OF SUBJECTS

Subjects	Chronological Age	Intellectual Age	Gender	Other disorders And syndrome
Case A	17	11	Female	Attention Deficit Disorder (ADD)
Case B	14	11	Female	Attention Deficit Disorder (ADD)
Case C	8	7	Female	Attention Deficit Disorder (ADD)
Case D	14	11	Male	Attention Deficit Disorder (ADD)
Case E	7	4	Male	Attention Deficit Hyper-active Disorder (ADHD)
Case F	11	4	Male	Autism

Subsequently the differences between the pre-, post- and retention tests, with regard to the various test sections, as well as the individual progress of the subjects will be presented in Table 2.

TABLE 2: DESCRIPTIVE ANALYSIS OF THE MOTOR PROFICIENCY IMPROVEMENTS AS MEASURED ACCORDING TO THE MABC

Subjects	Test Elements	Pre-Test	Post-Test	Improvement from Pre- to post-test	Retention Test	Improvement from Pre-to retention test
Case A	MD (Manual dexterity)	6	6	0	5	1
	BS (Ball skills)	6	2	4	3	3
	BL (Balance)	9	12	-3	10	-1
	MABC Total	21	20	1	18	3
Case B	MD (Manual dexterity)	12.5	1	11.5	7.5	5
	BS (Ball skills)	3	4.5	-1.5	0	3
	BL (Balance)	14	9	5	10	4
	MABC Total	29.5	14.5	15	17.5	12
Case C	MD (Manual dexterity)	15	5.5	9.5	8	7
	BS (Ball skills)	6.5	1	5.5	2	4.5
	BL (Balance)	3	2	1	7	-4
	MABC Total	24.5	8.5	16	17	7.5
Case D	MD(Manual dexterity)	8	0.5	7.5	2.5	5.5
	BS(Ball skills)	2.5	0	2.5	0	2.5
	BL(Balance)	11	7	4	3	8
	MABC Total	21.5	7.5	14	5.5	16
Case E	MD(Manual dexterity)	3	8.5	-5.5	2	1
	BS(Ball skills)	10	6	4	0	10
	BL(Balance)	10	7	3	3.5	6.5
	MABC Total	23	21.5	1.5	5.5	17.5
Case F	MD (Manual dexterity)	11	14.5	-3.5	8.5	2.5
	BS (Ball skills)	5	0	5	1	4
	BL (Balance)	5	10	-5	10	-5
	MABC Total	21	24.5	-3.5	19.5	1.5

* Low values indicate better performance and (-) values indicate a weakening of the initial score in subtests

Case A showed an improvement in the MABC-total as well as with the ball skills and the manual dexterity, from the pre- to the retention test. The balance skills subtest decreased from the pre- to the retention test.

Case B improved from the pre- to the post testing in the manual dexterity and ball skill subtests but weakened in the balance subtest. The greatest improvement was in the

manual dexterity subtests. In the pre- to retention testing, Case B improved in all of the subtests.

Case C improved in the all the subtests, from the pre- to the post-test, with the greatest improvement in the manual dexterity subtest. In the pre- to retention test she showed a weaker performance in the balance subtest. Her performances were entirely depended on her emotional state, as we discovered during the water activity sessions. She improved in all of the other subtests, except in the balance subtest. Case C showed improvement in the MABC-total as well as in all the subtests, from the pre- to retention testing.

Case D improved in the MABC-total as well as in all the subtests from the pre- to the retention test, with the greatest improvement in the manual dexterity subtest. Case D also showed improvement regarding his emotional state. During the participation in the water activity sessions and he became more manageable and calm and teachers noted that this had a long lasting effect.

Case E showed a weaker score on the post-test in comparison with the pre-test, in the manual dexterity subtest, but improved in the ball skills- and balance subtest, and in the MABC total. The greatest improvement was with the ball skills subtest. This improvement might be attributed to the inclusion of the coordination activities in the water activity intervention programme. This subject also showed improvement in the MABC-total as well as in all the subtest items, from the pre-test to the retention test.

Case F showed weaker scores from the pre- to the post-test in the manual dexterity and the balance subtest, but he improved in the ball skill subtest. This boy suffers from Autism and this could have attributed to the poor performance. His attention was easily diverted, he was difficult to control and found it difficult to follow instructions. From the pre- to retention test he showed the greatest improvement in the manual dexterity subtest, but poorer performance was noted in the ball skills subtest. The balance subtest weakened in the retention test. His performances in the water activity intervention programme, as well as his test performance, were influenced by his mood, the

environment and the number of distractions that were present in the swimming area. Improvements were noted in the MABC-total, manual dexterity and the ball skills from the pre- to the retention test. The balance skill, however, seemed to have weakened.

From the above results it can be concluded that all the children showed improvements in their motor proficiency levels as measured by the MABC. It can thus be concluded, that the water activity intervention programme contributed to the improvement of all the children included in the research group.

The MABC-total can also be used to determine the percentile and the DCD level classification as specified by the MABC norms. These results are depicted in Table 3.

TABLE 3: PERCENTILE AND DCD LEVELS

Research Group	Percentile Pre-test	DCD class Pre-test	Percentile Post-test	DCD Class Post-Test	Percentile retention test	DCD Class Retention test
Case A	1	3	1	3	1	3
Case B	1	3	8	2	1	3
Case C	1	3	20	1	2	3
Case D	1	3	26	1	40	1
Case E	2	3	3	3	34	1
Case F	3	3	1	3	4	3

≤5-serous DCD = classification 3; >5 + ≤15, moderate DCD = classification 2; >15-non risk for DCD = classification 1

From the results of the pre-test, all the children in the group were classified with DCD according to their percentile ranking. Case C and F improved in percentile, although their DCD level stayed the same, Case D and E improved in percentile and DCD classification and Case A and B percentile and DCD classification remained the same same. The above table shows once again the precarious nature of these children.

Therefore, it can be stated that a water activity intervention programme can alter and improve, children with Fetal Alcohol Syndrome's, motor development.

Other improvements: An interesting improvement that was reported by the teachers and parents was of an improvement in self-confidence as well as the positive improvements in the children's social interaction and general behaviour at school. Teachers also noted improvement in mood swings and a decline in their aggression levels. The fact that the children were exposed to an exciting and different movement medium, could have contributed to these improvements. The programme, which lent itself to experimentation and opportunities for success, could also have contributed to these improvements,

TABLE 4: MEANS, STANDARD DEVIATIONS AND PRACTICAL SIGNIFICANCE OF THE IMPROVEMENTS WITHIN THE GROUP

Variable	M	SD	d
Improvement MD1	3.3	7.1	0.5*
Improvement MD2	3.7	2.5	1.5**
Improvement BS1	3.3	2.5	1.3**
Improvement BS2	4.5	2.8	1.7**
Improvement BL1	0.8	4.0	0.2
Improvement BL2	1.4	5.5	0.3
Improvement TOTAL1	7.3	8.6	0.8**
Improvement TOTAL2	9.6	6.7	1.5**

- **1** Is an indication of the comparison of the improvement of the pre-test with the post-test.

2 Is an indication of the comparison of the improvement of the pre-test with the retention test.

$\geq$0.5 (moderate practical significance)*, $\geq$0.8 (large practical significance) **

In order to determine whether the intervention programme was successful and has had a prolonged effect on these children's motor proficiency levels, effect-sizes were used to determine practical significance. Table 4 shows the improvements that occurred in pre- to post-test and in the pre- to retention test, in all of the subtests and the MABC-total. From this table it can be seen that the standard deviation in all the subtests were very high, which means that the children's improvements differed immensely. This could be

attributed to the fact that these children are very temperamental and their performances are totally depended on their moods and biorhythms (19).

A large practical significance was noted with the improvement of the ballskills, from the pre to the retention test. This might be attributed to the total body coordination conditioning and ball play that formed part of the water activity intervention programme. The MABC-total also showed high practical significance (d=1.5) which means that the water activity intervention programme had a positive effect on the children's overall motor proficiency levels. Improvement in the manual dexterity subtest showed a moderate practical significance, while improvement in the balance subtest showed no practical significance.

Improvement from the pre- to the retention test showed high practical significance in the: Manual dexterity, ball skills, and the MABC-total. This could mean that the water activity intervention programme had a positive and lasting effect on the children's motor proficiency levels except for the balance skill. The manual dexterity development showed an immediate moderate effect, but a lasting effect was evident.

4.4 SUMMARY AND CONCLUSION

No similar studies could be found on the motor proficiency levels of children with Fetal Alcohol Syndrome. This study should therefore be seen as a study providing baseline data in this regard. From the result of the study it can be concluded that a water activity intervention programme can be beneficial to the motor development of children with Fetal Alcohol Syndrome. In this study the biggest improvement was noted from the pre-test to the retention test which means that the programme had a lasting long-term effect on the children's motor proficiency levels. Total body coordination and manual dexterity were the two motor skills that seemed to have benefited the most over the longer period. All the children showed improvement with regard to the MABC-total.

Four of the six children showed improvements in motor development from the pre-test to the post-test. In the retention test all the subjects showed improvement in the motor proficiency levels. All of the children were classified with DCD in the pre-test. Two children progressed to the non-risk DCD group and four children stayed on the same level, although they showed a slight improvement in percentile ranking. The individual results of the six children, however, showed great diversity, which concur with the view that children with Fetal Alcohol Syndrome, should be handled as individually. Additional benefits of the water activity intervention programme were that affective, behavioural and emotional improvements were noted by the teachers and parents, which might be attributed to a positive improvement in the children's behaviour and mood swings. This is a aspect that is noteworthy for further research.

4.5 RECOMMENDATIONS

Subsequently some recommendations to improve the water activity intervention programme are given:

- It is recommended that the programme last at least twelve weeks, as it was discovered that children with Fetal Alcohol Syndrome found it difficult to adapt to a new environment, activities and routines.
- It is also recommended that further studies will include a greater number of subjects in a water activity intervention programme, so that the results may have a broader application.
- Children with Fetal Alcohol Syndrome require a lot of individual attention. It is essential that the trainer and assistants, are well trained to handle these children in an one on one situation, so that the necessary attention and support can be given.
- It is furthermore recommended that future studies apply test instruments that might be more suitable for children with mental retardation, e.g. the Brockport Physical Fitness Test.

- Detailed background information of each participant should be obtained beforehand, so that the child's mood swings and behaviour can be better understood and anticipated.
- Children with Fetal Alcohol Syndrome are easily distracted, provoked and agitated, therefore, a stress-free environment is advisable.

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CHAPTER 5

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Chapter 5

Summary, Conclusion and Recommendations

5.1 Summary

Mental retardation is a heterogeneous group of disorders with countless causes. It is characterised by cognitive and functional limitations in everyday skills, for example social skills, communication skills and motor skills and can be classified in behavioural, etiological and educational systems. Down' syndrome and Fetal Alcohol Syndrome are two of the many syndromes defined under mental retardation.

Down's syndrome is one of the most recognizable chromosomal abnormalities which causes mental retardation. Some physical characteristics are, hypermobility of the joints, moderate obesity, short legs and arms in comparisson to the torso, short neck and small ears, poor balance, poor muscle tone, poor visual and auditive capabilities, a small head, a small mouth and thin small lips, a small nose and a flattened nose bridge, prominent folds on the handpalms, an underdeveloped respiratory and cardiovascular system and white dots in the iris of the eye. Children with Down's syndrome also have many physiological drawbacks that can inhibit them from living and functioning in a normal society. Their motor functioning is underdeveloped and their motor milestone development is much slower than that of a normal child. According to literature people with Down's syndrome have delayed aquisition of motor skill, postural reactions, joint laxity, a slower reaction time and slower muscle co-activation.

Fetal Alcohol Syndrome is referred to when a combination of mental and physical defects occurs because of a mother that ingested excessive amounts of alcohol during pregnancy. Fetal Alcohol Syndrome is patterns of problems that include behavioral deficits, learning

difficulties and characteristic physical abnormalities resulting from alcohol abuse by a mother during pregnancy. Fetal Alcohol Syndrome is the most prevalent known cause of mental retardation.

A water activities intervention programme was chosen for remedial purposes to establish whether participation in an eight week water activities programme could improve the motor proficiency levels of children with Down's syndrome and Fetal Alcohol Syndrome The reasons for using a water activity program are based upon the fact that water activities have been classified as a safe medium of exercise by numerous researchers. Swimming and aquatic exercises' therapeutic effects on physical fitness and well being have been recognized for people with dissabilities.

In Chapter 1 the problem statement , aim and hypotheses were presented.

In Chapter 2, a summary of the literature regarding mental retardation, Down' syndrome and Fetal Alcohol Syndrome were discussed. This literature overview is used as a basis for the two following articles (Chapter 3 and 4).

Chapter 3 was presented in the form of an article. The aim of this study was to investigate the effect of participation in a specially designed water activity programme on the motor proficiency levels of children with Down's syndrome. Six institutionalized children classified as having Down's syndrome from a school for the mentally retarded took part in the study. The children's chronological ages ranged between 4 and 15 years, with a mean age of 11 years. Their mental age classification was that of a 4-6 year old. Pre-, post- and retention testing were conducted with the MABC (level 1, age band 4-6) and two items of the Charlop Atwell test. Four children were part of the experimental group which took part in the 8-week water activity program, while two children formed the control group. During the pre-test all the children in the group were classified with DCD. After participation in the programme the experimental group showed great improvement in their motor proficiency levels, especially with regard to MABC-total, balance and coordination. One child improved from the serious DCD level 3 to the non-

risk level 1, while two children improved to the moderate DCD level 2. The children in the control group showed no improved in DCD level. Improvements were also found in the control group, but to a lesser degree. The results of the study showed that exposure to a water activity intervention programme can enhance the motor proficiency levels of children with Down's syndrome.

Chapter 4 was also presented in the form of an article. The aim of this study was to determine whether a water activity intervention programme can improve the motor proficiency levels of children with Fetal Alcohol Syndrome. Six institutionalized children classified as having Fetal Alcohol Syndrome, from a school for the mentally handicapped, took part in this study. The children's chronological ages ranged between 7 and 17 years, with the mean age of 11 years. Their mental age classification were between 4 to 11 years. Pre-, post and retention testing were conducted with the MABC (Age band 1, 2 and 4). The reporting of the results were in the form of a case study. All the children showed improvement in their motor proficiency levels, especially with regard to the total body coordination and manual dexterity. All the children were classified as DCD-cases. After participation in the intervention programme two children improved to the non-risk DCD level 1, two children improved in percentile level and two children remained at the same DCD level. The results of the study showed that exposure to a water activity intervention programme can enhance the motor proficiency levels of children with Fetal Alcohol Syndrome.

Thus, this dissertation can be seen as a step in the direction of much-needed research on the motor development and motor proficiency levels of children with Down's syndrome and Fetal Alcohol Syndrome. The findings in this dissertation therefore emphasize the importance of sufficient opportunities for children with mental retardation to practice and participate in physical activities such as provided in this water activity programme.

5.2 Conclusion

The conclusions of the study are provided in relation to the hypotheses set out in Chapter 1.

Hypothesis 1:

The motor proficiency levels of children with Down's syndrome will improve after having participated in an eight week water activity intervention programme

The results showed that all the children in the experimental group showed improvements in their motor proficiency levels, especially with regard to the MABC-total, the balance- and the coordination component. The first hypothesis could therefore be accepted.

Hypothesis 2:

The motor proficiency levels of children with Fetal Alcohol Syndrome will improve after having participated in an eight week water activity intervention programme.

The results showed that after the participation in the eight week water activity intervention programme the motor proficiency levels of all of the children in the research group improved especially regarding the MABC total, the total body coordination and manual dexterity subtests. The improvements also seemed to have a lasting effect on the children. It can be concluded that the water activity intervention programme improved the motor profociency levels of children with Fetal Alcohol Syndrome and therefore the second hypothesis can also be accepted.

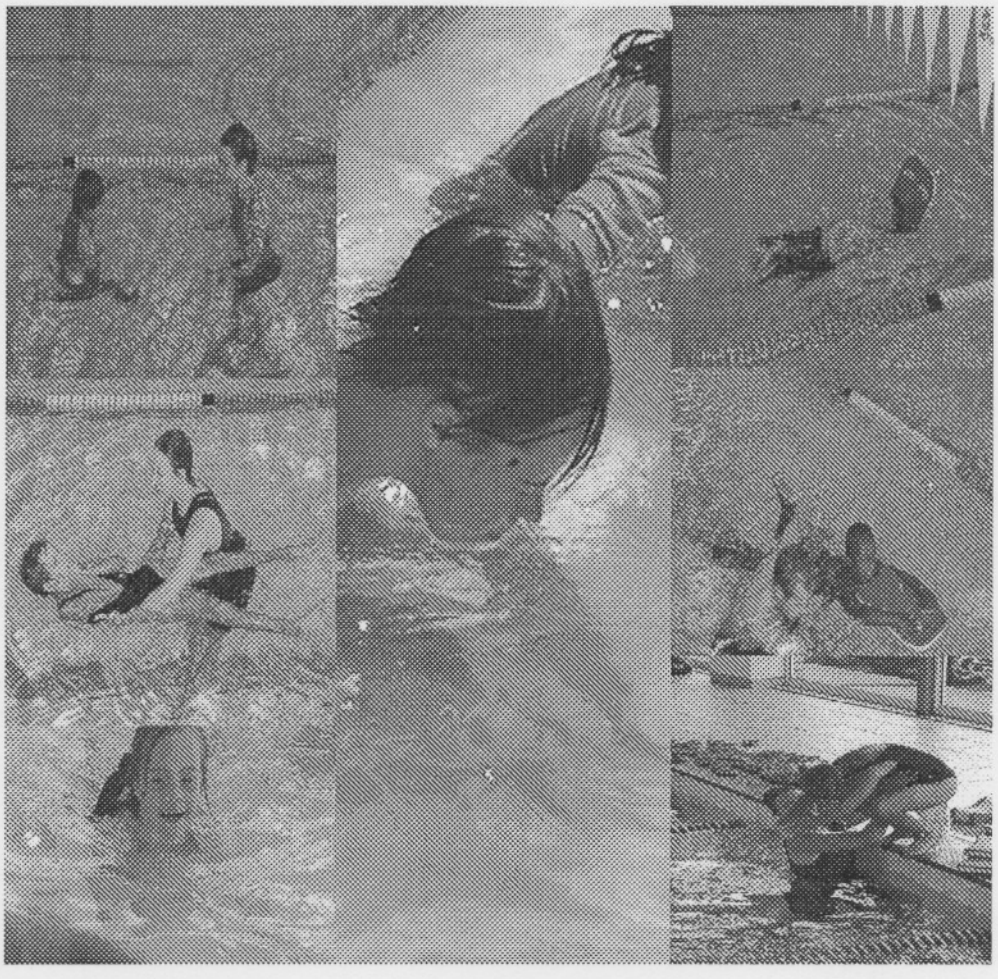
5.3 Recommendation

The results of this study provided valuable insight into the motor proficiency levels of children with Down's syndrome and Fetal Alcohol Syndrome. The following recommendations can be made from the results in the literature as well as from the results of this study:

- Further research is needed regarding the motor development of children with Down's syndrome and Fetal Alcohol Syndrome to confirm the results of this study.

- It is recommended that a more comprehensive study be undertaken to establish baseline data on the motor skills of the mentally and physically handicapped.
- It is recommended that further studies use other evaluation instruments specifically developed for the mentally and physically disabled, for example the Brockport Physical Fitness Test.
- Detailed background information of each participant should be obtained beforehand, so that the child's mood swings and behaviour can be better understood and anticipated.
- Children with mental retardation, requires a lot of individual attention. It is essential that the trainer and assistants are well trained to handle these children in an one to one situation, so that the necessary attention and support can be given.
- It is recommended that the programme last at least twelve weeks, because it was found that children with Fetal Alcohol Syndrome and Down's syndrome found it difficult to adapt to a new environment, activities and routines.
- Children with Fetal Alcohol Syndrome and Down's syndrome, are easily distracted, provoked and agitated, therefore, a stress-free environment is advisable.

APPENDICES



Letter of Consent

20 February 2002

Beste Ouer

Graag verkry ons toestemming om ____________________ bloot te stel aan 'n remediërende intervensie program wat hoofsaaklik wateraktiwiteite sal behels. Die doel is om die kind se motoriese behendigheid te bevorder. Lesse word gratis aangebied deur 5 honneurs studente en 'n navorser verbonde aan die Potchefstroomse Universiteit vir Christelike Hoër Onderwys. Die program word aangebied op Maandae en Woensdag gedurende die skooldag in Virgin Active se verhitte swembad en die lesse sal 25-45 minute lank duur vir 8 weke. 'n Onderwyser/res sal ten alle tye saam toesig hou en vervoer word verskaf.

Met dank.

____

Tanya Höll
(Program Koördineerder en Kinderkinetikus)

Antwoordstrokie

✂- ✂

Ek ____________________ veleen toestemming dat __________________________

mag deelneem aan die water aktiwiteits intervensie program.

The Water Activities Intervention Programme

Introduction

The water activity intervention programme was designed and implemented twice weekly over an eight week period. This programme took place during school hours on a Monday and a Wednesday morning. The lessons were 25-45 minutes long and conducted Virgin Active's heated indoor pool. The pool measures 25 x 15 meters and was 130 centimeters deep. A hand rail was positioned on the left side of the pool, just above the surface. Four instructors were present at all times with the children in the water while the coordinator and a teacher were positioned on the outside of the pool. Two lanes were put out for the use of the program. The less skilled children were sorted into one lane and the more skilled children were put in the other. The children were unaware of the aim and goal of each session. Games and stories were used to create a fun atmosphere for the children.

The programme

Lesson One

The first lesson can be seen as an introductory lesson with emphasis being placed on the assessing the aquatic abilities of the children. The aims included:

- Assess the aquatic readiness and general water skills of the children. Divide the children into the two different lanes.
- Introduce children to the instructors, the surrounding areas and the change rooms

Warm up

- Walk around the whole pool area, to warm up
- Hop with both legs from the one side to the other.
- Lunge with one leg and alternate. Remember to keep body straight.
- Crawl-kick with kicking board (1 length).
- Doggy-paddle (1 length).

Activities

- Do boxing-movement (rolling action) for 10 seconds and repeat four times. Hands must be under the water's surface
- Pushups on the hand rail.
- Skipping
- Pendulum
- Jumping Jacks
- Tumbling
- Leg raises while holding the hand rail.
- Place hoop around waist and run in pool without running into each other
- Dive through the hoops

Cool down

- End off the lesson with a chariot race in the hoops.

Lesson 2

Objectives

- Increase water confidence
- Encourage relaxation
- Ensure lesson is full of fun and excitement.

Warm up

- Walk lengths of the pool
- Forwards
- Backwards
- Run forward

Activities

- Blow bubbles while performing crawl kicking with kicking board.
- Glide under water while blowing bubbles.
- Lie back leaning on hands and float, relax and lay head back in water
- Repeat not using hand, relax completely and float.
- Float on back while propelling forward using hands at side to push down.
- In sitting position use hand to propel forward.
- Grip a ball between hands, hop on one leg.
- Breaststroke kick with board (One length).
- Forward karate kick – alternate legs (x20)

Cool down

- Show children how to make a rubber ball with rubber band.
- Give time so they can practice and give assistance where the instructions aren't understood.
- Give rubber bands and paper so they can make own ball for homework

Lesson 3

Objectives

- Increase water confidence
- Encourage relaxation
- Encourage the correct use of force
- Ensure precision and accuracy of correct timing
- Begin developing balance control
- Ensure lesson is full of excitement

Warm up

- Float on stomach
- Float on Back
- Swim crawl (One length).
- Crawl pulling with pull buoy (One length).
- Crawl kicking with board while playing piano with fingers on board (two length).

Activities

- Float on back and turn over on stomach (logroll)
- Pendulum
- Skip without touching the lines on the bottom.
- Tumble exercises with assistance
- With pool noodle between the legs do cycling movements.
- Use pool noodle as skipping rope and skip.
- Crawl drills with pull buoy (zipping).
- Balance kicking board on head and walk forwards and backwards.
- Sit on kicking boards, try to balance.
- Backstroke kick with board (One length)

Cool down

- 5 minutes free time play

Lesson 4

Objectives

- Increase water confidence.
- Encourage correct use of force.
- Ensure precision and accuracy of correct timing.
- Begin developing control of balance.
- Practice previous lesson activities.
- Ensure lesson is full of fun and excitement.

Warm up

- Walk lengths of the pool
- Forwards
- Backwards
- Run forwards
- Run backwards

Activities

- Blow bubbles while kicking crawl with board.
- In floating position propel forward using hands at side to push forward.
- In sitting position use hand to propel forward.
- Pushups on the hand rail.
- Skipping
- Pendulum
- Jumping Jacks
- Tumbling
- Leg raises using hand rail.
- Breaststroke pulling (one length)

Cool down

- One and two hand catch with homemade rubber ball.

- Throw ball at target.

Lesson 5

Objectives

- Encourage correct use of force.
- Ensure precision and accuracy of correct timing.
- Begin developing control of balance and endurance.
- Practice previous lesson activities.
- Ensure lesson is full of fun and excitement

Warm up

- Walk lengths of the pool
- Forwards (x1)
- Backwards (x1)
- Run forwards (x1)
- Run backwards (x1)
- Hop on one leg (x1)

Activities

- Breaststroke (One lengths)
- Backstroke (One lengths)
- Float on stomach
- Float on stomach while propelling forward using both arm at the same time.
- Logrolls
- Use pool noodle to push down with both arms under the water.
- Bicep curls with pool noodle.
- Leg raises with hand rail.
- Pick up coins, one at a time, from the bottom of the pool at put in piggy bank.

Cool down

- Doggy paddle (One length)
- 5 min free play time.

Lesson 6

Objectives

- Provide opportunity to master previous lesson activities
- Reinforce previous lesson experiences
- Build muscle strength
- Encourage exploration different strokes.
- Ensure lesson is full of fun and excitement

Warm up

- Crawl stroke (One length)
- Breaststroke (One length)
- Backstroke (One length)
- Fly kick with board (One length)

Activities

- Play tag in water, moving around using just the arms.
- Play tag, moving around using only the legs.
- Run backwards
- Run sideways
- Pushups on the hand rail.
- Leg raises
- Bicep curls with pool noodle
- Rolling hands boxing for 10 seconds and repeat four times. Hands must be under the water's surface
- Logrolls

Cool down

- Float on stomach
- Float on Back
- Dive over pool noodle
- 5 minute free play time

Lesson 7

Objectives

- Encourage exploration with new strokes.
- Provide opportunities for developing self-confidence.
- Ensure lesson is full of excitement.

Warm up

- Crawl stroke (One length)
- Breaststroke (One length)
- Backstroke (One length)
- Fly kick with board (One length)

Activities

- Logrolls
- Pendulum (x10)
- Skip without touching the lines on the bottom. (One length)
- Tumble
- With pool noodle between the legs, run lengths. (Motor cycle)
- Use pool noodle as skipping rope and skip.
- Crawl drills with pull buoy (zipping). (two lengths)
- Balance board on head and walk forwards and backwards.

- Balance sitting on board
- Balance standing on board
- Balance tennis ball on board while walking.
- Balance tennis ball while kicking.
- Backstroke kick with board.
- Lifesaving kick (two lengths)
- Sidestroke (two lengths)

Cool down

- Make stress ball using balloons and flower.

Lesson 8

Objectives

- Provide opportunity to master previous lesson activities
- Reinforce previous lesson experiences
- Build muscle strength
- Encourage exploration different strokes.
- Ensure lesson is full of fun and excitement

Warm up

- Crawl stroke (One length)
- Breaststroke (One length)
- Fly kick with board (One length)
- One arm fly with pull buoy (One length)

Activities

- Play tag in water, moving around using just the arms.
- Play tag, moving around using only the legs.
- Doggy paddle (One length)
- Skip with pool noodle
- Dive over pool noodle
- Pushups on the hand rail.
- Skip forward
- Skip backwards
- Pendulum
- Run sideways

Cool down

- 5 minute free play time

Lesson 9

Objectives

- Provide opportunity to master previous lesson activities
- Reinforce previous lesson experiences
- Build muscle strength
- Encourage exploration different strokes.
- Ensure lesson is full of fun and excitement

Warm up

- Walk lengths of the pool
- Forwards
- Backwards
- Run forwards
- Run backwards
- Hop on one leg

Activities

- Crawl kick, two lengths with kick board.
- Backstroke kick, two lengths with kick board.
- Balance board on head while walking
- Balance sitting on board.
- Balance standing on board.
- Using hula hoop, climb into and out of it without letting go.
- Use hula hoop as a skipping rope.
- Swim through a hoop held by the instructor.
- Jump into the hoop from the edge of the pool.
- Jump into the pool like an animal (like a duck or dog).
- Dive through hoops.

Cool down

- 5 minutes free play time

Lesson 10

Objectives

- Introduce new and unusual activities
- Provide opportunities for developing self-confidence
- Practice timing
- Enhance balance
- Ensure lesson is full of fun and excitement

Warm up

- Walk lengths of the pool
- Run forwards
- Run backwards
- Sideways
- Frog leap

- Walk like a duck
- Walk on knees
- Stand still and hop on one leg – alternate legs

Activities

- Play "Simon says".
- Throw and catch balloons filled with water.
- Let children jump in while trying to catch the balloons.
- Throw balloons at targets.
- Use floating ladder and let children swim under the ladder and come up between the ladder openings.
- Grip board while doing lifesaving kick. (One length)
- Sidestroke (One length).
- Crawl stroke (One length)
- Breaststroke (One length)

Cool down

- 5 minute free play time

Lesson 11

Objectives

- Introduce new and unusual activities
- Provide opportunities for developing self-confidence
- Practice timing
- Enhance balance
- Ensure lesson is full of fun and excitement.

Warm up

- Walk lengths of the pool
- Run forwards
- Run backwards
- Sideways
- Frog leap
- Walk like a duck
- Walk on knees
- Stand still and hop on one leg – alternate legs

Activities

- Crawl stroke with pull buoy.
- Crawl drill – "catch up".
- Play tag in water, moving around using just the arms.
- Play tag, moving around using only the legs.
- Doggy paddle (One length)
- Skip with pool noodle

- Dive over pool noodle
- Pushups on the hand rail.
- Bicep curl with pool noodle.
- Skip forward
- Skip backwards
- Pendulum
- Run sideways

Cool down

- 5 minute free play time

Lesson 12

Objectives

- Practice previous lesson activities.
- Provide opportunities for developing self-confidence
- Practice timing
- Enhance balance
- Ensure lesson is full of fun and excitement.

Warm up

- Crawl stroke (One length)
- Breaststroke (One length)
- Fly kick with board (One length)
- One arm fly with pull buoy (One length)

Activities

- Tumble
- Crawl stroke (two lengths)
- Jumping jacks
- Hop on one leg – alternate legs
- Handstand under water.
- Cart wheel with assistance
- Boxing, alternate hands
- Logrolls
- Use pool noodle and ride bicycle
- Pendulum

Cool down

- Use pegs as clamps to pick matches out of the water and put them in the box.
- 5 minutes free play time.

Lesson 13

Objectives

- Introduce new and unusual activities
- Provide opportunities for developing self-confidence
- Practice timing
- Enhance balance
- Ensure lesson is full of fun and excitement

Warm up

- Walk lengths of the pool
- Run forwards
- Run backwards
- Sideways
- Frog leap
- Walk like a duck
- Walk on knees
- Stand still and hop on one leg – alternate legs

Activities

- Breaststroke (Two lengths)
- Backstroke (Two lengths)
- Float on stomach
- Float on stomach while propelling forward using both arm at the same time.
- Logrolls
- Use pool noodle to push down with both arms under the water.
- Bicep curls with pool noodle.
- Leg raises with hand rail.
- Handstand under water.
- Cart wheel with assistance
- Boxing, alternate hands.
- Side kick – alternate legs.
- Front kick – alternate legs.

Cool down

- Play "Pick-up-sticks"
- 5 minute free play time.

Lesson 14

Objective

- Introduce new and unusual activities
- Provide opportunities for developing self-confidence
- Ensure lesson is full of fun and excitement

Warm up

- Crawl stroke (One length)
- Breaststroke (One length)
- Fly kick with board (One length)
- One arm fly with pull buoy (One length)

Activities

- Crawl kick, two lengths with kick board.
- Backstroke kick, two lengths with kick board.
- Balance board on head while walking
- Balance while sitting on board.
- Balance while standing on board.
- Using hula hoop, climb into and out of it without letting go.
- Use hula hoop as a skipping rope.
- Swim through a hoop held by the instructor.
- Jump into the hoop from the edge of the pool.
- Jump into the pool like an animal (like a duck or dog).
- Dive through hoops.

Cool down

- 5 minutes free play time

Lesson 15

Objectives

- Reinforce previous lesson experiences
- Ensure lesson is full of fun and excitement

Warm up

- Walk lengths of the pool
- Run forwards
- Run backwards
- Sideways
- Frog leap
- Walk like a duck
- Walk on knees
- Stand still and hop on one leg – alternate legs.

Activities

- Play tag in water, moving around using just the arms.
- Play tag, moving around using only the legs.
- Doggy paddle (One length)
- Skip with pool noodle
- Dive over pool noodle
- Pushups on the hand rail.

- Skip forward
- Skip backwards
- Pendulum
- Run sideways
- Crawl stroke (One length)
- Breaststroke (One length)
- Fly kick with board (One length)
- One arm fly with pull buoy (One length)

Cool down

- Float on back
- Doggy paddle
- Play finger games

Lesson 16

Objectives

- Reinforce previous lesson experiences

Warm up

- Walk lengths of the pool
- Forwards
- Backwards
- Run forwards
- Run backwards
- Hop on one leg

Activities

- Play tag
- Play "Simon says".
- Crawl kick, two lengths with kick board.
- Backstroke kick, two lengths with kick board.
- Balance board on head while walking
- Balance while sitting on board.
- Balance while standing on board.
- Grip board, while doing lifesaving kick. (One length)
- Sidestroke (One length).
- Crawl stroke (One length)
- Breaststroke (One length)

Cool down

- 5 minute free play time

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Appendix C.

Journal Articles: Surname of the first author, initials, then initials and surname of each of the co-authors; title of article (capatalize only the first letter of the word); name of journal (abbreviated), volume, inclusive page, and year. (Example 1)

Book References: Author(s) as above; title of book (main words capped); city of publication, publisher, and year. (Example 2)

Chapter in Edited Book: Same as book references, but add name of chapter, name of editor, and inclusive pages of chapter. (Example 3)

1. Chrisholm, D.J., J.D. Young, and L. Lazarus. The gastrointestinal stimulus to insulin release. *J. Clin. Invest.* 48:1453-1460, 1969.
2. Weibel, E.R. *Morphology of the human lung.* New York: Academic Press, 1963.
3. Young, L.R., and M.D. Altose. Respiratory responses to ventilatory loading. In: *Regulation of breathing*, T.F. Hornbein (Ed.). New York: Dekker, 1981, pp. 905-964.

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