UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA

UFS
HEALTH SCIENCES
SCHOOL OF HEALTH AND REHABILITATION SCIENCES
EXERCISE AND SPORT SCIENCES

The effect of gross motor stimulation on gross motor proficiency of Grade R learners in a low-resourced environment

---

Chanté Elizabeth Mathews
2014136127

Submitted in fulfilment of the requirements in respect of the

Master's degree in Human Movement Sciences

in the Department of Exercise and Sport Sciences,
School for Allied Health Professions,
in the Faculty of Health Sciences
University of the Free State

Supervisor:
Dr E. de Waal

2021

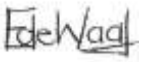
DECLARATION

I, Chanté Mathews, declare that the dissertation, titled: *The effect of gross motor stimulation on gross motor proficiency of Grade R learners in a low resourced environment*, that I herewith submit for the Master's Degree qualification in Human Movement Sciences at the University of the Free State is my independent work, and that I have not previously submitted it for a qualification at another institution of higher education.

Signature: Date: 28 November 2021

DECLARATION BY THE SUPERVISOR

I declare and approve the submission of this dissertation and the included articles as fulfilment for the Master's Degree in Human Movement Sciences at the University of the Free State. I also confirm that this dissertation has not previously, either in part or in its entirety, been submitted to examiners or moderators.



Dr Elna de Waal

Supervisor

29 November 2021

ACKNOWLEDGEMENTS

I would like to thank the following people:

- Firstly, my parents Frank and Christelle Mathews; thank you for always believing in me and helping me make this dream a possibility. Thank you for setting the example that hard work pays off.

- Dr Elna de Waal for her continuous support and guidance on this journey. Without her, this would not have been possible.

- Prof Robert Schall, thank you for your time and wisdom, helping me with my study's statistics.

- Dr Luna Bergh, thank you for your proofreading and language-editing services.

- The 2021 fourth-year B. Biokinetics students of the University of the Free State; thank you for assisting me with my data collection and for always having positive attitudes.

- Carmen Bonafede, thank you for assisting me with my data collection and always being there with advice.

- Kaylin Mathews, thank you for always lending an ear when times got tough.

- Christo van Staden, it is not just page numbers. Thank you for all your help and support.

- The Exercise and Sport Science Department of the University of the Free State for supporting me in my Master's journey and creating an opportunity to further my studies.

- The University of the Free State - for creating a space where anything is possible.

ABSTRACT

Introduction: Motor development has been reported as a crucial part of learners's overall development and is interweaved into many different fascist of the growing child. In addition, the growth and development of young learners can be influenced by many factors, with nutrition and the surrounding environment being highlighted as major contributing factors. Grade R learners in South Africa are typically five – six years of age and are expected to perform certain tasks and skills as set out by the National Curriculums and Assessment Policy Statement (CAPS). In the CAPS, specific motor skill tasks are identified which needs to be mastered by the Grade R learner. The development of Grade R learners' motor skill ability will influence the motor skill foundation they start Grade 1 with. Exploring Grade R learners's motor proficiency levels and growth status in low resourced environments will enable the identification of possible delays, and consequently provide direction for future interventions.

Aims: This study aims to answer three questions. Firstly, what is the gross motor proficiency of Grade R learners in a low-resourced environment? Secondly, using the anthropometric profile of the participants, does stunting influence gross motor proficiency? Lastly, will a gross motor stimulation program have an impact on the gross motor proficiency of Grade R learners in a low-resourced environment?

Methodology: This study was conducted in a low resourced town in the Southern Free State in South Africa. The participant group included Grade R learners (four to six years old). The study consisted of a pre-test, intervention and post-test. During the pre-test 57 learners with a mean age of 5.2 years (SD=0.33) were evaluated, of which 36 were girls (62.1%) and 21 were boys (37.9%). Motor proficiency was evaluated using the Bruininks-Oseretsky Test of Motor Proficiency, second edition. Anthropometric data collected consisted of height, weight, body mass index (BMI) and upper-arm circumference. After concluding the pre-test, the experimental group (n=18) participated in an 18 week gross motor intervention, specifically designed by the researcher to aid in the gross motor development of Grade R learners. Teachers were equipped to present the gross motor intervention in a set out free-play period. After the intervention concluded a post-testing was conducted. The motor proficiency of 49 participants was again measured.

Results: The anthropometric profile of the participants indicated a mean average height of 107.3 cm, weight of 17.3 kg, BMI of 15.03 kg/m² and upper arm circumference of 15.6 cm. These measurements were slightly lower than the indicated norms by the World Health Organization. When the anthropometric profiles were compared to the norms of malnutrition, two (3.5%) out of the 57 participants were underweight and nine (15.5%) were stunted. The motor proficiency results identified upper-limb coordination (17.5%) and running speed and agility (15.7%) as gross motor skills that participants struggled with. In regards to balancing skills, 50.8% of the participants scored mainly on or above standard. No statistically significant gender differences were found with regard to motor proficiency.

When comparing the pre- and post-test data of the experimental and control group, no statistically significant differences were found. Small increases were noted in the running speed and agility (control = 14.9 vs 17.9; experimental = 15.1 vs 16.9) and upper-limb coordination (control = 15.96 vs 17.1; experimental = 15.5 vs 17.8) subtests' standard mean scores.

Conclusion: Grade R learners in low resourced environments portray anthropometric measurements below standard norms, and although their balance skills were adequate, below average upper-limb coordination, and running speed and agility were noted. Although the gross motor intervention program did not yield any statistical significant improvements, a need was identified to better equip teachers to be able to deliver meaningful gross motor stimulation.

Key words: Gross motor skills; stunting; low resourced environment; anthropometry, gross motor intervention, motor proficiency.

TABLE OF CONTENTS

GLOSSARY

TERM	DEFINITION
Fundamental movement skills	Fundamental movement skills replace the rudimentary movements of infants with the most basic object manipulation, stability and locomotor skills. In this phase, learners actively explore the potential of their newly found mobility (Goodway, Ozmun & Gallahue, 2019:51).
Gross motor skills	Using the large muscles in your body to accomplish movement tasks (Goodway et al., 2019:15).
Gross motor stimulation	Gross motor stimulation for this study will take place by means of a gross motor proficiency intervention program designed and produced by the researcher. This program includes a set list of gross motor activities accompanied by a handmade apparatus, including activity cards and a time schedule with specific instructions (Goodway et al., 2019:15). It is aimed that the gross motor stimulation will aid the improvement of gross motor proficiency of learners.
Locomotor skills	A skill that allows a person to move with a specific purpose in mind, from one point to another (Goodway et al., 2019:220). This includes running and walking.
Low resourced environment	For the purpose of this study, a low resourced environment will indicate one primary school within a low socio-economic setting, determined according the school quintile ranks within South Africa. Poverty ranking is the main way to determine a school's quintile (Hall, Giese, Access, African, Act, Norms & Norms, 2008:37). South Africa makes use of 5 ranks/quintiles, with quintile one being the poorest schools and quintile five being the richest schools (Hall et al., 2008:37). A two-step system is used in classifying schools into ranks: firstly, a national poverty table set up by the Treasury is used, putting a specific area into a

	bracket. Secondly, the schools that fall in that area receive their rank based on the area they are situated in (Hall et al., 2008:37). Grants given per child by the Department of Education depend on the quintile school with the poorest quintile schools receiving the highest grants (Hall et al., 2008:37). Quintal one schools receive a grant of up to R1 000 per child per month, whereas quintal five schools receive a R200 grant per child (Hall et al., 2008:37).
Motor proficiency	Motor proficiency is defined as the amount of success in which gross motor tasks or motor skills are executed (Goodway et al., 2019:14). The Bruininks-Oseretsky Test of Motor Proficiency, second edition will be used to evaluate motor proficiency in this study. The BOT-2 is a standardized test measuring motor proficiency in individuals between the ages of 4- and 21-years old. The BOT-2 tests gross- and fine motor skills. For the purposes of this study, the following gross motor subtests will be used to determine gross motor proficiency: bilateral integration, balance, running speed and agility, and upper-limb coordination (Bruininks & Bruininks 2005:1). Using sex-specific norms, the results will be interpreted (Bruininks & Bruininks 2005:256).
Object Manipulation	Applying or receiving a force to or from an object (entailing the throwing, catching and hitting of an object) (Goodway et al., 2019:17).
Perceptual motor	Perceptual motor is the reaction or response caused by a movement that is derived from sensory information (Goodway et al., 2019:34). Perceptual motor is using the information from your sensory system to aid you in responding accordingly. For example, the eyes see a ball traveling towards oneself, the brain uses this information to tell the arm muscles to activate and bring forward muscle movement to catch the ball.

Socio-economic status	The combination of social and economic pressures that influence job status, income generated and social positions of a person (National Centre of Education Statistics, 2013).
Stability skills	Maintaining the body's equilibrium against forces from outside (Goodway et al., 2019:17). Stability can be divided into two types: Dynamic stability and Static stability (Goodway et al., 2019:17). Dynamic stability is being able to maintain stability in a moving environment; for example, running and changing direction. Static stability is being able to maintain stability in a stationary environment; for example, standing on one leg.
Stunting	According to the World Health Orginization (WHO Multicentre Growth Reference Study Group, 2006:58), stunting is the result of inadequate nutrition, repeated infection and improper psychosocial stimulation on a child's development and growth. To determine stunting, height-for-age is taken into consideration and if this value is below the median value with more than two standard deviations, a child can be defined as stunted (WHO Child Growth Standards). In this study, height-for-age will be compared to the WHO (WHO Multicentre Growth Reference Study Group, 2006:59) scores to determine if stunting is present in participants. *HAZ WHO classification (Height for age) Z scores* <–3SD Severely stunted –3SD - <–2SD Stunted –2SD - <–1SD Mildly stunted –1SD - +1SD Normal height >+1SD - ≤+2SD Abnormal height

LIST OF ABBREVIATIONS

Abbreviations:	Descriptions:
BOT-2	Bruininks-Oseretsky Test of Motor Proficiency, second edition
CAPS	Curriculum and Assessment Policy Statement
DoE	Department of Basic Education
FMS	Fundamental movement skills
LSEE	Low socio-economic environment
PM	Perceptual motor
SES	Socio-economic status

LIST OF FIGURES

LIST OF TABLES

Chapter One:

Background and motivation for the study

Table of Contents

1.1 Introduction

Learners brought up in low socio-economic status (SES) environments have been noted to present with developmental delays (Burger, 2010:140). Burger (2010:142) goes further and specifically identifies these delays, being guided by Hoff (2006:59), as cognitive and social of nature. These learners are prone to repeat grades and socially tend to withdraw themselves from situations (Hoff, 2006:58). Developmental delays in general, in learners from low SES environments, may be present due to a lack of flourishment in fine and gross motor skills (Campinas, 2007:1193). It has also been reported that motor delays are the result of a lack of stimulation in low SES environments (Greenfield, 2004:3). A low socio-economic area has also contributed to an increased risk of motor delays in learners (Van Der Walt, Plastow & Unger, 2020:2).

1.1.1 Motor skills

Motor skills comprise fine and gross motor skills (Goodway, Ozmun & Gallahue, 2019:13-15). Gross motor skills involves the ability to conquer skills by making use of the larger skeletal muscles to achieve movement goals (Goodway et al., 2019:15). Fundamental movement skills (FMS) form part of gross motor skills and represent the most basic form of movement before movements become more specialized (Bouffard, Watkinson, Thompson, Causgrove Dunn & Romanow, 1996:71, Goodway et al., 2019:14). FMS include object manipulation skills, for example hitting a ball; stability skills such as balancing on one leg; and locomotor skills such as running (Bouffard et al., 1996:71). Although fine motor skills are not the focus of this study, they are briefly defined. Goodway et al. (2019:13) define fine motor skills as the ability to complete tasks requiring precision, using multiple hand muscles. Examples of fine motor skills include writing, sewing and typing (Goodway et al., 2019:14).

The attainment of motor skills depends on several different components, such as muscle strength, postural support, child's mood, brain development, environmental conditions, previous experiences and task-specific requirements (Hadders-Algra, 2000:567). The Dynamic Systems Theory states that dynamic components play a role within a single process (Thelen, Schöner, Scheier & Smith, 2001:32).

According to this theory, cognitive thinking is involved in perception, planning, decision-making and memory, which is used to bring forward motor movement (Thelen et al., 2001:28). Furthermore, the Neuronal Group Selection Theory states that motor development primarily starts with neural pathways, where after afferent information (environmental contexts, physical characteristics and previous experiences) strengthens synaptic connections. This strengthening leads to interactions between genes, neural control and the environment, consequently producing motor movements (Hadders-Algra, 2000:567-568). Gross motor skills together with its building blocks play a significant role in movement patterns and social interaction (Payne & Isaacs 2011:40-55). Payne and Isaac (2011:40-55) found that the level of mastery of gross motor skills play a direct role in the participation of sports and in the social interaction between learners. Consequently, poor gross motor proficiency might negatively influence the child in sport and social domains (Payne & Isaacs 2011:40-55).

This study will be focussing on gross motor skills, because of the researcher's educational background and the foundational importance of gross motor skills for physical activity, academic achievement and social domains regarding play and sport (Goodway et al., 2019:12). The proficiency with which a movement is executed forms an important part of motor skills (Bardid, Rudd, Lenoir, Polman & Anderson, 2015:1). Motor proficiency is defined as how well motor skills are performed, making use of the relationship between muscle groups and the creation of meaningful movements (Gabbard, 2008:10; Magill, 2011:230). Motor proficiency is a direct predictor of lifelong participation in physical activity, which is why Bardid et al. (2015:2) express the importance of measuring motor proficiency and using this information to streamline strategies to aid motor development.

1.1.2 Gross motor proficiency and physical activity

The benefits of keeping learners active have been linked to an increase in how well they execute motor skills (William, Pfeiffer, O'Neil, Dowda, McIver, Brown & Pate, 2008:1424). In the development cycle of learners, they first need to master motor skills before applying them in more complex ways, as would be needed for physical activity (Piek, Hands & Licari, 2012:403).

This being said, poor motor skill development could also impact learners's participation in life-long physical activity (Barnett, van Beurden, Morgan, Brooks & Beard, 2009:257). In addition, factors such as low socio-economic environments can also influence physical activity participation, either in hindering it by not having structured activities due to low resources, or creating opportunity as a way to escape the poverty in the environment (Inchley, Currie, Todd, Akhtar, & Currie, 2005:387). Also, adequate gross motor skills can further be linked directly to physical well-being (Pagani & Messier, 2012:104). Lastly, physical activity also has a favourable effect on academic abilities (Sattelmair & Ratey, 2009:367) and learners need to be encouraged to be physically active regularly.

1.1.3 Gross motor proficiency and cognitive abilities

Adequate gross motor skills play a vital role in developing sociable learners and enabling learning to take place through play (Pagani & Messier, 2012:104). Burton and Rodgers (2001:363) refer to motor skills as a main source for producing any sort of movement, but also places emphasis on the cognitive component behind these movements. In the brain, cognitive processes, movement and motor skills have been linked by being produced in the same regions, namely the prefrontal cortex and the cerebellum (Diamond, 2000). The cognitive component together with other motor skills such as perceptual motor, sensory motor and psychomotor all contribute to the proficiency of the motor movements (Adolph & Berger, 2006:210).

In South Africa, Botha and Africa (2020:727) conducted a perceptual motor intervention study, which specifically researched the relationship between motor proficiency and letter knowledge. The motor proficiency and reading and spelling of 97 Grade one learners in the Western Cape were evaluated using the ESSI test for reading and spelling and the Bruininks-Oseretsky Test of Motor Proficiency, second edition, for motor proficiency (Botha & Africa, 2020:731). The results of this study indicated that a correlation exists between certain gross motor skills and reading and spelling (Botha & Africa, 2020:733). These skills included balance, bilateral coordination, manual dexterity, upper-limb coordination and fine motor precision and integration (Botha & Africa, 2020:727).

In a recent study done in Japan, the possible correlation between fine and gross motor skills and academic achievement of 7 378 learners between the ages of six and seven years was explored (Katagiri, Ito, Murayama, Hamada, Nakajima, Takayanagi, Uemiya, Myogan, Nakai & Tsujii, 2021:607). The results indicated that the better a child's motor skills, the better their long-term academic performance will be (Katagiri et al., 2021:607). Taking the results of these studies into consideration, it can be gathered that well-developed motor proficiency can positively impact the cognitive abilities and academic success of learners.

1.1.4 Gross motor proficiency, perceptual motor proficiency and play

Motor development and motor proficiency have been aided by Kinderkineticits' physical and gross motor programs, as a strategy to increase gross motor and perceptual motor skills (Pienaar, Van Rensburg & Smit, 2011:126). Perceptual motor skills include movement responses caused by an action that is derived from sensory information (Goodway et al., 2019:33). Perceptual motor proficiency is a needed component of motor proficiency as perceptual motor components are important puzzle pieces to motor skills (Goodway et al., 2019:277). Perceptual motor proficiency is seen as the successful mastery of the perceptual motor components, including body-, spatial-, directional- and temporal awareness (Goodway et al., 2019:277). The execution of these skills makes use of the information from the sensory systems to aid an individual to respond correctly according to the received information (Goodway et al., 2019:34). For example, the eyes see a ball traveling towards the person, the brain uses this information to tell the arm muscles to activate and catch the ball (Cheatum & Hammond, 2012:33).

Elkind (2008:4) proposed a concept which stated that learners learn that an action creates a reaction. The example used was a child throwing a ball (action) and seeing how it flew through the sky, while it being caught by someone else (the reaction) (Elkind, 2008:4). Based on this, Elkind (2008:4) conceptualised the idea of using toys as a way to improve general skills such as measuring, vocabulary, motor movement and language.

A document by the United Nations International Learners's Emergency Fund (UNICEF) (Morse & Clayton, 2007:11) expresses the concern that preschools only have pointless toys and not the appropriate tools for learners to facilitate their learning and motor proficiency. The term tools in this case describes toys that have a purpose. UNICEF (Morse & Clayton, 2007:11) went further by publishing a report done on households that stated all the tools learners need to flourish are in their parents' houses. This included tools that are cost-effective, functional and made from scratch (Morse & Clayton, 2007:11). Toys do not need to be complicated, as Guyton (2011:2) stated that toys that are made from everyday household items are the best for learning and that expensive toys are usually not as age appropriate. Hohmann and Weikart (2000:27) expressed how important it is for toys to be age appropriate, as the chance of under stimulation is very high when a toy is not age appropriate. The age-appropriateness of the toys is used as a pathway for the mastery of the specific skill at hand (Richards, Putnick, Bradley, Lang, Little, Suwalsky & Bornstein, 2020:11).

The viewpoint that toys do not need to be complicated, is encouraging for households that struggle financially, so enabling parents or caregivers in these households to provide stimulation with what they have available (Guyton, 2011:2). This viewpoint is also of importance for certain households in South Africa, as 20.4% of South African households' primary income is grants, where 11% make use of remittances and 10.8% make use of other means (Statistics South Africa, 2018:58). Concluding that 42.4% (almost half) of the households in South Africa depending on other means for income; for example, salaries and wages. According to Statistics South Africa (2018:11), out of the 17 000 households that completed the Education section of the survey, only 2.7% of learners above the age of 5 attended preschool.

Consequently, many of these aged South African learners are pre-dominantly at home during the day. The diverse household settings in South Africa are also seen in the school setting, with the schooling system being ranked from quintile one (poorest/low resourced) to quintile five (richest/high resourced) (van Dyk & White, 2019:2).

1.1.5 Gross motor proficiency in young South African learners

Within a South African school context, Grade R learners have certain basic gross motor as well as perceptual motor standards they need to adhere to before being promoted to Grade 1 (CAPS, 2011). These standards have been included in the Department of Basic Education’s Curriculum and Assessment Policy Statement (CAPS, 2011). According to the CAPS (2011:10) fine- and gross motor development are regarded very important for Grade R learners Holistic development of learners includes social, emotional and personal domains, while physical and motor development play an integrative role in the development of the above-mentioned domains (CAPS, 2011:10). Gross motor activities within the CAPS document include, amongst others, jumping and balancing on both legs or alternating legs, being able to catch and throw a ball, being able to jump onto and off of objects (CAPS, 2011:28). In general, other aspects to be addressed in Grade R include locomotor movement, perceptual-motor skills, rhythm, coordination, balance, spatial orientation, and laterality, mainly through fun activities and games (CAPS, 2011:28).

Specific time allocations are also included within the CAPS document and it states that Grade R learners should spend at least 2 hours per week on physical education. Learners in pre-kindergarten spent less time on maths and gross motor activities, compared to language, art, and social studies (Early, Iruka, Ritchie, Barbarin, Winn, Crawford & Pianta, 2010:189). No clear indication was given as to why this happened, but small possible reasons could have been the teacher’s influence and group preferences (Early et al., 2010:191). The hope for the CAPS system is that the importance of motor development amongst Early Childhood Centres and pre-primary schools in South Africa are realised, and that the CAPS guidelines are effectively implemented (CAPS, 2011:28).

Research on 419 boys and 397 girls in Grade 1 (n=816, low and high SES learners) in the North-West Province of South Africa reported on the population’s gross motor skills and whether these skills were influenced by SES (Pienaar & Kemp, 2014:167). The results indicated that, in general, boys performed better than girls, and that high SES learners outperformed low SES learners with regard to motor proficiency.

The areas of motor proficiency the learners struggled with included fine motor integration, fine motor precision and muscle strength (Pienaar & Kemp, 2014:167).

More recently, the motor proficiency of learners in Mpumalanga and Cape Town, South Africa were assessed (Tomaz, Jones, Hinkley, Bernstein, Twine, Kahn, Norris &, Draper, 2019:690). Participants included 259 learners with a mean age of five years and two months, who were tested with the Test for Gross Motor Development 2nd Ed. (Tomaz et al., 2019:690). The results stated only 7% of the participants scored below the expected average category for gross motor skill execution (Tomaz et al., 2019:691). Boys outperformed girls in certain aspects of the gross motor skills, including the strike, leap and hitting a stationary ball (Tomaz et al., 2019:691).

Addressing the motor proficiency of five- to six-year-old learners before they enter the formal schooling system is essential (CAPS, 2011:28). Observing how they move, how they interact with each other and with their environment, as well as how these environments typically look, is important and relevant to the current study. According to Ayers (2005:24), the typical five- to six-year-old has a natural drive that makes them seek learning opportunities. Their usual movements include running, jumping, hopping, skipping and rolling, which tie in with the expected standards stipulated in the CAPS document (Ayers, 2005:24; CAPS, 2011:28). A pre-schooler's typical environment is the playground - which is filled with swings, slides, monkey bars and tunnels (Ayers, 2005:24), all of which aids motor development. During the early childhood years, learners start to improve their balance, eye-hand coordination and motor planning (Ayers, 2005:24). The specific motor planning skills that a typical five- to six-year-old should be able to accomplish has been specified by Ayers (2005:99).

According to Ayers (2005:99), the motor planning skills for a five-year-old include the ability to dress themselves and look after their personal hygiene; be able to draw a cross with a crayon; and build structures like a tent, using furniture (Ayers, 2005:99). While for six-year-olds, these skills include hopping on one foot, colouring between the lines and tying shoelaces (Ayers, 2005:99).

1.1.6 Motor proficiency and socio-economic environments (SES)

SES is the social and economic condition that individuals find themselves in, which directly impacts how they perceive their lives (Business & Management Dictionary, 2007:6918). Twenga and Cambell (2002:59) placed parents or family schooling high on the list of factors that determine SES. Schooling directly impacts a family's income level by determining the types of jobs they can perform (Twenga & Cambell, 2002:59). In addition, family income and employment, as well as health and disability, are some of the main areas used to establish SES (Morley, Till, Ogilvie, & Turner, 2015:152, Campinas, 2007:1190). One of the developmental domains in a child's development that is negatively affected by a low socio-economic environment, is the development of competency in motor skills (Ferreira, Godinez, Gabbard, Vieira & Caçola, 2018:801). Burger (2010:140) states that general developmental setbacks in developing learners can be directly caused by their low SES.

Campinas (2007:1194) found that learners who start school at a young age in low SES areas, have a bigger vulnerability towards a delay in their fine motor skills. A study on learners ages four- to seven-years old in the United Kingdom determined the correlation between motor proficiency and low SES (Morley et al., 2015:154). It was reported that learners from high SES environments performed significantly better in fine- and gross motor skills, compared to their low- and middle-SES environment counterparts (Morley et al., 2015:154). Another study conducted in Nebraska in the United States reported a higher standard score mean (using the Test for Gross Motor development 2nd Ed.) in high socio-economic learners compared to learners from low socioeconomic backgrounds (mean=6.35 vs mean=5.96) (Adkins, Bice, Dinkel, & Rech, 2017:31).

The results further indicated that learners from high socio-economic environments specifically performed better in locomotor (4.08 mean vs 3.56 mean) and object control skills (2.76 mean vs 2.39 mean) when their mean results where compared to learners from low socio-economic environments (Adkins et al., 2017:31).

In South Africa, Pienaar and Kemp (2014:176) reported the difference in motor proficiency between low socio-economic and high socio-economic Grade 1 learners.

Although most of the high socio-economic learners were white and most of the low socio-economic leaners were black, race was not a factor - but rather the difference in environments between the learners (Pienaar & Kemp, 2014:176). Pienaar and Kemp (2014:176) concluded that 58.73% of learners from low SES showed below average motor proficiency levels.

1.1.7 Stunting and the effect on motor proficiency

SES not only affects motor proficiency directly, but can also have an indirect effect on motor development via undernutrition or malnourishment (Olsen, Iuel-Brockdorff, Yaméogo, Cichon, Fabiansen, Filteau, Phelan et al., 2020:4). According to Pienaar (2009:49), undernutrition directly affects the association between a child's motor, cognitive and physical development. Malnutrition includes the lack in variety of nutrients, such as too much from one type of nutrients and too little from another, as well as the incapability of absorbing nutrients effectively (WHO, 2016). Malnutrition in the form of undernutrition includes stunting, wasting and underweight (WHO, 2016). According to the World Health Organisation (WHO Multicentre Growth Reference Study Group, 2006:58), stunting is the result of inadequate nutrition, repeated infection and improper psychosocial stimulation on a child's development and growth. When defining stunting, height-for-age is taken into consideration and if this value is below the median value with more than two standard deviations, a child can be defined as stunted (WHO Multicentre Growth Reference Study Group, 2006:58). Wasting occurs when a child's weight is too low for their height, while a child is defined as underweight when their weight is too low for their age. The focus of this study will be on stunting and findings on stunting will shortly be highlighted.

UNICEF, WHO and the World Bank (2020:1) published a document specifically reporting on the stunting prevalence across different countries. According to this document, as many as 144 million learners under the age of five are globally affected by stunting (UNICEF, WHO, & World Bank, 2020:1).

First world countries such as Australia and New Zealand have no current stunting data due to low shared data of the population (UNICEF, WHO, & World Bank, 2020:4). Regions with the lowest prevalence of stunting include North America (based on

United States data) (2.6%), Eastern Asia (excluding Japan) (4.5%), South America (7.3%) and Central Asia (9.9%) (UNICEF, WHO, & World Bank, 2020:4). Regions with the highest prevalence of stunting include Middle- (31.5%) and Eastern Africa (34.5) as well as Southern Asia (31.7%) (UNICEF, WHO, & World Bank, 2020:4).

In South Africa, the rural areas (mostly low socio-economic environments) have been especially named as areas where stunting has a severity in the community with a 73.7% incidence (Coutsoudis & Coovadia, 2001:459). A high prevalence of stunting was reported for learners from low SES, especially in learners from Quintile 1-3 schools, with the stunting prevalence varying between 3.88% and 10.70% (Kruger, Steyn, Swart, Maunder, Nel et al., 2012:549; Monyeki, Cameron & Getz, 2000:42). Dukhi, Sartorius and Taylor (2017:1876) conducted a study on the prevelance of stunting in KwaZulu Natal South Africa, specifically for the ages of zero to under five years old. The participants included 300 boys and 310 girls, but results were only reported on 572 participants (Dukhi et al., 2017:1877). The results indicated that 21.1% were stunted and 7.5% were severly stunted (Dukhi et al., 2017:1877). In Gauteng South Africa, Madiba, Chelule and Mokgatle (2019:5) had 1254 participants between the ages of 12-60 months. The nutritional status of the participants were evaluated and presented that 35.8% were stunted and 22.4% were severly stunted (Madiba et al., 2019:6).

A study exploring the relationship between stunting and motor development included 82 learners between the ages of one and five years old in Indonesia, and used the Denver Developmental Screening Test to assess motor development (Setianingsih, Permatasari, Sawitri & Ratnadilah, 2020:188).

Findings reported stunting to have a negative effect on the motor development of these young learners (Setianingsih et al., 2020:187). Meylia, Siswati, Paramashanti and Hati (2020:3) using the Stimulation, Detection, and Early Inter-vention of Child Growth Development (SDIDTK) survey, reported a relationship between stunting and impaired fine motor skills in Indonesia on learners below the age of five. However, no correlation was found between stunting and gross motor skills (Meylia et al., 2020:4). Both Setianingsih et al. (2020:188) and Meylia et al. (2020:3) only compared the total score for gross motor skills and did not compare any individual components or skills. In South

Africa, Pienaar (2019:8) also found that stunting has a negative influence on perceptual motor skills. The results also indicated that the school performance of these six-year-old participants were also negatively affected by stunting (Pienaar, 2019:8).

1.1.8 Motor proficiency intervention

With motor proficiency being a foundation for many other skills and on the other hand being impacted by a child's environmental resources and available nutrients, intervening to prevent or minimize motor backlogs is important. Recent research supports this summary by saying that when it comes to preschool learners, the facilitation of motor development to create positive learning is necessary (Ruiz-Esteban, Andrés, Méndez & Morales, 2020:7). Ruiz-Esteban et al. (2020:8) found that a structured form of motor development will yield much better results than free play.

During their research in Spain, Ruiz-Esteban et al. (2020:3) tested 136 learners between the ages of two years and eight months and three years and six months with the McCarthy Learners's Psychomotricity and Aptitude Scales. After the first round of testing, a 24-week intervention was conducted twice a week for 45 minutes (Ruiz-Esteban et al., 2020:4). The control group (n=108) received unstructured free play, while the intervention group (n=28) received the intervention (Ruiz-Esteban et al., 2020:4). This intervention was presented by the teachers with 20 years of teaching experience. The two areas of gross motor skills specifically looked at was arm and leg coordination. The intervention group showed improved leg coordination, improving from 10.46 (mean) to 12.67 (mean), while arm coordination improved from 4.50 (mean) to 15.10 (mean) (Ruiz-Esteban et al., 2020:4).

Draper, Achmat, Forber and Lambert (2012:148) conducted a motor development programme intervention in South Africa called "Little Champs". This intervention made use of 118 learners from Cape Town, with a mean age of four years and six months (Draper et al., 2012:142). During pre-testing, the Test for Gross Motor Development 2nd Ed. was used to establish the learners's motor proficiency (Draper et al., 2012:142). The intervention consisted of eight months of one session per week for 45 – 60 minutes (Draper et al., 2012:142). The intervention was presented by trained Little Champs coaches (Draper et al., 2012:142).

After the post-testing, the results indicated that the intervention group's locomotor ($p<0.005$) and object control skills ($p<0.01$) improved (Draper et al., 2012:142). Gross motor mean scores improved from 14.1 for pre-testing to 15.3 for post-testing (Draper et al., 2012:142).

1.2 Problem statement

Greenfield (2004:3) reported that learners who grow up in environments that are deprived of stimulation are directly influenced in domains such as play and motor development. Ferreira et al. (2018:1) found that low SES directly and negatively influences a child's motor development and that the younger the child, the greater the influence. This delay in motor development can be caused by the absence of kindergartens that provide stimulation in low SES environments (Greenfield, 2004:3), as well as the lack of available age appropriate toys (McNeal, 1992:51). Another reason for a possible motor delay could be because of a form of malnutrition, stunting, which has been directly linked to delays in motor development (Olsen et al., 2020:6).

Taking the above-mentioned into consideration, it is essential that the gross motor development of learners in low socio-economic environments need to be addressed before the delays become detrimental. As mentioned in the discussion, addressing the motor proficiency of five- to six-year-old learners before they enter the formal schooling system should be a crucial part of schools curriculum (CAPS, 2011:28). South African learners in low socio-economic environments' motor proficiency profiles have been investigated but also compared with other socio-economic environments (Pienaar & Kemp, 2014:167; Tomaz et al., 2019:690). The common phenomenon here is that these learners from either seem to struggle with certain motor tasks (object control) or perform weaker (but not under standard) than their higher socio-economic piers. Studies reporting specifically on low SES environments and the impact these environments have on motor development are limited for ages above five years across the world (Caçola, Gabbard, Santos & Batistela, 2011:822; Meylia et al., 2020:3; Setianingsih et al., 2020:187). As researchers in South Africa (Draper et al., 2012:140; Pienaar & Kemp, 2014:176) have reported, a negative correlation between low SES environments and motor proficiency in young South African learners, it might be necessary to conduct motor interventions in these environments.

The field of Kinderkinetics (also known as paediatric exercise science) addresses the gross motor developmental needs of learners and aids in the preparation for school readiness by honing learners's abilities in motor development, as well as the overall wellness of their bodies (Pienaar, Van Rensburg & Smit, 2009:49). The introduction of a gross motor proficiency intervention in a low resourced environment may increase the chance of improving these learners's motor proficiency.

Improvement in motor proficiency can possibly lay the groundwork for further specialised skills, cognitive activities and sport, as well as overall physical participation. This study will therefore firstly aim to determine the motor proficiency of Grade R learners in a low resourced environment; and secondly, to determine factors such as stunting's influence on these learners' gross motor proficiency. Lastly, this study aims to evaluate the impact of gross motor stimulation on these Grade R learners' gross motor proficiency.

1.3 Research questions and Objectives

1.3.1 The research questions of this study are:

1.3.1.1 What is the gross motor proficiency of Grade R learners in a low-resourced environment in the Southern Free State of South Africa?

1.3.1.2 How does the Grade R learners' anthropometric measurement profiles look like, in view of determining the influence of stunting on gross motor proficiency?

1.3.1.3 What is the impact of a gross motor stimulation on the gross motor proficiency of Grade R learners in a low-resourced environment in the Southern Free State of South Africa?

1.3.2 The objectives for this study:

1.3.2.1 To determine the gross motor proficiency of Grade R learners in a low-resourced environment in the Southern Free State of South Africa.

1.3.2.2 To profile Grade R learners' anthropometric measurements, in order to determine the influence of stunting on gross motor proficiency.

1.3.2.3 To evaluate the impact of gross motor stimulation on the gross motor proficiency of Grade R learners in a low-resourced environment in the Southern Free State of South Africa.

1.4 Hypothesis:

1.4.1 The gross motor profiency levels of Grade R learners are expected to be below the norms for their age group.

1.4.2 The anthropometric measurements of Grade R learners are expected to be below the healthy norms and may indicate stunting.

1.4.3 The gross motor stimulation will have a positive effect on the motor proficiency of the Grade R learners.

1.5 Justification of study:

Noteworthy aspects of this study include the amount of light that will be shed on the gross motor proficiency and anthropometric profile of Grade R learners in a low SES environment. The literature available is very scarce, especially regarding South African learners in low-resourced environments in the Southern Free State. Another substantial contribution of this study will be the potential positive effect of implementing a gross motor stimulation programme for Grade R learners. If the use of the gross motor intervention yields positive results, it would pave the way for future research within low SES environments, specifically using this type of gross motor stimulation in rural areas and schools. Also, an anthropometric profile of this age group in this specific environment will be gathered in order to see if possible malnutrition has an impact on gross motor development. The principal and teachers will also gain knowledge regarding the gross motor proficiency of these learners.

1.6 Methodology

1.6.1 Study design

A cluster-randomised control, pre-test post-test research design was used for this study (Thomas, Nelson & Silverman, 2015:393, Creswell, 2003:16). The motor proficiency of a group of 57 Grade R learners (ages four- to six-years-old) in a low-resourced environment (a school in a town in the Southern Free State) was determined using the Bruininks-Oseretsky Test of Motor Proficiency, second edition (BOT-2). This study made use of selected subtests. These selected subtests were specifically selected by the researcher due to their relevance as gross motor components, and included a) Bilateral integration (Subtest 4), b) Balance (Subtest 5), c) Running speed and agility (Subtest 6) and d) Upper-limb coordination (Subtest 7). All the above-mentioned subtests have standardised norms, and although they can be either be sex-specific or combined (Bruininks & Bruininks, 2005:6), the current study made use of sex-specific norms. Also, during pre-testing, the height, weight and upper-arm circumference was measured in order to establish the prevalence of malnutrition (specifically stunting).

Twenty gross motor activities accompanied by a handmade gross motor apparatus (Appendix A, B, C, D) were used to apply a gross motor stimulation during the intervention period (Appendix E, F & G). Each activity card described and illustrated the activity in an understandable manner. The handmade gross motor apparatus was specifically designed by the researcher to be a convenient way of delivering gross motor stimulation to young learners. The gross motor activities were selected based on the fundamental movement skills and motor proficiency ability levels learners of this age should be able to accomplish (as set out in the CAPS). The age of the learners was also taken into consideration as the apparatus had to be age appropriate and of the correct size for Grade R learners' body dimensions and abilities. The apparatus was made of a car tyre, which acted as the base of the product (Appendix C & D). The tyre is covered in a net on one side and has handles made of rope, to conveniently carry, move or manipulate the apparatus. Each apparatus cost R400.00.

This study made use of three identical apparatuses to ensure that all the learners enjoyed equal stimulation opportunity with each 30-minute session. Teachers were trained in the use of the gross motor apparatus during a workshop conducted by the researcher (Appendix H). The teachers received a facilitation log to keep track of the sessions they presented, as well as a log to report learners's absence (Appendix I & J). Specifications of the methodology are provided in the articles (Chapters Three and Four), where more detail regarding participants, measurement instruments, procedures and the statistical analysis will be discussed.

1.7 Ethical considerations

Permission from the Health Science Research Ethics Committee (HSREC) of the University of the Free State (UFS-HSD2020/0141/2605) (Appendix K) and the Department of Education (Appendix L) was obtained. Permission from the principal and teachers, and informed consent from parents were also obtained (Appendix M, N & O). The consent form, written in the parents' home language, explained why their child was tested, as well as who tested their child. Learners were asked to sign an assent form in their home language, if they agreed to participate (Appendix P).

The learners were young; so if they could not yet write their own name in the consent letter, the child had the option to mark an emoji, which implied assent provided. After all the consent forms and assent forms were signed and received, testing commenced.

During testing, each child received a number (Appendix Q). No names or any physical attributes by which learners could be identified were used. Leaners could withdraw at any point in time during the study as participation was voluntary. Neither the teachers, nor learners or parents received compensation for their participation in the study. Learners who formed part of the control group were able to receive gross motor stimulation after the study, as the gross motor apparatus and the gross motor activities accompanying this apparatus were donated to the school and the researcher facilitated gross motor stimulation lessons afterwards. The data was kept confidential by keeping the hard copy data and electronic version in a secure location and password protected (for electronic purposes), only accessible by the researcher.

1.8 Layout of the study

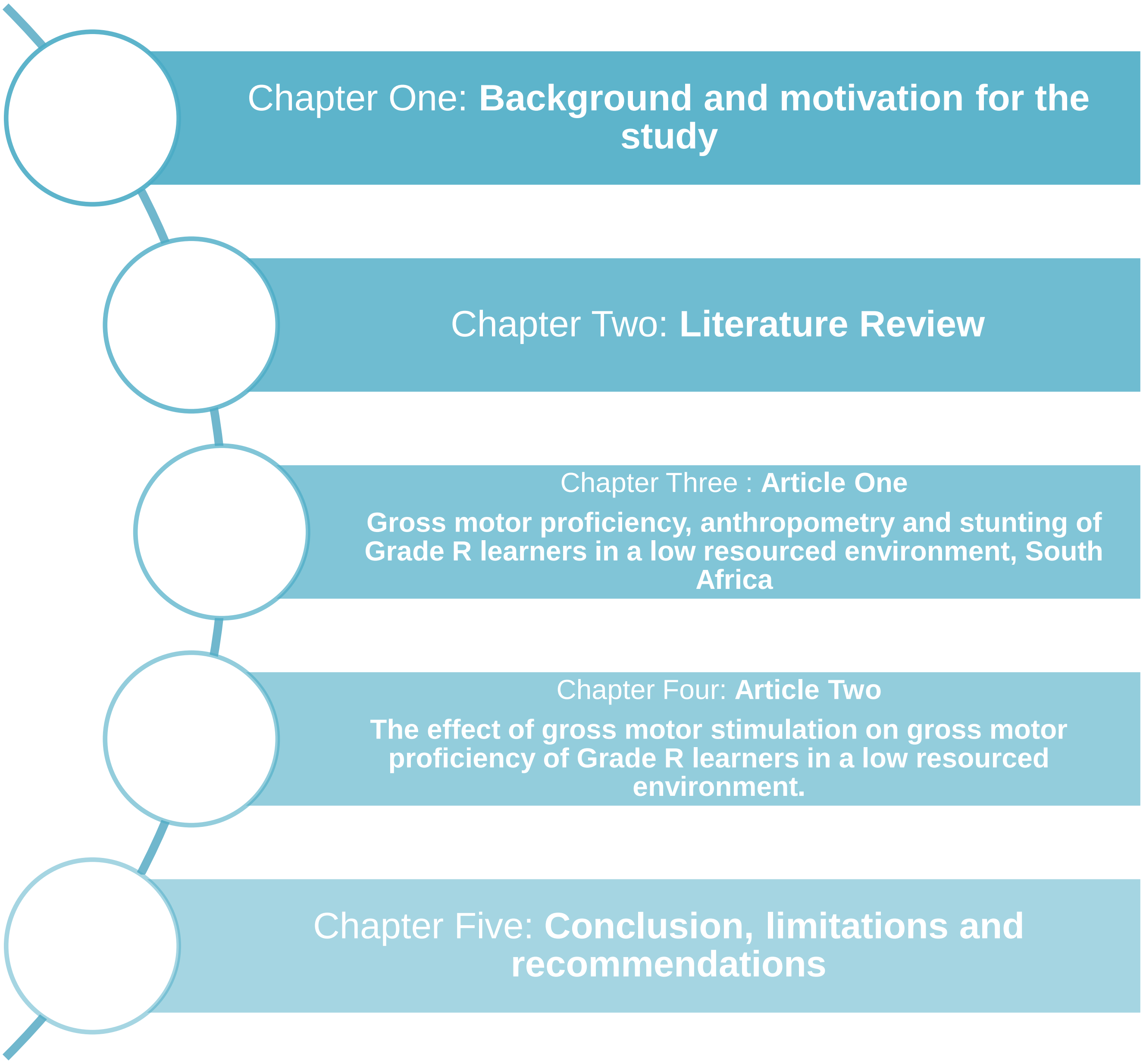


Figure 1: Structure of the study

This Master's research project is submitted in article format and outlined in five chapters, all according to the requirements of the Senate of the University of the Free State (UFS). Harvard Referencing is used for Chapter One, Two and Five, in accordance with the University of the Free State guidelines. Chapters Three and Four are written in article format, already as prescribed by the potential journal: *Child: care, health and development* (Appendix R). American Psychological Association, Seventh Edition (APA-7) referencing is used in Chapter Three and Four.

Chapter One provides background regarding the research project, including the aims, justification of the study and a brief discussion surrounding the procedure. In Chapter Two, a more in depth look into the literature of the study is reviewed. Motor proficiency and low socio-economic environments are some of the topics discussed. Chapter Three contains Article One, entitled: *Gross motor proficiency, anthropometry and stunting of Grade R learners in a low-resourced environment, South Africa.* Article One discusses the anthropometric and gross motor proficiency of the Grade R learners as well as the relation to external factors such as a low socio-economic environment and stunting. Chapter Four contains Article Two, entitled: *The effect of gross motor stimulation on gross motor proficiency of Grade R learners in a low-resourced environment.* This article discusses the gross motor intervention set up by the researcher. The results of the research articles in Chapters Three and Four are presented and interpreted in each chapter respectively. Chapter Five will be the concluding chapter, while also discussing the limitations and recommendations.

The BOT-2, referenced in the Chapters is a standardised motor proficiency test. Due to copyright protection, the data sheets and relevant information are not included in the dissertation.

1.9 Conclusion

The above overview discussed motor skills and gross motor proficiency including several related factors. Motor proficiency is multi-faceted and can be affected by several aspects, while motor proficiency itself can influence cognitive, social and physical domains. External factors such as a low-resourced environment and malnutrition should be taken into consideration when a child's motor development is considered.

According to these interacting factors, motor interventions addressing motor proficiency is of importance. Motor interventions are used to aid learners with motor delays and have been shown to be mostly beneficial. With low SES in mind, it is important to conduct motor interventions in low-resourced areas where malnutrition in learners is also a concern. The above literature has led to the aims and objectives of this study, as stipulated under section *1.3 Objectives* (page 12). A detailed discussion will follow on gross motor proficiency, low resourced environments, malnourishment, as well as the South African Grade R learner, in Chapter Two.

1.10 References

Adkins, M.M., Bice, M.R., Dinkel, D. & Rech, J.P. 2017. Leveling the Playing Field: Assessment of Gross Motor Skills in Low Socioeconomic Children to their Higher Socioeconomic Counterparts. *International Journal of Kinesiology and Sports Science*, 5(3): 28.

Adolph, K.E. & Berger, S.E. 2006. Motor development: In Damon, W., Lerner, R. M., Kuhn, D. & Siegler, R.S., *Eds.* Handbook of child psychology: cognition, perception, and language. Hoboken, NY: Wiley, Vol. 2, 6th ed., pp. 161–213.

Ayers, J.A. 2005 *Sensory Integration and the child. Understanding hidden sensory challenges*. WPS Publish America. (1) 24; (6) 99.

Bardid, F., Rudd, J.R., Lenoir, M., Polman, R. & Anderson, D.I. 2015. Cross-cultural comparison of motor competence in children from. *Frontiers in Psychology*, 6: 1–8.

Barnett, L.M., van Beurden, E., Morgan, P.J., Brooks, L.O. & Beard, J.R. 2009. Childhood Motor Skill Proficiency as a Predictor of Adolescent Physical Activity. *Journal of Adolescent Health*, 44(3): 252–259.

Botha, S. & Africa, E.K. 2020. The Effect of a Perceptual-Motor Intervention on the Relationship Between Motor Proficiency and Letter Knowledge. *Early Childhood Education Journal*, 48(6): 727–737.

Bouffard, M., Watkinson, J.E., Thompson, L.P., Causgrove Dunn, J.L. & Romanow, S.K.E. 1996. A test of the activity deficit hypothesis with children with movement difficulties. *Adapted Physical Activity Quarterly*, 13: 61–73.

Bruininks, R. H., Bruininks, B. D. 2005. *Bruininks-Oseretsky Test of Motor Proficiency* (2nd ed.). Minneapolis, MN: Pearson Assessment.

Burger, K. 2010. How does early childhood care and education affect cognitive development? An international review of the effects of early interventions for children from different social backgrounds. *Early Childhood Research Quarterly*, 25(2): 140–165.

Burton, A.W. & Rodgerson, R.W. 2001. New Perspectives on the Assessment of Movement Skills and Motor Abilities. *Adapted Physical Activity Quarterly*, 18: 347–365.

Business and Management Dictionary. 2007. London: A & C Black Publishers.

Caçola, P., Gabbard, C., Santos, D.C.C. & Batistela, A.C.T. 2011. Development of the affordances in the home environment for motor development-infant scale. *Pediatrics International*, 53: 820–825.

Campinas, U.E. 2007. Factors associated with inadequate fine motor skills in Brazilian students of different socio-economic status'. *Perceptual and Motor skills*, (105): 1187–1195.

CAPS *see* National Curriculum Statement Curriculum and Assessment Policy Statement.

Cheatum, B.A. & Hammond, A.A. 2012. *Physical activities for improving learners's learning and behavior: A guide to sensory motor development*. Human Kinetics, United States of America Illinois, pp. 1-341.

Creswell, J.W. 2003. *Research Design Qualitative, Quantitative and Mixed Methods Approaches*. Second Edition. Sage Publications: International Educational and Professional Publisher.

Coutsoudis, A. & Coovadia, H.M., 2001 'Nutrition activities in South Africa', *Nutrition Research,* 21(1): 459–463.

Diamond, A. 2000. Close interrelation of motor development and cognitive development and of the cerebellum and prefrontal cortex. *Child Development*, 71(1): 44–56.

Draper, C.E., Achmat, M., Forbes, J. & Lambert, E.V. 2012. Impact of a community-based programme for motor development on gross motor skills and cognitive function in preschool children from disadvantaged settings. *Early Child Development and Care*, 182(1): 137–152.

Dukhi, N., Sartorius, B., & Taylor, M. (2017). Stunting in children (0–59 months): what is the current trend in South Africa? *Early Child Development and Care*, *187*(12), 1874–1886. https://doi.org/10.1080/03004430.2016.1193501

Early, D.M., Irukaa, I.U., Ritchiea, S., Barbarinb, O.A., Winna, D.C., Crawforda, G.M., Fromea, P.M., Clifford, R.M., Margaret Burchinala, M., Carollee Howesc, C., Bryanta, D.M. & Piantad, R.C. 2010. How do pre-kindergarteners spend their time? Gender, ethnicity, and income as predictors of experiences in pre-kindergarten classrooms. *Early Childhood Research Quarterly*, 25: 177–193.

Elkind, D. 2008. The power of play: Learning what comes naturally. *The American Journal of Play,* Summer (1): 1–6.

Ferreira, L., Godinez, I., Gabbard, C., Vieira, J.L.L. & Caçola, P. 2018. Motor development in school - age children is associated with the home environment including socioeconomic status. *Child Care Health and Development*, 44 (6): 1–6.

Gabbard, C.P. 2008. *Lifelong Motor Development*, 5th Ed. San Francisco, CA: Pearson Benjamin Cummings. pp. 482.

Goodway, J.D., Ozmun, J.C. & Gallahue, D.L., 2019. *Understanding motor development: Infants,* children*, adolescents and adults*. (9th Ed.). Boston: McGraw-Hill, 461p.

Greenfield, C. 2004. Can run, play on bikes, jump the zoom slide, and play on swings: Exploring the value of outdoor play. *Australian Journal of Early Childhood*, 29: 1–5.

Guyton, G. 2011. Using Toys to Support Infant-Toddler Learning and Development, Young children. *ERIC*, 66: 50–54.

Hadders-Algra, M. 2000. The Neuronal Group Selection Theory: a framework to explain variation in normal motor development. *Developmental Medicine and Child Neurology,* 42: 566–572.

Hall, K., Giese, S., Access, P., African, S., Act, S., Norms, A.N., Norms, T.A. & Security, S. 2008. Addressing quality through school fees and school funding. *South African Child Gauge*, Volume? 35–40.

Hoff, E. 2006. How social contexts support and shape language development. *Developmental Review*, 26(1): 55–88.

Hohmann, M. & Weikart, D.P. 2000. Educating Young Children: Active Learning Practices for Preschool and Child Care Programs. *Educating Young Learners*, 13–41.

Inchley, J.C., Currie, D.B., Todd, J.M., Akhtar, P.C. & Currie, C.E. 2005. Persistent socio-demographic differences in physical activity among Scottish schoolchildren 1990-2002. *European Journal of Public Health*, 15(4): 386–388.

Katagiri, M., Ito, H., Murayama, Y., Hamada, M., Nakajima, S., Takayanagi, N., Uemiya, A., Myogan, M., Nakai, A. & Tsujii, M. 2021. Fine and gross motor skills predict later psychosocial maladaptation and academic achievement. *Brain and Development*, 43(5): 605–615.

Kruger, H.S., Steyn, N.P., Swart, E.C., Maunder, E.M., Nel, J.H., Moeng, L. & Labadarios, D. 2012 Overweight among children decreased, but obesity prevalence remained high among women in South Africa, 1999–2005, *Public Health Nutrition,* 15(4), 594– 599.

Madiba, S., Chelule, P. K., & Mokgatle, M. M. (2019). Attending informal preschools and daycare centers is a risk factor for underweight, stunting and wasting in children under the age of five years in underprivileged communities in South Africa. *International Journal of Environmental Research and Public Health*, *16*(14). https://doi.org/10.3390/ijerph16142589

Magill, R. A. 2011. *Motor Learning and Control: Concepts and Applications*, 9th Ed. New York, NY: McGraw-Hill, 1-480.

McNeal, J.U. 1992. *The littlest shoppers. American Demographics*, 14(2), 48–53.

Meylia, K.N., Siswati, T., Paramashanti, B.A. & Hati, F.S. 202). Fine motor, gross motor, and social independence skills among stunted and non-stunted children. *Early Child Development and Care*, 1–8.

Monyeki, K.D., Cameron, N. & Getz, B. 2000 Growth and nutritional status of rural South African children 3–10 years old: The Ellisras growth study, *American Journal of Human Biology*, 12(1): 42–49.

Morley, D., Till, K., Ogilvie, P. & Turner, G. 2015. Influences of gender and socioeconomic status on the motor proficiency of children in the UK. *Human Movement Science*, 44: 150–156.

Morse, A. & Clayton, S. 2007. UNICEF Annual Report, 1-72. Accessed August 2021.

National Centre for Educational Statistics. 31 March 2008. http://nces.ed.gov/programs/coe/glossary/s.asp. Accessed August 2021.

National Curriculum Statement Curriculum and Assessment Policy Statement – Foundation Phase Grade R. 2011. Department of Basic Education. Government Printing Works. 1-78.

Olsen, M.F., Iuel-Brockdorff, A.S., Yaméogo, C.W., Cichon, B., Fabiansen, C., Filteau, S., Phelan, K., Ouédraogo, A., Wells, J.C., Briend, A., Michaelsen, K.F., Lauritzen, L., Ritz, C., Ashorn, P., Christensen, V.B., Gladstone, M. & Friis, H. 2020. Early development in children with moderate acute malnutrition: A cross-sectional study in Burkina Faso. *Maternal and Child Nutrition*, 16(2): 1–14.

Pagani, L.S., & Messier, S. 2012. Links between motor skills and indicators of school readiness at kindergarten entry in urban disadvantaged children. *Journal of Educational and Developmental Psychology*, 2: 95–107.

Payne, G. & Isaacs, L. 2011. Human Motor Development: A Lifespan Approach. 8th Edition. *McGraw Hill,* Boston: 1-608.

Piek, J.P., Hands, B. & Licari, M.K. 2012. Assessment of motor functioning in the preschool period. *Neuropsychology Review*, 22(4): 402–413.

Pienaar, A.E., 2009. Kinderkinetics: an investment in the total well-being of children, *South African Journal for Research in Sport, Physical Education and Recreation,* 31(1), 49–67.

Pienaar, A.E. 2019. The association between under-nutrition, school performance and perceptual motor functioning in first-grade South African learners: The north-west child health integrated with learning and development study. *Health SA Gesondheid*, 24: 1–10.

Pienaar, A.E. & Kemp, C. 2014. Motor proficiency profile of grade 1 learners in the North West province of South Africa: NW-CHILD STUDY. *South African Journal for Research in Sport, Physical Education and Recreation*, 36(1): 167–182.

Pienaar, A.E., Van Rensburg, E. & Smit, A. 2011. Effect of a Kinderkinetics programme on components of children’s perceptual-motor and cognitive functioning. *South African Journal for Research in Sport, Physical Education and Recreation*, 33(3): 113–128.

Richards, M.N., Putnick, D.L., Bradley, L.P., Lang, K.M., Little, T.D., Suwalsky, J.T.D. & Bornstein, M.H. 2020. Children’s utilization of toys is moderated by age-appropriateness, toy category, and child age. *Applied Developmental Science*, 1–14.

Ruiz-Esteban, C., Andrés, J.T., Méndez, I. & Morales, Á. 2020. Analysis of motor intervention program on the development of gross motor skills in preschoolers. *International Journal of Environmental Research and Public Health*, 17(13): 1–12.

Sattelmair, J. & Ratey, J.J. 2009. Physically Active Play and Cognition: An Academic Matter? *American Journal of Play*: 365–374.

Setianingsih, Permatasari, D., Sawitri, E. & Ratnadilah, D. 2020. Impact of Stunting on Development of Children Aged 12–60 Months. *Advances in Health Science Research*. 27(ICoSHEET 2019): 186–189.

Statistics of South Africa. 2018. Economy and Finance of South Africa: 67–86. https://www.gov.za/about-sa/economy. Accessed March 2021.

Thelen, E., Schöner, G., Scheier, C. & Smith, L.B. 2001. The dynamics of embodiment: A field theory of infant perseverative reaching. *Behavioural and Brain Sciences*, 24: 1–86.

Thomas, J.R., Nelson, J.K., & Silverman, S.J. 2015. *Research methods in physical activity*. Human Kinetics. 479.

Tomaz, S.A., Jones, R.A., Hinkley, T., Bernstein, S.L., Twine, R., Kahn, K., Norris, S.A. & Draper, C.E. 2019. Gross motor skills of South African preschool-aged children across different income settings. *Journal of Science and Medicine in Sport*, 22(6): 689–694.

Twenga, J.M. & Cambell, W.K. 2002. Self-esteem and socioeconomic status: a meta analytic review. *Personality and Social Psychology Review*, 6(1): 59.

UNICEF, WHO & World Bank. 2020. Levels and trends in child malnutrition: Key findings of the 2020. Edition of the Joint Child Malnutrition Estimates. *Geneva: WHO*, 24(2): 1–16.

Van Der Walt, J., Plastow, N.A. & Unger, M. 2020. Motor Skill Intervention for Pre-School Children: A Scoping Review. *African Journal of Disability*, 9: 1–8.

Van Dyk, H. & White, C.J. 2019. Theory and practice of the quintile ranking of schools in South Africa: A financial management perspective. *South African Journal of Education*, 39(September): 1–9.

WHO Multicentre Growth Reference Study Group. 2006. Assessment of differences in linear growth among populations in the WHO Multicentre Growth Reference Study. *Acta Paediatrica Supplement*, 450, 56–65.

World Health Organisation. Charts of stunting prevalence under learners (2016). https://www.who.int/nutrition/healthygrowthproj_stunted_videos/en/ . Accessed Februrary 2020.

Williams, H.G., Pfeiffer, K.A., O'Neil, J.R., Dowda, M., McIver, K.L., Brown, W.H. & Pate, R.R. 2008. Motor skill performance and physical activity in preschool children. *Obesity*, 16(6): 1421-1426.

Chapter Two:

Literature review

Table of Contents

2.1 Introduction

This chapter will provide a detailed discussion on the gross motor development of Grade R learners, while elaborating on the impact that external factors such as economic status and nutrition have on gross motor development in general. The importance of adequate gross motor development will be discussed, with specific emphasis being placed on its association with academic achievement, cognitive abilities, physical activity participation and social development. The environment of a Grade R learner will also be explored to gain further knowledge of how external factors such as socio-economic status (SES) can affect their development. In a low socio-economic environment, malnutrition is often encountered. The relation between stunting and motor proficiency will thus be investigated. Lastly, the success of motor interventions on motor proficiency of individuals living in a low socio-economic environment will also be discussed, especially considering teacher involvement in the intervention and the required standards as stipulated by the CAPS curriculum for Grade R learners.

2.2 Importance of adequate gross motor development

Participation in sports or physical activities, encompasses the use of the body in a specialized way (Okely, Booth & Chey, 2004:243). In order to accomplish this specialized execution, one uses the body’s building blocks of movement, called gross motor skills (Okely et al., 2004:243). Gross motor competency can lead to higher participation in physical activity, which then leads to healthier fitness levels and a lower percentage of body fat (Logan, Webster, Robinson, Getchell & Pfieffer, 2015:422, Okely et al., 2004:243; Okely, Booth & Patterson, 2001:388). Several researchers support the positive effect of adequate gross motor development on self-esteem (Schoemaker & Kalverboer, 1994:135), cognitive function (Wassenberg, Kessels, Kalff, Hurks, Jolles et al., 2005:1092), academic performance (Donnelly, Hillman, Etnier, Lee, Tomporowski, Lambourne & Szabo-Reed, 2017:1198, Nourbakhsh, 2006:40), social development and lifelong participation in sport (Kambas, Michalopoulou, Fatouros, Christoforidis, Manthou et al., 2012:34; Payne & Izaacs, 2001:4). An inverse effect can also be observed, where inadequate gross motor skills can lead to lower self-esteem and anxiety in learners (Piek, Baynam & Barrett, 2006:72; Schoemaker & Kalverboer, 1994:135; Skinner & Piek, 2001:90; Ulrich, 1987:63). Children who struggle with gross motor skills may also portray cognitive delays (Wassenberg et al., 2005:1092), academic issues (Donnelly et al., 2017:1198; Nourbakhsh, 2006:40), lack of social development (Payne & Isaacs, 2001:4), and lack of participation in physical activity (Kambas et al., 2012:34). The effect of gross motor skills on academic performance and cognitive function, as well as participation in sport will be discussed in the next section.

2.2.1 Gross motor skills, academic performance and cognitive function

Cognitive functions and motor abilities make use of the same brain parts, namely the cerebellum and pre-frontal cortex (Diamond, 2000:50, De Barros, Câmara Fragoso, Bezerra de Oliveira, Cabral Filho & Manhães de Castro, 2003:173; Leonard, 2016:3). Cognitive and motor abilities also develop at the same time during ages five to 10 years old (Anderson, 2002:78). A study done on Portuguese learners aged nine to 12 years (Lopes, Santos, Pereira & Lopes, 2013:13) concluded that learners who are struggling with gross motor coordination have a higher rate ($p<.05$) of unsuccessfulness in academic achievements. The results of this study also indicated that the entire sample group presented with below average gross motor coordination (Lopes et al., 2013:13). The gross motor tasks that were assessed included balance, jumping laterally, hopping on one leg over an obstacle and shifting platforms, and were compared to academic achievements in Portuguese home language and mathematics (Lopes et al., 2013:12). According to several researchers, performance in mathematics is directly benefitted by increased physical activity and level of gross motor skills (Beck, Lind, Geertsen, Ritz, Lundbye-Jensen & Wienecke, 2016:2; Ericsson, 2008:310). Beck et al. (2016:12) conducted a study on 165 seven-year-old learners and reported that gross motor activities and math lessons integrate with one another to create the highest success rate in maths performance. Ericsson (2008:311) and Taras (2005:218) both found that improved motor skills and increased physical activity also cause improvements in academic performance. A possible explanation for the relationship between academic achievement and motor skills (Haapala, 2013:55) and/or participation in regular physical activity (Trudeau & Shephard, 2007:61)**,** is the involvement of working memory in all of the above-mentioned aspects.

Working memory is also known as short-term memory, which is the temporary storage of information. Working memory involves the storing and using of information recently received (Magill & Anderson, 2017:231). The recently stored information is combined with old memories to be able to execute skills (Magill & Anderson, 2017:231). The primary task of working memory includes making decisions, helping solve problems, helping movement production, performing evaluations/reflections, and aiding long-term memory function (Magill & Anderson, 2017:231). An increase in cognitive abilities being stimulated more during physical activity due to the involvement of working memory are reported by researchers (Kamijo, Pontifex, O'Leary, Scudder, Wu & Castelli et al., 2008:14; Trudeau & Shephard, 2007:61). Working memory directly causes a better capability to concentrate (Trudeau & Shephard, 2007:61) and improving classroom manners, which leads to an improvement in classroom performance (Alloway, Gathercole, Adams, Willis, Eaglen & Lamont, 2005:424; Trudeau & Shephard, 2007:61). Diamond (2006:87) recognises working memory as being able to retain information and to use this information in a critical, objective-driven way. For the reason that working memory is objective driven, it enhances one's ability to pay attention (Trudeau & Shephard, 2007:61). Likewise, it has been found that gross motor coordination exercises have the same effect on working memory, by facilitating cognitive functions such as paying attention (Budde, Voelcker-Rehage, Pietraßyk-Kendziorra, Ribeiro & Tidow, 2008:222; Diamond, 2006:87).

2.2.2 Sport participation and motor skills

Sport is any recreational game or form of play that requires physical activity (The Chambers dictionary, 2014:1506). A sport skill can be executed when all the fundamental movement skill building block blocks come together to perform specialized movement skills, with the correct form, accuracy and control (Goodway, Ozmun & Gallahue, 2019:15). Adequate motor skills do not just promote sport participation, but also indicates the longevity thereof (Barnett, Morgan, Beurden & Beard, 2008:8). How learners perceive their motor skill competency also plays a significant role in their sports participation (Barnett et al*.,* 2,008:8). Sports also create a platform to learn certain skills, such as furthering developmental motor skills (Côté, Strachan & Fraser-Thomas, 2007:34), improving perceptual motor skills (Nourbakhsh, 2006:44), and expanding fundamental movements skills (Hardy, King, Farrell, MacNiven & Howlett, 2010:508).

Benefits of sport participation further include the improvement of physical fitness, which in turn can lead to more positive social interactions (Tomik, Olex-Zarychta & Mynarsk, 2012:103), as well as health benefits - such as lowered blood pressure and less strain on the heart (Coakley & Burnett, 2014:88).

Recent research findings reiterate the importance of well-established motor skills for physical activity participation. De Meester, Stodden, Goodway, True, Brian, Ferkel and Haerens (2018:58) set out to establish if learners with a certain level of motor proficiency will have a certain level of physical activity they can perform at. The study took place in the United States in Ohio and included 326 nine-year-old learners (De Meester et al., 2018:59). Motor competency was measured using the Test for Gross Motor Development 2nd Ed. and moderate to vigorous physical activity was measured using ActiGraph GT3X+ accelerometers (De Meester et al., 2018:60). Learners were instructed to wear these accelerometers for five days (three weekdays and two weekend days). The accelerometer was attached to the left hip and was taken off for sleeping and any activity that involved water (De Meester et al., 2018:60). The participant group was divided into categories based on their results for motor competence: 76.07% fell into the low motor competence category, 15.64% fell into the average motor competence category; and 8.28% fell into the high motor competence category (De Meester et al., 2018:60). Learners from the average ($p=.763$) and high ($p=0.003$) motor competence category had a significantly higher chance of completing the 60 min daily recommended physical activity compared to their below average motor competency peers (De Meester et al., 2018:60).

The importance of adequate gross motor skill development during childhood years has shown to be beneficial for several developmental domains, as gross motor skills form a basis on which many important skills are built (Donnelly et al., 2017:1198; Kambas et al., 2012:34; Nourbakhsh, 2006:40; Payne & Izaacs, 2001; Schoemaker & Kalverboer, 1994:135; Wassenberg et al., 2005:1092). With the importance of gross motor skill development in mind, it is also necessary to understand how and when motor development takes place throughout the childhood years. The section below will thus be dedicated to theories and studies that report on the theoretical understanding behind motor development.

2.3 Motor development

Motor development is defined as continuous changes in our motor ability, all throughout life (Goodway et al., 2019:3; Payne & Isaacs, 2016:2). These changes are caused by specific needs of motor tasks, the individual and the environment (Goodway et al., 2019:3).

2.3.1 The four domains of motor development

A classification system originally developed by Bloom divided developmental behaviour into three domains: psychomotor, cognitive and affective (Goodway et al., 2019:12). Payne and Isaacs (2016:3) added a fourth developmental domain, the physical domain. These domains will now be discussed in detail.

a) <u>Psychomotor domain</u>

The psychomotor domain is responsible for all the structures involved in the physical motor output of a movement. This includes physical structures working together with the neuromuscular functions, such as a child catching a ball. Using the arms to catch a ball (physical structures), while including brain activation (neuromuscular functions) to lift the arms to catch the ball (Goodway et al., 2019:12; Payne & Isaacs, 2016:4).

b) <u>Cognitive domain</u>

The cognitive domain is the link between mind and body, movement and cognitive abilities. This domain explores how movement can impact cognitive performance. Learners who are exposed to motor programmes and then perform better in school subjects is an application of this domain. This is also the domain that features Jean Piaget’s work (Goodway et al., 2019:12; Payne & Isaacs, 2016:4).

c) <u>Affective domain</u>

The affective domain comprises emotions and feelings. Concepts such as self-worth and perceived competence are part of this domain. This regards how a child feels about their movement abilities (Goodway et al., 2019:12; Payne & Isaacs, 2016:4).

d) <u>Physical domain</u>

Payne and Isaacs (2016:5) branded this domain as being closely related to the psychomotor domain. The physical domain includes all the changes the body goes through, for example height and weight and has an effect on the other mentioned domains. Being incompetent in motor abilities due to being overweight, can cause feelings of low self-esteem (Payne & Isaacs, 2016:5).

2.3.2 Influences of Piaget on development

Jean Piaget is the father of the cognitive development theory (Louw & Louw, 2014:25), a theory that is based on the notion that learners want and need to explore their environments (Louw & Louw, 2014:25). Piaget's theory has four phases taking place at different points during child development: sensorimotor, preoperational thought, concrete operation and formal operations (Goodway et al., 2019:39). Piaget also developed five classifications, which are pivotal to this theory: organisation, adaption, assimilation, accommodation and equilibration (Goodway et al., 2019:39; Louw & Louw, 2014:27). The last-mentioned classifications will first be explained briefly, where-after a discussion of the four phases of Piaget's cognitive development theory will follow.

Over time, cognitive processes gain complexity, and they become more systematic and understandable. This process is called organisation (Louw & Louw, 2014:27). As a child develops, the need to make changes in the environment becomes a necessity. As the environment creates questions, a child needs to adapt to these questions and they do this by using processes such as accommodation and assimilation (Goodway et al., 2019:39; Louw & Louw, 2014:27). Assimilation is the process of information similar to old cognitive structures entering the cognitive system with an added piece of new information. If a child knows how to throw a ball but now is asked to throw with a bean bag, assimilation is involved. Throwing (old cognitive structure) remains the same, but an assimilation is being made for the properties and added new information of the bean bag (Goodway et al., 2019:39; Louw & Louw, 2014:27). After executing the skill and receiving feedback information from the instructor, the child has learned of the weight difference between the bean bag and ball, as well as the amount of strength needed to throw each. The process of learning something new is called accommodation (Goodway et al., 2019:39; Louw & Louw, 2014:27).

There is a constant, ongoing process to find balance between accommodation and assimilation (Louw & Louw, 2014:27).

The four phases of Piaget's theory; namely, the sensorimotor phase, the preoperational thought phase, concrete operations phase and formal operations phase will now be discussed.

a) <u>Sensorimotor phase</u>

The sensorimotor phase takes place between birth and two years. During this phase, emphasis is placed on how infants receive information. A baby receives information through sensory inputs using motor activities to aid in this process. Infants use a circular reaction to improve their cognitive development, meaning they recreate previous experiences that were captivating to them. The sensorimotor phase has six sub-phases (Goodway et al., 2019:40; Louw & Louw, 2014:109). Reflexes is sub-phase one and takes place between birth and one month. Infants react in a reflexive way towards stimuli from the environment (Goodway et al., 2019:40; Louw & Louw, 2014:109). Primary circular reactions represent sub-phase two and takes place between month one and month three. The infant begins to create meaning using the circular reaction. Gradually, the reflexive moments are replaced with voluntary movements (Goodway et al., 2019:40; Louw & Louw, 2014:109). Sub-phase three (namely, secondary circular reactions) takes place between month three and month nine. In this phase, the connection between actions and reactions or responses are established. A baby will begin to recreate certain actions to gain a favourable response (Goodway et al., 2019:40; Louw & Louw, 2014:109). Application of the secondary schemata to new situations is sub-phase four and takes place between months eight and month 12. In this phase, a child will begin to learn that each task has a goal (Goodway et al., 2019:41; Louw & Louw, 2014:109). Sub-phase five describes tertiary circular reactions and takes place between month 12 and month 18. A child will use old and new circular reactions to achieve a goal. In this phase, a child will start to walk - which enables them to explore their environment more thoroughly and by using a trial-and-error approach to find the best solutions to problems (Goodway et al., 2019:41; Louw & Louw, 2014:110).

Invention of new means through mental combinations is sub-phase six and takes place between month 12 and month 24. In this phase, the trial-and-error method is being replaced with a planning approach and creativity and insight will become apparent (Goodway et al., 2019:41; Louw & Louw, 2014:110).

b) Preoperational thought phase

The preoperational thought phase takes place between the ages of two and seven years and is the phase of pre-primary school learners. This is also the phase of particular interest to the current study, as participants of this study are between the ages of four and six years. In this phase, the child starts out as egocentric (only concerned with him- of herself), as they at this stage cannot decide on their viewpoints and understand the viewpoints of others. As part of egocentric behaviour, a child also tends to focus only on one part of a situation. When a gross motor activity has more than one part, a child of this age will struggle with this activity. Assimilation is an important tool to help with egocentric behaviour, by questioning the surroundings and asking “who” or “why”. A child will later evolve into having more sociably expectable behaviour (Goodway et al., 2019:42; Louw & Louw, 2014:168, McLeod, 2018: Simply Psychology).

The child’s social vocabulary is now growing bigger and he or she participates more eagerly. Playing is the number one tool in the assimilation toolbox. Pretend play becomes a way to escape their egocentric way of thought. In this phase, sensorimotor activities are now replaced with language as a way to complete tasks. Language for younger learners (two years) will be copying sounds or making noises, and will progress to forming one or two word answers or questions. In the beginning of this phase (up until five years of age) language is not used for social interaction. This phase is the start of logical thinking, but because it is not yet a well-developed skill, the child struggles with certain concepts; for example, animism and artificialism. Animism is the belief of a child that an inanimate object, like a toy, has feelings. Artificialism is the belief that objects such as the sky has been made by people. This is believed up until the age of four. Learners five- to seven years old believe that only objects that move have purpose. Assimilation is now being used by the child, by interpreting new information based on the current information that is available to the child (Goodway et al., 2019:42; Louw & Louw, 2014:168, McLeod, 2018: Simply Psychology).

This study will focus specifically on four- to six-year-old learners being grouped in the middle to later stage of the preoperational thought phase.

c) Concrete operations phase

The concrete operations phase takes place between the ages of seven and 11 years of age. This phase's most important key concept is reversibility, which is the understanding that any form of number, shape, order or position can be reversed to its original state. This enables the child to see the bigger picture from beginning to end or end to beginning. Reversibility has three categories: numbers (e.g. adding, subtracting and multiplying), categories of classes (e.g. organising according to colour or size) and spatial orientation between objects (e.g. reading maps). A balance between assimilation and accommodation is now being reached. Play time in this phase is characterized by the use of rules. This causes learners to think more critically about what they are playing (Goodway et al., 2019:42; Louw & Louw, 2014:243).

d) Formal operations phase

This phase takes place from 11 years and onwards. During this phase, learners develop the ability to think abstractly and scientifically. In this phase, a systematic approach is used to solve problems. Learners now have the ability to think past the present and no longer use only reality to form thoughts (Goodway et al., 2019:43; Louw & Louw, 2014:342).

2.3.3 Phases of motor development

Motor development can be categorized in four phases, which are based on a deductive method of theory formulation by Goodway et al. (2019:48). Motor development is ever-ongoing, and humans are constantly busy learning to move their bodies in a controlled and effective manner (Goodway et al., 2019:48).

The first phase of motor development is the reflexive movement phase. This phase is present in infants and is characterized as the first building block of motor development. Reflexes are the main way a baby receives information from the outside world; reacting with involuntary movements (Goodway et al., 2019:49). The reflexive movement phase has two subcategories: Primitive and Postural reflexes. Primitive reflexes are known as the reflexes used to gather information; that help with receiving nourishment; and to protect the baby.

Postural reflexes form the foundation for locomotor, stability and object manipulation skills. Reflexes such as crawling and grasping can later be tied to walking and holding an object (Goodway et al., 2019:49).

The second phase in motor development is the rudimentary movement phase. This is the first phase where voluntary movements as a reaction to information are used. Rudimentary movements are needed to survive and are depend on how quickly the baby matures (Goodway et al., 2019:50). Greater precision is gained in this phase, as development moves over to the third phase, called the fundamental movement phase (Goodway et al., 2019:51).

In the fundamental movement phase, learners realize that they can actively explore and experiment by means of their moving bodies. In this third phase, a child will start to respond to stimulation with more controlled motor movements. Locomotion, stabilization and object manipulation are the three most important skills for a child to conquer in this phase (Goodway et al., 2019:52). Locomotion is the ability to travel from one point to another, either walking, running or skipping. Stabilization is the ability to keep the body upright against the pull from gravitation. The ability to produce a force or reacting to either the throw or catch of a ball is called object manipulation (Goodway et al., 2019:48).

The fundamental phase has three stages, the initial stage, emerging stage and proficient stage. Another researcher (Pienaar, 2018:15) referred to these stages as the initial stage (two to three year olds), the elementary stage (four to five year olds) and the mature stage (six to seven year olds). The proficient/mature stage of the fundamental movement phase is where a Grade R learner is expected to be in their motor development. The proficient stage is known for motor movements being and becoming more organized, synchronized and controlled due to practice, opportunity and maturation (Goodway et al., 2019:53). Skills in the proficient stage will also improve in their quality as time goes by. Examples of where the quality of the action improves include the following: making better contact with the ball, hitting with better accuracy and completing the action with more precision (Goodway et al., 2019:53). Better quality can therefor also lead to better achieved quantity.

The fourth and final phase in motor development is the specialized movement phase. This phase is the accumulation of all the previously mentioned phases to create a skilful motor tool, which can be applied in everyday living situations and in sports (Goodway et al., 2019:53). Stabilizing, locomotor and manipulative skills are now combined and refined to create skills of mastery (Goodway et al., 2019:53). The ultimate goal of the specialized movement phase is lifelong participation in physical activity or being more active as adults, as well as using the motor skills to participate in sports and recreation (Goodway et al., 2019:54).

2.3.4 Different types of motor skills

The one dimensional scheme of motor skills is used to explain the basic concepts that make out the larger picture of motor development. The one dimensional scheme is made out of four parts that each contribute to this motor development picture (Goodway et al., 2019:16). Magill and Anderson (2017:7) make use of one dimensional classification systems to classify motor skills, and mention three of the four concepts addressed by Goodway et al. (2019:16).

The muscular aspect of motor development is the first part of this scheme using gross and fine motor skills to complete tasks. Gross motor skills make use of the body's larger muscles to perform tasks, while fine motor skills make use of smaller more refined muscles (Goodway et al., 2019:16). Magill and Anderson (2017:8) also noted that there are tasks (like shooting a goal in netball) that make use of both fine and gross motor skills, for example using the smaller finger muscles to give accuracy to the ball and using the larger leg muscles to generate power.

The second part to the one dimensional scheme, is the temporal aspect. This aspect uses the concept of time or timing to give motor skills meaning in the temporal series of events (Goodway et al., 2019:16). Discrete motor skills are defined as motor skills that have a specific start and ending; for example, kicking a ball. Serial motor skills are discrete skills that happen in succession; for example, dribbling a ball with a hockey stick (Magill & Anderson, 2017:9). Lastly, activities or skills that are performed for a certain period of time are called continuous motor skills (Goodway et al., 2019:16). Continuous skills have a natural starting and ending point and these skills usually involve repetitions (Magill & Anderson, 2017:9).

Thirdly, motor development takes place in certain environments. Magill and Anderson (2017:10) defined these environments using three characteristics involved in the tasks. Firstly, the type of surface that the task is being performed on; secondly, the objects being used in the task; and thirdly, the other people in the environment. Goodway et al. (2019:16) describe two types of environments, an ever-changing/unpredictable environment and an environment that is secure with no surprises. The surface, objects and/or people in the unpredictable environment are called open motor skills. Magill and Anderson (2017:10) mentioned that to perform these open motor skills with success, the child must work according to the information from the surface, the object and/or people in the environment. A child needs to take these external factors into consideration before performing their task and this consideration or planning of a skill is called externally paced skills (Magill & Anderson, 2017:10). On the other hand, motor skills executed in a consistent environment are called closed motor skills (Goodway et al., 2019:16). This environment according to Magill and Anderson (2017:10) has surfaces, objects and/or people that are unchanging. A child as no external factors to consider when initiating the movement skill and can do so when they feel ready. These skills are called self-paced skills (Magill & Anderson, 2017:10).

Lastly, as part of the one dimensional scheme, Goodway et al. (2019:16) list the functional aspects of movement on the basis of the goal they are trying to achieve. As was mentioned earlier, the three main functional movement classifications as part of the child's motor development are stability (one's ability to maintain equilibrium against gravity), locomotion (to travel from point A to B with intent) and object manipulation (to practice force on an object or to receive force from an object) (Goodway et al., 2019:16).

A main source of impact on child development, which also affects gross motor development, is the immediate environment that child development transpires in (Goodway & Rudisill, 1997:322; De Barros et al., 2003:174).

2.4 Child development and the environment

A social environment is considered to be one of the foremost factors in child development, and this includes life at home, the surrounding neighbourhood and the school setting (Rojas, Gómez, Montero, Rodríguez, Valdiva & Paiva, 2014:41).

Home environments are dictated by interactions with parents, and as Bronfenbrenner and Ceci (1994:574) emphasise, this is an important social environment for development. The neighbourhood affects child development through factors such as the available resources or opportunities present to pursue (Minh, Muhajarine, Janus, Brownwell & Guhn, 2017:171). The social development of a child is also affected by the environment (Louw & Louw, 2014:10).

2.4.1 Bronfenbrenner's bio ecological model of human development

Bronfenbrenner's bio ecological model is a globally recognized model describing human development from a contextual perspective (Louw & Louw, 2014:28). According to Bronfenbrenner (2013:723) a child is the centre point of an environment in/with which he or she interacts, while proximal and contextual processes are also present within the surrounding environment. Proximal processes are the immediate, extended interaction between the child and the environment. Such processes are pattern type and take place on a regular basis; for example, the parent-and-child relationship (Ashiabi & O'Neal, 2015:3; Bronfenbrenner & Ceci, 1994:569). Contextual processes are the environmental and social factors affecting the development of the child, but not in a direct manner (Ashiabi & O'Neil, 2015:3). An example of this is the socio-economic environments around the child (Ashiabi & O'Neil, 2015:3). In Bronfenbrenner's bio ecological model, five environments are identified: micro-, meso-, exo-, macro- and the later added chronosystem (Bronfenbrenner, 2013:723-724, Bronfenbrenner, 1977:514, Louw & Louw, 2014:28).

a) <u>Microsystem</u>

This is the starting point of the whole model, and refers to the child. It has reference to his or her closest connections, such as parents, siblings, friends, teachers and neighbours. It is also the groundwork for the proximal processes, as the above-mentioned are some of the first and most meaningful interactions a child will have in the beginning of their lives.

This system is not only about influences on the child, but also how the child influences others. The microsystem is the main setting were development takes place (Bronfenbrenner, 1977:514, Ashiabi & O'Neil, 2015:2; Krishnan, 2010:7; Louw & Louw, 2014:29,).

b) Mesosystem

This is the second system in the model, consuming the microsystem. The mesosystem focusses on the interaction between two microsystems. For example, if the child's parents dislike the child's teacher, this can create conflict within the child. Mesosystem interactions can also serve as an aid; for example, if a teacher sees that the child is struggling academically, the teacher can interact with the family for added support at home (Bronfenbrenner, 1977:515, Ashiabi & O'Neil, 2015:2; Krishnan, 2010:7; Louw & Louw, 2014:29).

c) Exosystem

This is the third layer of the model, but the first system that does not directly involve the child. This system, however, still has an influence on the child. The impact that a crippling or negative (formal or informal) exosystem interaction can have on a child's development can be dire. This means that the exosystem can affect proximal processes; for example, if financial insecurity is relevant due to a parent working for low wage, it can have a negative effect on the food security in the household (Bronfenbrenner, 1977:515, Ashiabi & O'Neil, 2015:2; Krishnan, 2010:8; Louw & Louw, 2014:29).

d) Macro system

This is the outermost layer as well as the most important layer regarding contextual processes. This layer is the groundwork for aspects that influence how the child sees the world in their microsystem. Examples of macro systems include, for example, if a depression hits the economy, one of the child's parents might lose their job, or their family might live in a neighbourhood where there is gang violence. These interactions not only affect the system/setting, but also the type of interaction the child receives from others (Bronfenbrenner, 1977:515, Ashiabi & O'Neil, 2015:2; Krishnan, 2010:7; Louw & Louw, 2014:29).

e) <u>Chronosystem</u>

This system was added in 2005, yet does not form part of the previous four layers. The chronosystem refers to time. Learners do not stay young; they grow up to be adults. In this system, time refers to what learners will experience, and when and how this will impact them continuously throughout their lives. An example of this can be if a parent walks out on their family when the child is young, how this will impact the child throughout the rest of their life (Bronfenbrenner, 2013:724, Krishnan, 2010:7; Louw & Louw, 2014:29). The environment a child finds himself or herself in plays an important role in their development.

The above-discussed environments consequently affect the development of a child; lack of high-quality environments could influence learners negatively as they grow and develop.

2.5 Socio-economic status (SES)

Socio-economic status (SES) is the combination of social and economic pressures that influence job status, income generation and social positions of a person (National Centre of Education Statistics, 2013). Quite a few studies have used certain scales or charts to identify if an environment can be classified as a low or high socio-economic environment (Australian Bureau of Statistics: SEIFA, 2006:432; Kumar, Shekhar, Kumar & Kundu, 2007:1131), and most of them use the same common identifiers, namely: income, education and housing situation. In South Africa, SES is determined by factors including employment and type of occupation, total household income and economic activity (Department of Transport, 2017:6). For the purposes of this study, low socio-economic environment and low-resourced environment will be used interchangeably, as these notions indicate the same type of environment.

The effect that the SES of a household (Ferreira, Godinez, Gabbard, Vieira & Caçola, 2018:801) or disadvantaged status of the environment (Pagani, 2012:95) has on a child, impacts differently, depending on the age of the child. Ferreira et al. (2018:804) found that learners who are in an early stage of their development are more susceptible to the negative effect thereof than older learners.

Ghosh (2013:30) states that nutritional status together with SES are indicators of fine and gross motor delays, and that under-nourishment can predict these delays. SES is not the only factor contributing to delays in motor development, in that it is accompanied by several factors, including food insecurity. Socio-economic status' role in motor developmental delays will now be discussed, where-after food insecurity will be introduced and defined.

2.5.1 Low socio-economic environments and motor development

One of many of the developmental domains negatively affected by low socio-economic environments in a child's development, is the development of motor skill competency (Ferreira et al., 2018:805). Possible reasons for motor skills being negatively affected can be insufficient opportunity, more specifically due to a lack of space to enhance these skills; or a lack of toys aiding opportunity to practice and facilitate these skills (Venetsanou & Kambas, 2010:321). Researchers also argue that in low socio-economic environments, knowledge of motor skills are either non-existing, or practicing these skills are seen as redundant by the family (especially the parents) in the child's immediate environment (Freitas, Gabbard, Caçola, Montebelo & Santos, 2013:319).

In a study on 60 Turkish pre-schoolers using the Bruininks-Oseretsky Test of Motor Proficiency, second edition (BOT-2), significant differences in gross motor skills where observed among the learners from different socio-economic backgrounds (Mülazımoğlu-Ballı, 2016:237). Learners from low socio-economic environments scored lower in manual coordination, body coordination, as well as strength and agility compared to their counterparts from high socio-economic environments (Mülazımoğlu-Ballı, 2016:237). A study done on Belgium learners between the ages of six and 11 years highlighted that girls from low socio-economic environments tend to be more at risk for delays in motor skills compared to boys from a low socio-economic environment (Vandendriessche, Vandorpe, Vaeyens, Malina, Lefevre, Lenoir & Philippaerts, 2012:117). The reason supporting this finding is that girls from low socio-economic environments had the least amount of sports participation hours per week (Vandendriessche et al., 2012:225).

Vandendriessche et al. (2012:225) also found that learners between the ages of six and nine years old in low socio-economic environments in Belgium were less active or did not partake in sports at all, compared to learners in high socio-economic environments. The total fine and gross motor proficiency of learners in the United Kingdom between the ages of four and seven years in low socio-economic environments has been reported to be inferior to those of learners from high socio-economic environments (Morley, Till, Ogilvie & Turner, 2015:150). A potential reason for this can be that learners in low socio-economic environments' motor proficiency is influenced by their immediate environment, lack of exposure to motor activities and lack of parental involvement (Morley et al., 2015:155). With regard to locomotor skills, Hardy, Reinten-Reynolds, Espinel, Zask and Okely (2012:e390) found that girls (Grades two and four, as well as Grades six, eight and ten) in low socio-economic environments in Australia were less competent than their higher socio-economic peers.

Participants (n=335) living in New South Wales Australia, between the ages of 11 to 29 months, was assessed using the Peabody Developmental Motor Scales second edition to determine their motor skills (Veldman, Jones, Santos, Sousa-Sá, & Okely, 2018:1227). Socio-demographic information was also collected from the participants parents (Veldman et al., 2018:1227). The results indicated that 23.3% of the participants scored below average for the motor skills (Veldmand et al., 2018:1228). When the motor skills results were compared to the socio-economic status of the participants, a significant indication ($p<0.05$) between low motor skills and a low socio-economic existed (Veldmand et al., 2018:1228).

In Johannesburg, South Africa it was reported that five- to six-year-old learners in low socio-economic environments who were assessed with the Bruininks-Osetersky Test of Motor Proficiency (BOT-2) presented with varying motor skill abilities. Fifty-five percent portrayed average motor skills; 40% above average and only 5% below average (Durand, Roux & Burnett, 2019:209). These findings were made after Durand et al. (2019:206) conducted a study in Johannesburg on 88 learners (51 boys and 37 girls) in five selected, early developmental centres. Although the learners tested well within the motor skill categories, backlogs were found in certain BOT-2 subtests; namely, fine motor skills and running speed and agility (Durand et al., 2019:209).

In South Africa, the connection between low socio-economic environments and Developmental Coordination Disorder (DCD) has also been researched (Du Plessis, de Milander & Coetzee, 2020:1; Venter, Pienaar & Coetzee, 2015:169). DCD as defined by the American Psychological Association (APA, 2013), is when a child struggles to learn and execute coordinated motor skills. These motor skill impairments then affect performance in school and daily tasks (APA, 2013). Du Plessis et al. (2020:3) conducted a study in Mangaung, Free State in a low-resourced environment to determine the prevalence of DCD among 242 six- to eight-year-old learners in low socio-economic environments. Learners (n=242) were assessed with the Movement Assessment Battery for Learners-2nd edition (MABC-2nd) (Du Plessis et al*.,* 2020:3).

The results indicated that 24 learners (9.9%) could be identified with possible-DCD. It was also noted for manual dexterity that 27.7% of the learners's scores placed them in the at-risk-for-DCD category (Du Plessis et al., 2020:5). In Potchefstroom, North West Province, South Africa, the DCD prevalence in 53 three- to five-year-old learners from high and low socio-economic environments were found to be 28.30% and 11.32% for at-risk DCD and severe DCD, respectively (Venter et al*.,* 2015:172). Remarkably, learners in the high socio-economic group had the highest prevalence for severe DCD (Venter et al*.,* 2015:172).

Although the research mentioned above spoke about the negative impact that a low socio-economic environment can have on motor development and skill, there are studies that mention little to no impact or even a better performance by participants in a low socio-economic environment (Gottschling-Lang, Franze, & Hoffmann, 2013:2; Kwon & O'Neill, 2020:2). In Germany Gottschling-Lang et al. (2013:2) used the Dortmund Developmental Screening for the Kindergarten to test 636 participants between the ages of three and six for early developmental risks. Comparing the results gathered from the participants screening with information gathered based on their socio-economic status, a significant correlation was found between a low socio-economic environment and fine motor skills ($P<0.05$) (Gottschling-Lang et al., 2013:3). However, no statistically significant correlation ($P=0.078$) was found between gross motor skills and a low socio-economic status (Gottschling-Lang et al., 2013:3). In America a study by Kwon and O'Neil (2020:6) found that participants living in a low socio-economic environment (at or below the indicated line of poverty in the United States) are more likely to perform better in gross motor skills (odds ratio: 2.76%) than participants in higher socio-economic environments. This finding was reached by testing 329 participants (three to six years old) with the Test of Gross Motor Development second edition and comparing it to questioners completed by a family member of the participants (Kwon & O'Neil, 2020:2).

2.5.2 Low socio-economic environments on food security

The International Food Policy Research Institute (IFRPI, 2017) explains that food security is the availability of food that is rich in nutrients and available to all social and economic classes at any time. Poverty has been a main factor affecting food security in Nigeria, for instance (Babatunde, Omotesho & Sholontan, 2007:49). Salary income can be a predictor of food security, where the lower the household income, the higher the possibility of food insecurity occurs (Muhammad & Sidique, 2019:1042). In Sri Lanka, certain socio-economic factors were determined to have a substantial influence on the nutrition of the household (Subasinghe & Wijesinghe, 2006:5). Subasinghe and Wijesinghe (2006:6) found that the level of the mother's education and the parents' occupational status and level of income all played a role in whether or not their learners will be stunted. It came to light that there is a direct correlation between a household's SES and stunting and wasting (Zottarelli, Sunil & Rajaram, 2007:1337). These researchers went further to correlate a certain aspect of the household to stunting, namely the household size (Zottarelli et al., 2007:1337).

Child development in general is effected by food insecurity, as a lack of good nutrition can cause poor health and under-stimulating environments (Cook & Frank, 2008:5) Learners from the United States of America who faced food insecurity have a higher chance of suffering from being stunted or wasted (Cook & Frank, 2008:5). In South Africa, households in low socio-economic environments experience higher food insecurity (33.1%) than those high socio-economic environments (20.5%) (Labadarios, Mchiza, Steyn, Gericke, Maunder, Davids & Parker, 2011:893).

The World Health Organization (WHO, 2016) has specified that the three malnutrition conditions are stunting (low height-for-age), wasting (low weight-for-age) and overweight. Each of these conditions will be elaborated on in the discussion that follows.

2.6 Influences of nutrition on development

2.6.1 Nutrition and malnutrition

Nutrition, according to Grantham-Mcgregor, Fernald, Kagawa and Walker (2014:30) is a factor that should be taken into consideration when one is researching child development. These researchers are also of the view that combining nutrition and childhood developmental outcomes in an intervention has the best long-term outcomes (Grantham-Mcgregor et al., 2014:30). Nutrition is seen as the seeking and obtaining of food needed for proper growth and health (The Chambers, 2014:1058). According to the WHO (2018), adequate nutrition is beneficial for intact child development, and the main benefit of balanced nutrition, is the improvements observed in the learning ability of learners (WHO, 2018). Hurley, Yousafzai and Lopez-boo (2016:357) emphasized the importance of early intervention regarding child nutrition in their review study.

The Department of Health and Human Services of the United States of America conducted research from 2015-2020 on the Dietary Guidelines for Americans and in the process highlighted the appropriate nutrition needs of learners (Reference). Gender-specific guidelines were set for four- to eight-year-olds' daily nutritional consumption (Slavin, 2012:77). According to this document, girls (four- to eight-years old) should consume 1 200 to 1 800 calories daily, consisting of 85.04 to 141.7 grams of protein; 128 to 192 grams of fruit; 192 to 320 grams of vegetables; 113.3 to 170.09 grams of grains; and 320 grams of dairy (Slavin, 2012:77). Boys (four- to eight-years old) should consume 1 200 – 2 000 calories per day; with 85.04 to 155.9 grams of protein; 128 to 256 grams of fruit; 192 to 320 grams of vegetables; 113.3 to 170.09 grams of grains; and 320 grams of dairy (Slavin, 2012:77). In South Africa, the Nutrition Information Centre of Stellenbosch University (NICUS) summarized the dietary need for learners between the ages of four and six years old (NICUS, 2015:2).

They firstly stated that milk and dairy products should be consumed in half- to three-quarters of a cup, with three to four servings per day. Meat, fish, poultry and legumes should be consumed in portion sizes of 30 to 60 grams and in two servings per day.

Fruits and vegetables should be consumed in four to five servings per day. Bread and grain products should be consumed in three servings per day, depending on the type of grain product.

For example, one slice of bread or half a cup of cereal is recommended. Sweets and treats should be seen as add-ons and never as a meal replacement (NICUS, 2015:2).

If dietary guidelines are not met, malnutrition may occur (Slavin, 2012:77; NICUS, 2015:4). Malnutrition refers to the lack in variety of nutrients, too much from one type of nutrients and too little from another, and the incapability of absorbing nutrients effectively (WHO, 2016). Malnutrition in learners creates higher chances for compromised immune systems, shorter statures as adults and even child deaths (Komaini & Mardela, 2018:7). Learners between the ages of birth and three years are especially affected by food insecurity, due the fact that this age group is characterized by a high growth and development rate (Cook & Frank, 2008:198). Furthermore, these researchers is also of the opinion that learners whose households already struggle with food insecurity are at risk for malnutrition (Cook & Frank, 2008:198). As mentioned previously, the three main types of malnutrition are stunting, wasting and underweight (WHO, 2016). Stunting occurs when a child's height is below the expected norm for their age (WHO, 2016). Wasting occurs when a child's weight is below the expected norm for their height, and underweight occurs when a child's weight is below the expected norm for their age (WHO, 2016).

Komaini and Mardela (2018:9) found that 37 out of 60 kindergarten learners (almost 62%) in Indonesia were stunted. A direct link between malnutrition and motor delays, especially fine motor skills, was found (Costa & Neto, 2019:56). Using the Motor Development Scale and Anthropometric evaluations, Costa and Neto (2019:56) tested 23 learners between the ages of 24 and 48 months in Brazil. The participants were divided into two groups, where 11 learners were placed in the "Nutrition Education and Recovery centre" and constituted the experimental group, while 12 learners in municipal care constituted the control group (Costa & Neto, 2019:56).

A statistical significant difference ($p<0.001$) was found in the average quotient for fine motor skills between the control and experimental, with the experimental group testing poorer (Costa & Neto, 2019:56). Although the motor development scale used also included global motricity, balance, body schema, spatial organisation and temporal organization, the researcher solely reported on fine motor skills.

In Africa, a correlation between malnutrition and developmental delays were found in Tanzanian learners (Sudfeld et al., 2015:2705). Using the Bayley Scales of Infant Development III (BSID-III) and stunting and wasting norms on 1 036 learners between the ages of 18- and 36-months-old, Sudfeld et al. (2015:2707) reported a correlation between stunting and wasting and motor development (Sudfeld et al., 2015:2708). In South Africa, Zere and McIntyre (2003:9) identified stunting as one of the highest problems associated with malnutrition in low socio-economic environments. According to these researchers, learners in low socio-economic environments have a three to eight time's higher chance of being underweight and stunted than those from higher socio-economic status (Zere & McIntyre, 2003:5). This conclusion was reached after studying the Living Standards and Development Survey, which collected data on 3 765 learners under the age of five years old (Zere & McIntyre, 2003:2).

2.6.2 Prevalence of stunting and wasting

The prevalence of stunting and wasting under learners has become a growing concern in several parts of the world.

UNICEF (2019:37) found that, globally between 2013 and 2018, learners between the ages of zero and just under five years had a stunting prevalence of 21.9%. In Iran, a study found that 7.5% of 70 339 learners (35 792 boys and 34 547 girls) between the ages of zero and five years old were underweight, while 12.5% were stunted and 4.4% were wasted (Payandeh, Saki, Safarian, Tabesh & Siadat, 2013:208). In Ganota India, in the district of Doda, Jammu and Kashmir, 100 learners (79 boys and 21 girls) between the ages of six and 14 years were screened to determine their nutritional status (Katoch & Sharma, 2016:1). The results revealed that 36% were stunted, 9% underweight and 2% wasted (Katoch & Sharma, 2016:5).

Zottarelli et al*.* (2007:1336) reported on the nutritional status of 10 194 Egyptian learners (3 927 urban located and 6 222 rural located) under the age of five years old (5 252 boys and 4 942 girls). Differences between the urban and rural group were seen, where 13.79% of urban learners and 21.79% of rural learners were stunted (Zottarelli et al., 2007:1337). Differences were also noted in that study between wasted and underweight status, where 2.34% of urban learners and 2.63% of rural learners were wasted, while 3.01% and 4.73% of urban and rural learners respectively were underweight (Zottarelli et al., 2007:1337).

In addition, these researchers also reported the differences between boys and girls (Zottarelli et al., 2007:1337). In boys, 19.85% were stunted; 2.86% were wasted; and 4.44% were underweight, while in the girls, 17.42% were stunted; 2.15% were wasted; and 3.66% were underweight (Zottarelli et al., 2007:1337). These differences indicated that boys had a slightly higher prevalence of stunting and wasting compared to girls (Zottarelli et al., 2007:1337). In Ethiopia, Africa, as many as 47.9% of participants (N=820) between the ages of zero and almost five years old were stunted; 30.9% were reported to be underweight; and 16.7% were wasted (Kassahun Alemu, 2013:1).

According to a document recently published by UNICEF, *The state of the world learners* (UNICEF, 2019:222), 27.4% of learners under the age of 5 in South Africa are stunted and 2.5% of this population are wasted. In the North West Province of South Africa, the prevalence of stunting and wasting as malnutrition categories in a selected group of Grade one learners were 4.29% and 7.35%, respectively (Kruger, Pienaar, Coetzee & Kruger, 2014:6). The socio-economic differences were further reported in the categories of stunted, wasted and underweight. A statistical significant difference was found among high and low socio-economic environments with regard to stunting ($p \leq 0.01$), wasting ($p = 0.08$) and underweight ($p \leq 0.01$). With regard to stunting 6.0% of low socio-economic learners and 0% of high socio-economic learners were stunted (Kruger et al., 2014:6). This study reported that 39 (6.88%) learners representing low SES and 15 learners from high SES were wasted, while 31 (5.47%) learners from low SES and only 1 (0.46%) child representing the high SES were underweight. The nutritional status of 129 learners between the ages of three- and five-years-old living in rural Limpopo in South Africa, was determined by Mushaphi, Dannhauser, Walsh, Mbhenyane, and Van Rooyen (2015:99).

Findings of the study show that in both the control and the experimental groups, 20% of the learners were stunted, 8% underweight and 5% wasted (Mushaphi et al., 2015:99). In Polokwane, South Africa, 508 six to 15-year-old school learners (209 boys and 299 girls) participated in a study to determine childhood undernutrition in rural areas (Modjadji & Madiba, 2019:5). Modjadji and Madiba (2019:5) found that 22.0% of the participants were stunted and 27.0% were underweight.

Significant differences in stunting were found between the foundation phase (Grade one to three) and intermediate phase (Grade four to seven) learners, with intermediate phase learners having a higher rate of stunting (26.2% compared to 16.6%) than the foundation phase (Modjadji & Madiba, 2019:5). Another study done in three provinces (Western Cape, Northern Cape and Free State) in South Africa, included 225 learners (ages 12 to 60 months) and the following results were reported: 13% of learners (n=30) were wasted; 58% of learners (n=131) were stunted; and 21% learners (n=47) were both wasted and stunted (Steenkamp, Lategan & Raubenheimer, 2016:29).

In South Africa, the Department of Health have secured certain measures to help prevent or at least lessen the impact of stunting and wasting on pre-school learners (Willey, Cameron, Norris, Pettifor & Griffiths, 2009:450). The main intervention measure to be addressed, as indicated by the Department of Health, was identified as the prevention of unemployment by increasing parental education (Willey et at., 2009:450). By increasing the level of education of especially mothers, household food insecurity can be minimized. As soon as food insecurity is addressed, it can lead to a lower occurrence of malnourishment.

2.6.3 Impact of stunting and wasting on child development

Several studies report on the degrading effect of malnutrition on the development of learners.

Costa and Neto (2019:56) conducted a study on 23 two- to four-year- olds in Brazil, to follow the impact of malnutrition on motor development and cognitive development. The findings revealed that fine motor skills as well as reading and writing skills were negatively affected (Costa & Neto, 2019:56).

The impact of malnutrition during the early developmental phase of a child's life was explored by Komaini and Mardela (2018:3). The study took place in North Padang, Indonesia, and differences in fundamental movement skills between stunted (n=37) and non-stunted (n=23) pre-schoolers were explored (Komaini & Mardela, 2018:6). Out of the 37 pre-schoolers that were stunted, 13 had movement skills of moderate level (Komaini & Mardela, 2018:5). Learners who were stunted showed fundamental movement skills that were less adequate than those of their non-stunted peers (Komaini & Mardela, 2016:6).

The fine and gross motor skills of 100 three- to four-and-a-half-year-old pre-schoolers in Sri-Lanka were also negatively affected by stunting and wasting (Subasinghe & Wijesinghe, 2006:5).

In the North West Province of South Africa, 816 (4.29% stunted, 4.29% wasted and 7.35% underweight) Grade 1 learners' motor abilities were tested with the Bruininks-Oseretsky Test of Motor Proficiency (BOT-2), short form (Pienaar, 2019:5). In this study, learners who were stunted ($p<0.01$) and wasted ($p=0.0034$) portrayed significant poorer performance in the motor tasks compared to well-malnourished learners (Pienaar, 2019:5). Manual dexterity, upper limb coordination and strength were identified as sub-components that learners who were stunted and wasted struggled with, compared to their well-nourished peers (Pienaar, 2019:6).

2.7 Intervention programmes

In the literature (Auxter, Pyfer & Huettig, 2012:120), motor intervention makes use of two types of approaches: top-down and bottom-up. The top-down approach is primarily used for when a specific task needs to be learned or mastered (Auxter et al., 2012:120). The end result during the top-down approach is very important and this approach uses three sub-approaches to make this a possibility (Auxter et al., 2012:120). These four sub-approaches are Task-specific (when one certain task needs to be accomplished); Cognitive motor (giving and gaining feedback); Cognitive strategic (making plans to accomplish the task) (Auxter et al., 2012:120); and Neuromotor task training (cognitive processes needed for movement; for example, action planning) (Niemeijer, Smits-Engelsman & Schoemaker, 2007:406).

The second approach is bottom-up and should be seen as all the building blocks needed to aid development. The bottom-up approach works on the principle of receiving information; processing and integrating the information; and producing an executable action, but most importantly, addressing any underlying conditions that may affect this cycle (Auxter et al., 2012:123). The bottom-up approach also uses three sub-approaches: sensory integration, perceptual motor and kinaesthetic (Auxter et al., 2012:123). The sensory integration sub-approaches develop all of the sensory organs between birth and five years (Auxter et al., 2012:123).

The next sub-approach is perceptual motor in nature and is typically used between the ages of five and seven years. The perceptual motor sub-approach uses the information presented by sensory integration to perform tasks, specifically to strengthen the bond between the sensory information and the motor skill using the specific sensory information (Auxter et al., 2012:134). The perceptual motor sub-approach was also used to design the gross motor intervention used in this study. The kinaesthetic system closely relates to sensory integration as it is also a sensory organ; however, if a child presents with a specific condition such as proprioseption the kinaesthetic approach can be used as in intervention method (Auxter et al., 2012:132). An intervention program, specifically aimed at motor skills, can improve fundamental movement skills, as stated by Logan, Robinson, Wilson and Lucaz (2012:305).

Although there are limited studies specifically endorsing intervention programs to promote gross motor skills in learners between the ages of zero and five years old, (Veldman, Jones & Okely, 2016:1), the importance of motor intervention at this young age has been shown to be successful (Logan et al., 2012:305). The general statistical length and time of the motor interventions studied was summarized as six to 15 weeks, including 480 to 1 440 minutes of intervention time (Logan et al., 2012:307). When reviewing the other studies, it was evident that all of the intervention programmes had a positive effect on the fundamental movement skills of the participants, especially with regards to object control (Logan et al., 2012:308). Lastly, it was noted that a control group is necessary for valid results, whether researching participation in free play or in physical education programmes (Logan et al., 2012:308).

An intervention of 12 weeks with 24 sessions (35 minutes a session) was implemented on Kindergarteners in Brazil (Valentini &Rudisill, 2004:221). Valentini and Rudisill (2004:221) emphasized that using the same two expert instructors (with both more than 10 years' experience in the field of motor development) for all of the sessions added to the quality of the programme. After the 12 weeks' intervention, improvements were reported in the perceived physical fitness of the participants and in their locomotor and object control skills (Valentini & Rudisill, 2004:223).

A study on 60 four- to six-year olds in Esfahan city in Iran linked increased perceptual motor abilities with better gross motor skills (Sajedi & Barati, 2014:1).

Using the Bruninks-Oseretsky test for motor proficiency, gross motor proficiency in the experimental (n=30) and control (n=30) groups were evaluated before and after intervention (Sajedi & Barati, 2014:15). The intervention period of two months included 15 sessions of perceptual motor training for one hour per day. It was clear that the experimental group showed a higher increase in gross motors skills (p=0.000) after the intervention period (Sajedi & Barati, 2014:16). The correlation between an efficient perceptual motor programme on academic achievement has also been explored (Nourbakhsh, 2006:44; Pienaar, Barhorst & Twisk, 2013:1). Nourbakhsh (2006:43) reported a positive correlation between the grade point average and participation in a perceptual motor programmes in 400, 10- to 11-year-olds Iran. Nourbakhsh (2006:45) emphasised how important perceptual motor programmes are in schools, due to the influence these programmes have on gross motor activities, which aid in the improvement of cognitive abilities.

In a South African study conducted on 812 Grade one learners, a positive correlation between academic performance and gross- and perceptual motor programme participation was reported (Pienaar et al., 2013:1). In this study, certain gross motor components related more closely with certain academic subjects than other (Pienaar et al., 2013:6). The mastery of visual perception and visual motor integration was also closely related to competency in mathematics, reading and writing, while the SES of schools also influenced academic performance (Pienaar et al., 2013:6).

Barnett et al*.* (2008:1, 5) used their motor intervention programme to address a bigger picture, as they included the issue of sport participation and lifelong physical activity participation in their study. They concluded that if a child is more competent in motor and fundamental movement skills, they are more likely to participate and to keep participating in sport (Barnett et al., 2008:12). The implementation of motor developmental programmes not only help to improve motor skill delays, but also help with sport participation and aids parents and teachers working with learners from low socio-economic environments to practice and improve their motor skills by means of these programmes (Brian & Taunton, 2018:223; Draper, Achmat, Forbes & Lambert, 2012:137; Mülazımoğlu-Ballı, 2016:237; Pagani, 2012:103).

The study of Draper and co-workers (2012:137) focused on the effect of a motor development programme on the gross motor skills and cognitive function of learners in South Africa. Researching the effect of the Little Champs intervention programme on gross motor skills, Draper et al. (2012:142) tested 118 learners between the ages of four and six with the Test of Gross Motor Development second edition. The experimental group received intervention sessions of 45-60 minutes once per week for eight months, while the control group was offered participation after the study (Draper et al., 2012:141). Learners in the experimental group portrayed significantly better locomotor ($p<0.005$) and object control ($p<0.01$) skills compared to the control group.

The success of a motor intervention programme is not always assured, and to succeed, several aspects need to be in place. Commitment from stakeholders such as teachers and parents are vital.

2.7.1 Teacher involvement in intervention programmes

The importance of parents' and teachers' involvement in motor interventions are reported in published literature. Brian and Taunton's (2018:227) programme was unique in the sense that it equipped regular teachers and parents to also present the intervention. In this study, learners (ages 40- to 67 months) in low-resourced environments gained the most from fundamental movement intervention programmes (Brian & Taunton, 2018:223). Significant improvements in locomotor and object control were observed by using a programme consisting of 30 minute sessions, twice a week, for 6 weeks (Brian & Taunton, 2018:227).

In another study, the importance of teachers participating in the presentation of motor interventions of Grade three, four and five learners are highlighted (Goh, Hannon, Webster & Podlog, 2017:88, 90). The study employed 15 teachers in the United States of America, from two different schools, with teaching experience ranging from one to 38 years (Goh et al., 2017:90). The teachers were trained in the motor intervention programme, called TAKE 10, and implemented the 10 minute sessions for eight weeks at any time during the week they had time available (Goh et al., 2017:90).

By means of weekly questionnaires, the teachers listed time constraints and special difficulties (such as space for activities) as their major concerns during the presentation of the programme, but also emphasized the motor development knowledge and competence that they had gained throughout the process (Goh et al., 2017:88). The study focussed on teacher involvement and did not provide any statistics on the impact it had on the learners.

In South Africa the literature regarding teacher participation in motor interventions are very limited. In the Northern Cape South Africa, Pienaar, Gerber and Van Reenen (2020:181) conducted a study to determine to relation between a pre-school teachers' experience in motor development and their knowledge and ability to present a pre-set up motor intervention. The participants included 51 learners between the ages of three and five years old, that were divided into an experimental (n=30) and control (n=21) group (Pienaar et al., 2020:181). Seven learners were excluded from the study between pre- and post-test due to the participants leaving the school (Pienaar et al., 2020:181). Three teachers from the school partook in a two day training workshop on how to execute and implement the motor intervention (Pienaar et al., 2020:181). The workshop included core concepts such as what is motor development, how to set up lessons and the practice thereof (Pienaar et al., 2020:183). The motor intervention consisted of one 30 minute lesson a week for 16 weeks and was presented using provided equipment (Pienaar et al., 2020:184). The researcher visited the intervention school monthly to monitor progress and report on the teacher's progress specifically (Pienaar et al., 2020:184). The Movement Assessment Battery for Children two was used to test the participants during pre- and post-testing (Pienaar et al., 2020:184). The motor results indicated that the control performed better than the experimental group, although the improvements were statistically not significant (Pienaar et al., 2020:188). The results from the qualitative observations from the teachers highlighted two major limitations: firstly that the intervention programme consisted of too much information for them to feasibly implement and secondly that they struggled to learn and retain the information and skills needed to implement the programme (Pienaar et al., 2020:190).

2.8 Motor development in South African learners

In South Africa, diversity is one of the main things the country prides its self in, having 11 official languages, ranging eco systems and many different cultures. South Africa also has diversity in the poverty line of its people, living in and between low socio-economic and high socio-economic environments (Statistics of South Africa, 2018:68). The focus of the current study is on Grade R learners from a low-resourced environment in South Africa. These learners and the environment they find themselves in will now be discussed.

2.8.1 The school environment of the Grade R learner in South Africa

In South Africa, a typical Foundation phase learner's school day is divided between four subjects: home language, first additional language, mathematics and life orientation (CAPS, 2011:6). Life Orientation and in particular the physical education part thereof, is especially relevant to the current study. The Curriculum and Assessment Policy Statement (CAPS) for Grade R learners stated that, Life Orientation can be subdivided into four subjects: beginning knowledge, creative arts, physical education and personal and social well-being (CAPS, 2011:6). Grade R learners in South Africa, according to the CAPS, are required to have 23 hours of school per week (CAPS, 2011:6). In this 23-hour school week, only two hours are allocated to physical education (CAPS, 2011:6). In the CAPS document, physical education is defined as the development of a child as a whole, through developing their gross and fine motor skills, as well as their perceptual motor skills (CAPS, 2011:9). The CAPS lists items needed by Grade R teachers to complete the curriculum for physical education. These items include jungle gyms, obstacle course items, balls and more (CAPS, 2011:26). The South African school system is divided into quintiles one to five, with one being schools that struggle financially and receive grants from the Department, and five being schools where each learner's household can pay the school fees. This study's participant group fall in the lower range of the quintiles.

2.8.2 Physical education in South African schools

Physical education not only aids in learning mechanisms, but has a positive influence on cognitive abilities in school-going learners (Trudeau & Shephard, 2007:69).

After conducting a conceptual model on the importance of physical education during the early developmental stages of a child's life, Loprinzi, Davis and Fu (2015:836) state that physical education creates the perfect vessel for furthering and developing motor skills in young learners (Loprinzi et al., 2015).

In South Africa, physical education is not a subject on its own, but integrated into the subject Life Orientation (CAPS:2011), as mentioned above. A physical education period in the school setting, especially in low socio-economic environments, is very important (Walter, 2011:782). The physical education period boosts the overall time learners in these environments spend being active (Walter, 2011:787). Learners (n=112) between the ages of eight and 12 years' physical activity throughout the day was tracked using the GT1M ActiGraph accelerometers (Walter, 2011:782). During the school day, the learners were seated for 66% of the day, with only 9% participation in moderate to vigorous activity. The Grade six learners specifically showed a decrease in moderate to vigorous activity (Walter, 2011:782).

Van Deventer (2011:828) took a deeper look at the South African physical education system, especially in the foundation (n=70) and intermediate (n=76) phase of primary schools (n=146). Teachers in primary schools were asked to complete a questionnaire on their views of physical education and curriculum information (Van Deventer, 2011:828). The results indicate that in the foundation phase of participating schools, physical education was valued higher than in the intermediate phase. The foundation phase did, however, have the least amount of qualified physical education teachers (Van Deventer, 2011:831). A possible reason for less qualified teachers in physical education within the foundation phase could be attributed to the fact that the new CAPS document sets out Life Orientation as a too broad subject where training in each aspect would not be possible (Van Deventer, 2011:828).

An emphasis has been placed on the recommendations that physical education should be implemented at a young age to assist in the growth of sport participation and physical activity (Van Deventer, 2011:838; Stroebel, Hay & Bloemhoff, 2016:221). Schools in South Africa, especially schools in lower income environments, do however not necessarily have the facilities, equipment and apparatus to facilitate the Life Orientation outcomes set for physical education (Stroebel et al., 2016:221).

A lack of exposure to motor activities (Morley et al., 2015:155) for learners in low-resource environments could be because of the lack of physical education received in the school environment (Pienaar & Kemp, 2014:176), due to time constraints, and the lack of the necessary equipment. The aforementioned could be possible reasons for these learners portraying poorer motor proficiency than their peers from higher socio-economic environments (Pienaar & Kemp, 2015:155).

2.9 Conclusion

Over the years, adequate gross motor development has proven to be an important component in child development. The importance of focusing on this component, especially during the pre-school years, have been realised by many. Adequate gross motor skills underpin benefits such as better academic performance and higher sport participation in learners. Participating in gross motor activities enhances a child's ability to critically think about tasks and solutions, carrying these skills over to apply them in academics. Also, when a child feels confident in their gross motor abilities, they will seek out opportunities to use them, such as in sport-specific or recreational play scenarios.

As a child develops through life, requirements change and therefore their motor abilities change. Piaget believed that this need for change and for exploration is what drives motor development. From birth, a child is wired to seek out opportunities to improve themselves. Learners in pre-school use an egocentric approach to development. They only see themselves and not others, up until the age of five. A pre-schooler will progress through motor development in phases to reach the point where they can partake in gross motor activities and have progression in their motor development. The total development of a child is hugely impacted by the environment they find themselves in.

A child has not only one, but multiple environments that impact their development. Bronfenbrenner's bio ecological model focusses on the five environments that impact a child's development. His model has shown that the interactions a child have will shape their development. The different environments stretch from the child's home life, how this home life interacts with the outside world and how the outside world affects their home life. A factor from the outside world that has a huge impact on the child and their development is the socio-economic status of the household.

Exploring the implications that a low socio-economic environment has on child's development, it is concluded from reported literature that child development and motor proficiency are disrupted. Reasons for this can include, amongst others, the lack of knowledge regarding motor development, the lack of opportunities and the lack of exposure to motor activities.

Another aspect affecting motor development is food security. If a household has a low SES, this can increase the difficulty to provide adequate nutrition. Households are categorised as low socio-economic when insufficiencies are determined in terms of income, education and housing situations. The SES of a household, as well as malnutrition, has been determined to affect motor development. Learners facing food insecurity have a higher chance of being stunted or wasted. Stunting and wasting are the main growth delays caused by malnutrition, which also has an effect on the motor development of learners. In the South African population, stunting is highly associated with malnutrition. The prevalence of stunting statistics showed that globally 21.9% of learners are stunted. Countries such as Indonesia (36%) and Ethiopia (47.9%) had higher percentages of stunting in their low resourced areas, while countries such as Iran (12.5%) had a lower percentage of stunting in their low resourced area.

In South Africa, it was reported that 27.4% of learners under the age of five were stunted, placing South Africa higher than the global percentage.

Taking all of the above into consideration, it is of utmost importance that learners receive the needed exposure to gross motor stimulation and are provided ample opportunities to further aid their motor development. Interventions on pre-schoolers have shown to have favourable results in improving motor skills. Interventions lasting longer than five weeks have shown to have a bigger positive effect on motor skills compared to shorter timeline interventions. Intervention programmes in low socio-economic environments have also shown positive results.

Another aspect emerging from literature reporting on intervention programmes are the involvement of teachers and parents, and the gaining of motor skill knowledge by these individuals. Programmes facilitated by teachers have also shown to have favourable results regarding the improvement of motor skills.

The South African CAPS document is very specific on the motor skills a Grade R learner needs to master, to further progress to Grade one. The policies are in place, but practical implementation is difficult as only two hours per week are allocated to physical education. Another stumbling block include the equipment needed to execute the activities, which could also be a possible reason for inadequate physical education presentation by teachers. All of this can consequently lead to poor motor proficiency of the Grade R learners. As seen in the literature, teachers may not have the required resources or knowledge to present activities set out by the CAPS. Physical education, especially in the early developmental stages of a child's life, need greater structure, goals and teachers or movement specialists who are qualified in the field.

This research study aims to shed light on the motor proficiency of Grade R learners, and to determine if a motor stimulation programme can aid in their motor proficiency levels. This study also aims to determine the prevalence of stunting in the participant group and the impact stunting could possibly have on their motor proficiency. Chapters Three and Four are written in article format and will provide results on the aforementioned aims.

2.10 References

Alloway, T.P., Gathercole, S.E., Adams, A.M., Willis, C., Eaglen, R. & Lamont, E. 2005. Working memory and phonological awareness as predictors of progress towards early learning goals at school entry. *British Journal of Developmental Psychology*, 23(3): 417–426.

Anderson, P. 2002. Assessment and development of executive function (EF) during childhood. *Child Neuropsychology*, 8(2): 71–82.

APA (AMERICAN PSYCHOLOGICAL ASSOCIATION) 2013. *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: APA

Ashiabi, G.S. & O'Neal, K.K. 2015. Child Social Development in Context. *SAGE Open*, 5(2): 1–15.

Australian Bureau of Statistics: Socio-economic indexes for areas (SEIFA) Australia 432–2006: postal areas, index of relative socio-economic advantage and disadvantage. Canberra: Australian Bureau of Statistics; 2011. https://www.abs.gov.au/websitedbs/censushome.nsf/home/seifa. Accessed 2020.

Auxter, D., Pyfer, J., Huettig, C. 2012. Principles and Methods of Adapted Physical Education and Recreation. Boston: Mc Graw Hill.

Babatunde, R.O, Omotesho, O.A., S. 2007. Food security status of farming households in Nigeria. *Pakistan Journal of Nutrition*, 6(1): 49–58.

Barnett, L.M., Morgan, P.J., van Beurden, E. & Beard, J.R. 2008. Perceived sports competence mediates the relationship between childhood motor skill proficiency and adolescent physical activity and fitness: A longitudinal assessment. International *Journal of Behavioural Nutrition and Physical Activity*, 5: 1–12.

Beck, M.M., Lind, R.R., Geertsen, S.S., Ritz, C., Lundbye-Jensen, J. & Wienecke, J. 2016. Motor-enriched learning activities can improve mathematical performance in preadolescent children. *Frontiers in Human Neuroscience*, 10(DEC2016): 1–14.

Bialystok, E. & Fergus I.M. Craik. 2006. *Lifespan Cognition Mechanisms of Change. In The Early Development of Executive functions by Adele Diamond*. 70–95.

Brian, A. & Taunton, S. 2018. Effectiveness of motor skill intervention varies based on implementation strategy. *Physical Education and Sport Pedagogy*, 23(2): 222–233.

Bronfenbrenner, U. 2013. Ecology of the family as a context for human development: Research perspectives. *Adolescents and their Families: Structure, Function, and Parent-Youth Relations*, 22(6): 1–20.

Bronfenbrenner, U. 1977. Toward an experimental ecology of human development. *American Psychologist*, 32(7): 513–531.

Bronfenbrenner, U. & Ceci, S.J. 1994. Nature-Nurture Reconceptualised in Developmental Perspective: A Bioecological Model. *Psychological review*, 101(4): 568–586.

Budde, H., Voelcker-Rehage, C., Pietraßyk-Kendziorra, S., Ribeiro, P. & Tidow, G. 2008. Acute coordinative exercise improves attentional performance in adolescents. *Neuroscience Letters*, 441(2): 219–223.

CAPS *see* National Curriculum Statement Curriculum and Assessment Policy Statement.

Coakley, J. & Burnette, C. 2014. *Sport in society. Issues and controversies, a southern African edition*. Van Schaik Publishers. Pretoria. 1-384.

Cook, J.T. & Frank, D.A. 2008. Food security, poverty, and human development in the United States. *Annals of the New York Academy of Sciences*, 1136: 193–209.

Côté, J., Strachan, L. and Fraser-Thomas, J. 2007. Participation, personal development, and performance through youth sport. *In Positive youth development through sport*. (pp. 48-60)

De Barros, K. M. F. T., Câmara Fragoso, A. G., Bezerra de Oliveira, A. L., Cabral Filho, J. E., & Manhães de Castro, R. M. 2003. Do environmental influences alter motor abilities acquisition? A comparison among children from day-care centers and private schools. *Arquivos de Neuro-Psiquiatria*, *61*(2A); 170–175.

De Meester, A., Stodden, D., Goodway, J., True, L., Brian, A., Ferkel, R. & Haerens, L. 2018. Identifying a motor proficiency barrier for meeting physical activity guidelines in learners. *Journal of Science and Medicine in Sport*, 21(1): 58–62.

Department of Transport. 2017. Chapter 3. Demographics and Socio-Economic Status. 1–12. https://www.transport.gov.za/. Accessed 2020.

Diamond, A. 2000. Close interrelation of motor development and cognitive development and of the cerebellum and prefrontal cortex. *Child Development*, 71(1): 44–56.&

Donnelly, J.E., Hillman, C.H., Etnier, J.L., Lee, S., Tomporowski, P., Lambourne, K. Szabo-Reed, A.N. 2017. Physical activity, fitness, cognitive function, and academic achievement in children: A systematic review. *Medicine and Science in Sports and Exercise*, 48: 1197-1222.

Dos Santos Da Costa, A.G. & Neto, J.L.C. 2019. Fine motor development in children with chronic malnutrition. *Brazilian Journal of Occupational Therapy*, 27(1): 54–60.

Draper, C.E., Achmat, M., Forbes, J. & Lambert, E.V. 2012. Impact of a community-based programme for motor development on gross motor skills and cognitive function in preschool children from disadvantaged settings. *Early Child Development and Care*, 182(1): 137–152.

Du Plessis, A.M., de Milander, M., Coetzee, F.F. & Nel, M. 2020. Prevalence of possible developmental coordination disorder among grade 1 learners in low socio-economic environments in Mangaung, South Africa. *South African Journal of Childhood Education*, 10(1): 1–9.

Durand, M.J., Roux, C.J. & Burnett, C. 2019. Motor and physical development of five to six year-old children in a low socioeconomic community. *African Journal for Physical, Health Education, Recreation and Dance*, 25(2): 200–215.

Ericsson, I. 2008. Motor skills, attention and academic achievements. An intervention study in school years 1-3. *British Educational Research Journal*, 34(3): 301–313.

Ferreira, L., Godinez, I., Gabbard, C., Vieira, J.L.L. & Caçola, P. 2018. Motor development in school - age children is associated with the home environment including socioeconomic status. *Child: Care Health and Development*, (August): 1–6.

Freitas, T.C.B., Gabbard, C., Caçola, P., Montebelo, M.I.L. & Santos, D.C.C. 2013. Family socioeconomic status and the provision of motor affordances in the home. *Brazilian Journal of Physical Therapy*, 17(4): 319–327.

Goodway, J.D., Ozmun, J.C. & Gallahue, D.L. 2019. *Understanding motor development: Infants,* children*, adolescents and adults*. (8th Ed.). Boston: McGraw-Hill, 424p.

Ghosh, S., Chowdhury, S.D., Chandra, A.M. & Ghosh, T. 2013. A study on the influence of occupation on development of motor activities in children. *International Journal of Adolescence and Youth*, 18(1): 23–31.

Goh, T.L., Hannon, J.C., Webster, C.A. & Podlog, L. 2017. Classroom teachers' experiences implementing a movement integration program: Barriers, facilitators, and continuance. *Teaching and Teacher Education*, 66: 88–95.

Goodway, J.D. & Rudisill, M.E. 1997. Perceived physical competence and actual motor skill competence of African American preschool children. *Adapted Physical Activity Quarterly*, 14(4): 314–326.

Gottschling-Lang, A., Franze, M., & Hoffmann, W. (2013). Associations of Motor Developmental Risks with the Socioeconomic Status of Preschool Children in North-Eastern Germany. *Child Development Research*, *2013*, 1–6. https//doi.org/10.1155/2013/790524

Grantham-Mcgregor, S.M., Fernald, L.C.H., Kagawa, R.M.C. & Walker, S. 2014. Effects of integrated child development and nutrition interventions on child development and nutritional status. *Annals of the New York Academy of Sciences*, 1308(1): 11–32.

Haapala, E.A. 2013. Cardiorespiratory fitness and motor skills in relation to cognition and academic performance in children - A review. *Journal of Human Kinetics*, 36(1): 55–68.

Hardy, L.L., King, L., Farrell, L., Macniven, R. & Howlett, S. 2010. Fundamental movement skills among Australian preschool children. *Journal of Science and Medicine in Sport*, 13(5): 503–508.

Hardy, L.L., Reinten-Reynolds, T., Espinel, P., Zask, A. & Okely, A.D. 2012. Prevalence and correlates of low fundamental movement skill competency in children. *Paediatrics*, 130(2): e390–e398.

Harrap (Firm). 2014. The Chambers dictionary. 6th Ed.

Hurley, K.M., Yousafzai, A.K. & Lopez-boo, F. 2016. Early Child Development and Nutrition: A Review of the Benefits and Challenges. *Advances in Nutrition*, 7(2): 357–363.

International Food Policy Research Institute. Retrieved form: https://www.ifpri.org/search?keyword=Food+security. Accessed 2021.

Kambas, A., Michalopoulou, M., Fatouros, I.G., Christoforidis, C., Manthou, E., Giannakidou, D., Venetsanou, F., Haberer, E., Chatzinikolaou, A., Gourgoulis, V. & Zimmer, R. 2012. The relationship between motor proficiency and pedometer-determined physical activity in young children. *Pediatric Exercise Science*, 24(1): 34–44.

Kamijo, K., Pontifex, M., O'Leary, K., Scudder, M., Wu, C.-T., Castelli, D. & Hillman, C. 2008. The effects of an afterschool physical activity program on working memory in preadolescent children. *NIH Public Access*, 23(1): 1–7.

Komaini, A. & Mardela, R. 2018. Differences of Fundamental Motor Skills Stunting and Non Stunting Preschool Children in Kindergarten in North Padang. *IOP Conference Series: Materials Science and Engineering*, 335(1): 6–11.

Kassahun Alemu, K.M. 2013. Prevalence of Malnutrition and Associated Factors Among Children Aged 6-59 Months at Hidabu Abote District, North Shewa, Oromia Regional State. *Journal of Nutritional Disorders & Therapy*, 3(1-15).

Katoch, O.R., & Sharma, A. 2016. Socioeconomic Factors, Living Conditions and Child Undernutrition among School going children in Rural Areas of district Doda, Jammu & Kashmir, India: A Preliminary Study. *Indian Journal of Nutrition*, *3*(1), 1–7.

Krishnan, V. 2010. Early Child Development: A Conceptual Model. *Childhood Council Annual Conference*, (May): 7–9.

Kruger, G., Pienaar, A.E., Coetzee, D. & Kruger, S.H. 2014. Prevalence of stunting, wasting and underweight in Grade 1-learners: The NW-CHILD study. *Health SA Gesondheid*, 19(1): 1–7.

Kumar, N., Shekhar, C., Kumar, P. & Kundu, A.S. 2007. Kuppuswamy's socio-economic status scale – Updating for 2007. *Indian Journal of Pediatrics*, 74, 1131–1132.

Kwon, S., & O'Neill, M. (2020). Socioeconomic and familial factors associated with gross motor skills among us children aged 3–5 years: The 2012 nhanes national youth fitness survey. *International Journal of Environmental Research and Public Health*, *17*(12), 1–14. https://doi.org/10.3390/ijerph17124491

Labadarios, D., Mchiza, Z.J.R., Steyn, N.P., Gericke, G., Maunder, E.M.W., Davids, Y.D. & Parker, W. 2011. Food security in South Africa: A review of national surveys. *Bulletin of the World Health Organization*, 89(12): 891–899.

Leonard, H.C. 2016. The impact of poor motor skills on perceptual, social and cognitive development: The case of developmental coordination disorder. *Frontiers in Psychology*, *7*(MAR): 1–4.

Logan, S.W., Robinson, L.E., Wilson, A.E. & Lucas, W.A. 2012. Getting the fundamentals of movement: A meta-analysis of the effectiveness of motor skill interventions in children. *Child: Care, Health and Development*, 38(3): 305–315.

Logan, S.W., Webster, E.K., Robinson, L.E., Getchell, N. & Pfieffer, K.A. 2015. The relationship between motor competence and physical activity engagement during childhood: A systematic review. *Kinesiology Review*, 4: 416–426.

Lopes, L., Santos, R., Pereira, B. & Lopes, V.P. 2013. Associations between gross Motor Coordination and Academic Achievement in elementary school children. *Human Movement Science*, 32(1): 9–20.

Loprinzi, P.D., Davis, R.E. & Fu, Y.C. 2015. Early motor skill competence as a mediator of child and adult physical activity. *Preventive Medicine Reports*, 2: 833–838.

Louw, D.A. & Louw, A.E. 2014. *Die ontwikkeling van die kind en die adolessent*. Bloemfontein: Psychology Publication. (2)1-499.

Magill, R. & Anderson, D. I. 2017. Motor learning and control: Concepts and applications. *McGraw-Hill Education 11th Ed.* 480.

McLeod, S. A. 2018. Preoperational stage. *Simply Psychology*. https://www.simplypsychology.org/preoperational.html. Accessed 2021.

Minh, A., Muhajarine, N., Janus, M., Brownell, M. & Guhn, M. 2017. A review of neighbourhood effects and early child development: How, where, and for whom, do neighbourhoods matter? *Health and Place*, 46(March): 155–174.

Modjadji, P. & Madiba, S. 2019. Childhood undernutrition and its predictors in a rural health and demographic surveillance system site in South Africa. *International Journal of Environmental Research and Public Health*, 16(17): 1-14.

Morley, D., Till, K., Ogilvie, P. & Turner, G. 2015. Influences of gender and socioeconomic status on the motor proficiency of children in the UK. *Human Movement Science*, 44: 150–156.

Muhammad, N.A. & Sidique, S.F. 2019. Determinants of Food Security Among Households in Nigeria. *Pakistan Journal of Nutrition*, 18(11): 1042–1052.

Mülazımoğlu-Ballı, Ö. 2016. Motor Proficiency and Body Mass Index of Preschool Learners: In Relation to Socioeconomic Status. *Journal of Education and Training Studies*, 4(4): 237–243.

Mushaphi, L.F., Dannhauser, A., Walsh, C.M., Mbhenyane, X.G. & van Rooyen, F.C. 2015. Effect of a nutrition education programme on nutritional status of children aged 3 - 5 years in Limpopo Province, South Africa. *SAJCH South African Journal of Child Health*, 9(3): 98–102.

National Centre for Educational Statistics. 31 March 2008. http://nces.ed.gov/programs/coe/glossary/s.asp. Accessed 2021.

Niemeijer, A.S., Smits-Engelsman, B.C.M. & Schoemaker, M.M. 2007. Neuromotor task training for children with developmental coordination disorder: A controlled trial. *Developmental Medicine and Child Neurology*, 49(6): 406–411.

Nourbakhsh, P. 2006. Perceptual-motor abilities and their relationships with academic performance of fifth grade pupils in comparison with Oseretsky Scale. *Kinesiology*, 38(1): 40–48.

Nutrition Information centre of Stellenbosch University (NICUS). 2015. Feeding Learners: 4-6 years. http://www.sun.ac.za/afrikaans/faculty/healthsciences/nicus. Accessed 2021.

Okely, A., Booth, M. & Chey, T. 2004. Relationships between body composition and fundamental movement skills among children and adolescents. *Res Q Exerc Sport*: 75:238–247.

Okely, A., Booth, M. & Patterson, J. 2001. Relationship of cardiorespiratory endurance to fundamental movement skill proficiency among adolescents. *Pediatr Exerc Sci;* 13:380–91

Pagani, L.S. 2012. Links between Motor Skills and Indicators of School Readiness at Kindergarten Entry in Urban Disadvantaged Children. *Journal of Educational and Developmental Psychology*, 2(1): 95–107.

Payandeh, A., Saki, A., Safarian, M., Tabesh, H. & Siadat, Z. 2013. Prevalence of malnutrition among preschool children in northeast of Iran, a result of a population based study. *Global Journal of Health Science*, 5(2): 208–212.

Payne, V G. & Isaacs, L.D. 2001. *Human motor development: a lifespan approach*. Boston: McGraw-Hill.

Payne, V. & Isaacs, L. 2016. *Human Motor Development: A Lifespan Approach*. Holcomb Hathaway, Publishers Inc. Arizona. 9(1-438).

Piek, J., Baynam, G. & Barrett, N. 2006. The relationship between fine and gross motor ability, self-perceptions and self-worth in children and adolescents. *Hum Mov Sci*; 25:65–75.

Pienaar, A.E. 2018. *Motor development, growth, motor backlogs, the assessment and intervention thereof: a manual for Postgraduate students in Kinderkinetics*. (4th Ed.) Xerox Potchefstroom. 538p.

Pienaar, A.E. 2019. The association between under-nutrition, school performance and perceptual motor functioning in first-grade South African learners: The north-west child health integrated with learning and development study. *Health SA Gesondheid*, 24: 1–10.

Pienaar, A.E., Gerber, B.P. & Van Reenen, I. (2020). Evaluation of inexperienced pre-school teachers' implementation of a 16-week perceptual-motor development programme in a low- resourced South African community. *African Journal for Physical Activity and Health Sciences*, December (Supplement), 177-196. DOI: https://doi.org/10.37597/ajphes.2020.s.12

Pienaar, A.E. & Kemp, C. 2014. Motor proficiency profile of grade 1 learners in the North West province of South Africa: NW-CHILD STUDY. *South African Journal for Research in Sport, Physical Education and Recreation*, 36(1): 167–182.

Pienaar, A.E., Barhorst, R. & Twisk, J.W.R. 2013. Relationships between academic performance, SES school type and perceptual-motor skills in first grade South African learners: NW-CHILD study. *Child: Care, health and development*, (February): 1–9.

Rojas, K., Gómez, D., Montero, J., Tinguaro Rodríguez, J., Valdivia, A. & Paiva, F. 2014. Development of child's home environment indexes based on consistent families of aggregation operators with prioritized hierarchical information. *Fuzzy Sets and Systems*, 241: 41–60.

Sajedi, F. & Barati, H. 2014. The effect of perceptual motor training on motor skills of preschool children. *Iranian Rehabilitation Journal*, 12(19): 14–17.

Schoemaker, M.M. & Kalverboer, A.F. 1994. Social and affective problems of learners who are clumsy: How early do they begin? *Adapted Physical Activity Quarterly*, 11(2): 130–140.

Skinner, R. & Piek, J. 2001. Psychosocial implications of poor motor coordination in children and adolescents. *Hum Mov Sci*; 20:73–94.

Slavin, J. 2012. Dietary guidelines: Are we on the right path? *Nutrition Today,* 47(5): 245–251.

Statistics of South Africa. 2018. Economy and Finance of South Africa, 67–86. Retrieved from https://www.gov.za/about-sa/economy. Accesssed 2020.

Steenkamp, L., Lategan, R. & Raubenheimer, J. 2016. Moderate malnutrition in children aged five years and younger in South Africa: Are wasting or stunting being treated? *South African Journal of Clinical Nutrition*, 29(1): 27–31.

Stroebel, L.C.E., Hay, J. & Bloemhoff, H.J. 2016. Physical education in South Africa: Have we come full circle? *South African Journal for Research in Sport, Physical Education and Recreation*, 38(3): 215–228.

Subasinghe, S.M.L. & Wijesinghe, D.G.N. 2006. The Effect of Nutritional Status on Cognitive and Motor Development of Pre-School Children. *Tropical Agricultural Research*, 18: 1–9.

Sudfeld, C.R., McCoy, D.C., Fink, G., Muhihi, A., Bellinger, D.C., Masanja, H., Smith, E.R., Danaei, G., Ezzati, M. & Fawzi, W.W. 2015. Malnutrition and Its Determinants Are Associated with Suboptimal Cognitive, Communication, and Motor Development in Tanzanian Children. *The Journal of Nutrition*, 145(12): 2705–2714.

Taras, H. 2005. Physical activity and student performance at school. *Journal of School Health*, 75(6): 214–218.

Tomik, R., Olex-Zarychta, D. & Mynarski, W. 2012. Social values of sport participation and their significance for youth attitudes towards physical education and sport. *Studies in Physical Culture and Tourism*, 19(2): 99–104.

Trudeau, F. & Shephard, R.J. 2007. Physical education, school physical activity, school sports and academic performance. *International Journal of Behavioural Nutrition and Physical Activity*, 4: 61–71.

Ulrich, B. 1987. Perceptions of physical competence, motor competence, and participation in organized sport: their interrelationships in young children. *Res Q Exerc Sport*, 58: 57–67.

UNICEF. 2019. Learners, food and nutrition: The state of the world children 2019. Retrieved from by https://www.unicef.org/media/63016/file/SOWC-2019.pdf. Accessed 2021.

Valentini, N.C. & Rudisill, M.E. 2004. Mastery motivational climate motor skill intervention: Replication and follow-up Motivational Climate, Motor-Skill Development, and Perceived Competence: Two Studies of Developmentally Delayed Kindergarten Children. *Journal of Teaching in Physical education*, 23(January): 216–234.

Van Deventer, K.J. 2011. The state and status of Physical Education in selected primary schools in four South African provinces: A survey. *African Journal for Physical, Health Education, Recreation and Dance (AJPHERD)*, 17(4): 823–840.

Vandendriessche, J.B., Vandorpe, B.F.R., Vaeyens, R., Malina, R.M., Lefevre, J., Lenoir, M. & Philippaerts, R.M. 2012. Variation in sport participation, fitness and motor coordination with socioeconomic status among Flemish children. *Pediatric Exercise Science*, 24(1): 113–128.

Veldman, S. L. C., Jones, R. A., Santos, R., Sousa-Sá, E., & Okely, A. D. (2018). Gross motor skills in toddlers: Prevalence and socio-demographic differences. *Journal of Science and Medicine in Sport*, *21*(12), 1226–1231. https://doi.org/10.1016/j.jsams.2018.05.001

Veldman, S.L.C., Jones, R.A. & Okely, A.D. 2016. Efficacy of gross motor skill interventions in young children: an updated systematic review. *BMJ Open Sport & Exercise Medicine*, 2(1): 1-7.

Venetsanou, F. & Kambas, A. 2010. Environmental Factors Affecting Preschoolers' Motor Development. *Early Childhood Education Journal*, 37(4): 319–327.

Venter, A., Pienaar, A.E. & Coetzee, D. 2015. Extent and nature of motor difficulties based on age, ethnicity, gender and socio-economic status in a selected group of three-to five-year-old children. *South African Journal for Research in Sport, Physical Education and Recreation*, 37(3): 169–183.

Walter, C.M. 2011. In-school physical activity patterns of primary school learners from disadvantaged schools in South Africa. *African Journal for Physical Health Education, Recreation and Dance (AJPHERD),* 17(1742): 780–789.

Wassenberg, R., Kessels, A.G.H., Kalff, A.C., Hurks, P.P.M., Jolles, J., Feron, F.J.M., Hendriksen, J.G.M., Kroes, M., Beeren, M. & Vles, J.S.H. 2005. Relation between cognitive and motor performance in 5- To 6-year-old children: Results from a large-scale cross-sectional study. *Child Development*, 76(5): 1092–1103.

Willey, B.A., Cameron, N., Norris, S.A., Pettifor, J.M. & Griffiths, P.L. 2009. Socio-economic predictors of stunting in preschool children - A population-based study from Johannesburg and Soweto. *South African Medical Journal*, 99(6): 450–456.

World Health Organization. 2016. Retrieved from https://www.who.int/. Accessed 2021.

Zere, E. & McIntyre, D. 2003. Inequities in under-five child malnutrition in South Africa. *International Journal for Equity in Health*, 2: 1–10.

Zottarelli, L.K., Sunil, T.S. & Rajaram, S. 2007. Influence of parental and socioeconomic factors in stunting in children under 5 years in Egypt. *Eastern Mediterranean Health Journal*, 13(6): 1330–1342.

Chapter Three: Article One

Gross motor proficiency, anthropometry and stunting of Grade R learners in a low-resourced environment, Southern Free State, South Africa

Table of Contents

Abstract:

Gross motor proficiency has been reported as a foundational part of childhood development and has lifelong importance. This study aimed to profile the gross motor proficiency and anthropometric measures of 57 Grade R learners from a low-resourced environment in Southern Free State South Africa, while also reporting on the possible correlations between gross motor proficiency and anthropometric variables. The Bruininks-Oseretsky Test of Motor Proficiency, second edition (BOT-2) was used to measure motor proficiency, while anthropometric measures constituted height, weight and upper-arm circumference. Descriptive statistics indicated that nine (15.5%) participants were stunted, while two (3.4%) were underweight. A relatively large number of participants portrayed below average upper-limb coordination (17.5%) and running speed and agility (15.7%), while 50.8% had balance skills of above or well-above average. Associations between anthropometric and gross motor proficiency variables were generally small and not statistically significant.

Key words: Gross motor skills; stunting; low-resourced environment; anthropometry

3.1 Introduction

Adequate motor proficiency is a direct predictor of life-long participation in physical activity (Bardid et al., 2015). Motor proficiency is the ability to perform motor skills sufficiently by making use of the relationship between muscle groups to create meaningful movements (Gabbard, 2008; Magill, 2013). Motor proficiency, as a foundational aspect to development, not only affects physical activity participation (Kambas, Michalopoulou, Fatouros, Christoforidis, Manthou et al., 2012), but learners who struggle with gross motor skills may also portray cognitive delays (Wassenberg et al., 2005), academic backlogs (Donnelly et al., 2017; Nourbakhsh, 2006), and lack social development (Payne & Isaacs, 2001). Inadequate gross motor skills can also negatively affect self-esteem and lead to anxiety in learners (Piek et al., 2006; Schoemaker & Kalverboer, 1994; Skinner & Piek, 2001; Ulrich, 1987).

Motor development of young learners are impacted by external factors such as the socio-economic environment they reside in (Kelly et al., 2006). Low socio-economic environments are characteristic of insufficient stimulation opportunity, more specifically a lack of space to enhance motor skills, or a lack of toys aiding opportunity to practice and facilitate motor skill development (Venetsanou & Kambas, 2010). The previously mentioned factors are all present in and influence the immediate environment of the child. Bronfenbrenner (1977) labels this immediate environment as the microsystem and highlights it as the main place where child development occurs.

Undernutrition, more specifically stunting (height-for-age) and wasting (weight-for-age), has been reported to have a negative effect on a child's motor, cognitive and physical development (Pienaar, 2009). Findings in literature report an association between stunting and motor skills (Pienaar, 2009; Nahar et al., 2020). Results reported by Nahar et al. (2020) showcased the negative impact of stunting on motor skills ($p<0.001$), specifically indicating fine ($p=0.039$) and gross ($p<0.001$) motor skills being significantly influenced. A possible reason for the negative effect of stunting on motor skills was attributed to low muscle mass caused by stunted growth (Nahar et al., 2020).

In South Africa, socio-economic status is determined by several factors, including employment and type of occupation, total household income, and economic activity (Department of Transport, 2017). In a study done by Zottarelli, Sunil and Rajaram (2007), a direct correlation between a household's socio-economic status and stunting and wasting was reported. In South Africa, Zere and McIntyre (2003) identify stunting as one of the main problems associated with malnutrition in low socio-economic environments, with these learners having a three to eight time's higher chance of being underweight and stunted than those from higher socio-economic status.

According to UNICEF (2020), one out of every three learners in South Africa are stunted. A document published by UNICEF, *The state of the world learners* (UNICEF, 2019) stated that 27.4% of learners under the age of 5 in South Africa are stunted and 2.5% of the population can be categorised as wasted. With these alarming statistics in mind and the negative effect that stunting might have on adequate motor skill development, this study aimed to create a profile of the gross motor proficiency and anthropometric measures of Grade R learners from a low-resourced environment in South Africa. The second aim was to report on the possible correlations between anthropometric measurements and gross motor proficiency variables.

3.2 Materials and methods

3.2.1 Study design

A cluster-randomised, pre-test, intervention, post-test research design was used for this study. For the purpose of setting up a descriptive profile, the motor proficiency and anthropometric measures collected during the pre-test were used. Pre-test data was also used to assess the potential association between anthropometric and gross motor proficiency variables of learners in a low-resourced environment.

3.2.2 Participants

The study participants (N=57) were from a single school in a low-resourced environment in a rural town in the Southern Free State of South Africa. Participants were included if consent was received from the parents and the participant completed an assent form.

Participants were excluded if they had any known physical disabilities, were older than 7 years, or were absent on the day of testing. Learners of the correct age, but in the special needs class, were also excluded.

3.3 Measurements

3.3.1 Measurement of anthropometric data

The height, weight and upper-arm circumference of each participant were measured. Height was measured in full centimetres using a stadiometer and weight was measured in levels of 100 grams, using an electronic scale. The upper-arm circumference of each child was measured in millimetres using a measuring tape. Body Mass Index (BMI) was calculated with weight in kilograms divided by height in meters squared. According to the Centre for Disease Control and Prevention (CDC, 2015) the following norms are used to interpret BMI scores:

Table 3.3.1.1 BMI norms in percentiles (CDC:2021)

BMI norms in percentiles (CDC: 2021)	
Less than the 5th percentile	Underweight
5th percentile to less than 85th percentile	Healthy weight
85th percentile to less than 95th percentile	Overweight
Equal or greater than the 95th percentile	Obesity

3.3.2 Stunting

To determine the prevalence of stunting (height-for-age), the following normative cut of scores were used as established by the WHO (WHO stunting charts:2016).

Table 3.3.1.2 Stunting norms (WHO:2016)

HAZ WHO classification (Height for age) Z score	
<–3SD	Severely stunted
–3SD - <–2SD	Stunted
–2SD - <–1SD	Mildly stunted
–1SD - +1SD	Normal height
>+1SD - ≤+2SD	Abnormal height

3.3.3 Bruininks-Oseretsky Test of Motor Proficiency, second edition (BOT-2)

The motor proficiency was determined by using the Bruininks-Oseretsky Test of Motor Proficiency, second edition (BOT-2). The BOT-2 is a standardized test measuring motor proficiency in individuals between the ages of 4- and 21-years-old. The BOT-2 assesses gross- and fine motor skills. The test is divided into four composites, namely: fine manual control, manual coordination, body coordination, and strength and agility (Bruininks & Bruininks 2005). The composites are further divided into 8 subtests (fine motor precision; fine motor integration; manual dexterity; bilateral integration; balance; running speed and agility; upper-limb coordination; and strength). As the focus of this study was on gross motor proficiency, only four of the subtests were selected; namely, bilateral integration, balance, running speed and agility, and upper-limb coordination. The raw scores obtained by participants were converted to scale scores and standard scores. Using these scores, the descriptive categories could be determined for each subtest. The descriptive categories (based on standard score ranges) of the BOT-2 include well below average (30 or less), below average (31-40), average (41-59), above average (60-69) and well above average (70 or greater). According to Bruininks and Bruininks (2005), the reliability for the subtests are quite high with a range between the high 0.70 to the low 0.80, and the validity correlation of the BOT-2 subtests being 0.30 and 0.40.

3.3.4 Statistical analysis

Data was captured in Microsoft Excel, from which it was imported into a SAS data base and analysed by a Biostatistician using SAS STAT 14.3 (SAS, 2017).

For descriptive statistics, quantitative variables were summarized using mean, SD, minimum, Q1, median, Q3, maximum values, while categorical variables were summarized using frequencies and percentages.

Associations between two binary categorical variables (such as gender with stunting) were evaluated using Fisher's exact test.

Associations between an ordinal categorical variable (such as the descriptive categories of balance, running speed and agility, upper-limb coordination, and bilateral coordination) with a binary variable, were evaluated using the Cochran-Mantel-Haenszel chi-square test. Lastly, the associations between a continuous variable (such as age, height, weight, body mass index, upper-arm circumference) and a binary variable (such as gender) were evaluated using ANOVA.

Pearson correlations and associated p-values ($p<0.05$) were calculated between the following two sets of variables: age, height, weight, body mass index, upper-arm circumference with balance, running speed and agility, upper-limb coordination, bilateral coordination, and body coordination. The conventional significance level of 0.05 was used for all tests, including for the p-values associated with the correlations.

3.3.5 Ethical considerations

Ethics clearance was obtained from all involved bodies, including the Health Science Research Ethics Committee (HSREC) (UFS-HSD2020/0141/2605) of the University of the Free State, the Free State Department of Education, the principal, teachers, parents and leaners. All data collection procedures adhered to the principles of the Declaration of Helsinki (Li et al., 2018). During testing, each child received a participant number and therefore no names or any physical attributes were used by which learners could be identified. The data was kept confidential by keeping the hard copy data and electronic version in a secure location and password protected (for electronic purposes), only accessible by the researchers.

3.4 Results

Fifty-seven Grade R learners with a mean age of 5.27 years (SD±0.33) were included in this study, of which 36 were girls (62.1%) and 21 were boys (37.9%). The anthropometric data of 58 learners were collected and used, whereas the motor proficiency data and age data included only 57 learners, as one child did not want to participate in all the motor proficiency activities.

3.4.1 Anthropometric data:

Table 3.1 presents descriptive statistics for the anthropometric data of the total participant group (N=57). A mean height of 107.3 cm (SD±5.68) and weight of 17.3 kg (SD±2.41) are reported. The group's mean BMI was 15.0 kg/m² (SD±1.26) and they had a mean upper-arm circumference of 15.5 cm (SD±1.29).

No statistically significant differences were noted between the boys' and girls' height, weight, BMI or upper-arm circumference. An average height of 108.1 cm was recorded for boys and 106.7 cm for girls, while boys on average weighed 17.8 kg and girls 17.0 kg. Average BMI values of 15.2 kg/m² and 14.9 kg/m² were measured for boys and girls, respectively. With regards to upper-arm circumference, the boys had a slightly larger circumference of 15.96 cm, compared to 15.47 cm for girls, although not a statistically significant difference.

Table 3.1 Anthropometric data: Descriptive statistics for the total participant group, and by gender

		Height (cm)	Weight (kg)	BMI (kg/m^2)	UAC (cm)
Total group (n=57)	*Mean*	107.26	17.34	15.03	15.55
	SD	5.68	2.41	1.26	1.29
	Min	96.00	12.30	12.86	12.50
	Q1	104.00	15.90	14.32	14.80
	Med	107.00	16.95	15.01	15.40
	Q3	111.00	18.90	15.72	16.20
	Max	120.00	27.20	19.87	20.00
Boys (n=21)	*Mean*	108.09	17.84	15.20	15.69
	SD	5.61	2.94	1.48	1.56
	Min	96.00	13.90	13.24	14.00
	Q1	105.00	15.90	14.42	14.60
	Med	108.50	17.45	14.98	15.25
	Q3	112.00	18.90	15.72	15.90
	Max	118.00	27.20	19.87	20.00
Girls (n=36)	*Mean*	106.76	17.04	14.93	15.47
	SD	5.74	2.01	1.12	1.11
	Min	96.00	12.30	12.86	12.50
	Q1	102.50	15.65	14.04	14.80
	Med	107.00	16.80	15.04	15.50
	Q3	111.00	18.80	15.67	16.25
	Max	120.00	21.50	16.94	17.80
***F-value**		0.7490	1.5382	0.6230	0.3723
p-value		0.3905	0.2201	0.4333	0.5442

BMI: Body Mass Index; UAC: Upper arm circumference; SD: standard deviation; Min: minimum; Q1: quantile one; Med: median; Q3: quantile three; Max: maximum; * F- and p values are used for the comparison of genders.

Table 3.2 presents descriptive statistics for the z-scores of the anthropometric data. For a typical population, a z-score of 0 is expected. The current population had a somewhat lower mean weight, height and BMI for age than the "standard" population, since all means are negative. Girls had slightly lower mean z-scores than boys for weight, height and BMI, although these differences were not statistically significant. The height-for-age, together with the World Health Organization's data indicated that nine learners were stunted and two were underweight.

Table 3.2 Descriptive statistics for anthropometric z-scores of the total group and by gender.

		Height (cm)	**Weight (kg)**	**BMI (kg/m^2)**	**Height-for-age (stunting)**
Total participant group (N=57) Z-scores	*Mean*	-0.72	-0.59	-0.21	-0.72
	SD	1.05	0.91	0.89	1.05
	Min	-2.67	-2.72	-1.87	-2.67
	Q1	-1.36	-1.10	-0.68	-1.36
	Med	-0.55	-0.64	-0.11	-0.55
	Q3	-0.04	-0.05	0.31	-0.04
	Max	1.47	2.31	2.73	1.47
Boys (n=21) Z-scores	*Mean*	-0.61	-0.45	-0.10	-0.61
	SD	1.04	1.01	1.05	1.04
	Min	-2.62	-1.94	-1.69	-2.62
	Q1	-1.04	-1.10	-0.65	-1.04
	Med	-0.53	-0.48	-0.11	-0.53
	Q3	0.12	-0.17	0.35	0.12
	Max	0.96	2.31	2.73	0.96
Girls (n=36) Z-scores	*Mean*	-0.78	-0.67	-0.27	-0.78
	SD	1.07	0.84	0.79	1.07
	Min	-2.67	-2.72	-1.87	-2.67
	Q1	-1.55	-1.12	-0.88	-1.55
	Med	-0.75	-0.67	-0.14	-0.75
	Q3	-0.05	-0.03	0.28	-0.05
	Max	1.47	0.93	1.00	1.47

BMI: Body Mass Index; UAC: Upper arm circumference; SD: standard deviation; Min: minimum; Q1: quantile one; Med: median; Q3: quantile three; Max: maximum; * F- and P values are used for the comparison of genders.

3.4.2 Gross motor proficiency data:

Table 3.3 presents the descriptive statistics for the participant group's motor components based on each component's scale score. The table also includes the motor composite body coordination (balance and bilateral coordination combined), reporting a mean percentile of 64.2%, indicating average performance by the participant group. No statistically significant differences were found between genders.

Table 3.4 reflects the descriptive category for each of the motor component subtests, with none of the participants scoring in the well below average category. A relative high number of participants scored in the above average (33.3%) and well above average (17.5%) categories for balance. All together 17.5% of participants scored in the below average category for upper-limb coordination, while 15.8% fell in the below average category for running speed and agility. With regards to the body coordination composite (balance and upper-limb coordination), 26.3% of the participants scored in the above average category. This percentage could be affected by the high scores in the balance subtest. The results portray no statistically significant differences between the gross motor proficiency of boys and girls in the group.

Table 3.3 Descriptive statistics for the motor components of the participant group and by gender

		ULC (ss)	RSA (ss)	Balance (ss)	Bilateral (ss)	Body Co (SD)	Body Co %
Total participant group (N=57)	*Mean*	15.74	14.58	18.93	16.02	55.39	64.16
	SD	5.19	3.76	5.63	3.87	9.45	25.83
	Min	6.00	6.00	8.00	10.00	37.00	10.00
	Q1	12.00	12.00	15.00	13.00	49.00	46.00
	Med	16.00	15.00	19.00	16.00	54.00	66.00
	Q3	19.00	17.00	23.00	18.00	61.00	86.00
	Max	32.00	24.00	31.00	28.00	80.00	99.00
Boys (n=21)	*Mean*	14.62	15.33	17.90	15.90	54.05	60.29
	SD	3.54	3.28	4.30	4.29	9.30	25.06
	Min	7.00	10.00	11.00	10.00	41.00	18.00
	Q1	12.00	13.00	15.00	13.00	48.00	42.00
	Med	16.00	15.00	18.00	16.00	53.00	62.00
	Q3	17.00	17.00	21.00	18.00	60.00	84.00
	Max	20.00	22.00	27.00	28.00	80.00	99.00
Girls (n=36)	*Mean*	16.39	14.14	19.53	16.08	56.17	66.42
	SD	5.90	3.99	6.26	3.67	9.58	26.35
	Min	6.00	6.00	8.00	10.00	37.00	10.00
	Q1	11.50	11.50	15.00	14.00	49.00	46.00
	Med	15.00	14.00	20.00	15.50	55.00	69.00
	Q3	21.50	16.50	24.00	19.00	63.50	91.00
	Max	32.00	24.00	31.00	24.00	74.00	99.00
F-value		1.5549	1.3499	1.1039	0.0277	0.6625	0.7438
p-value		0.2177	0.2503	0.298	0.8683	0.4192	0.3922

ULC (ss): Upper-limb coordination scale score; RSA (ss): Running speed and agility scale score; Balance (ss): Balance scale score; Bilateral (ss): Bilateral coordination scale score; Body Co (SD): Body Coordination standard score; Body Co %: Body Coordination score percentage; SD: standard deviation; Min: minimum; Q1: quantile one; Med: median; Q3: quantile three; Max: maximum; * F- and p values are used for the comparison of genders.

Table 3.4 BOT-2 descriptive categories of motor component subtests for the participant group and by gender

		ULC (ss)		RSA (ss)		Balance (ss)		Bilateral (ss)		Body Co (SD)	
		n	*%*	*N*	*%*	*N*	*%*	*n*	*%*	*n*	*%*
Total participant group (N=57)	*B-Average*	10	17.5	9	15.8	2	3.5	3	5.3	1	1.8
	Average	35	61.4	42	73.7	26	45.6	43	75.4	37	64.9
	A-Average	9	15.8	6	10.5	19	33.3	9	15.8	15	26.3
	WA-Average	3	5.3	0	0.0	10	17.5	2	3.5	4	7.0
Boys (n=21)	*B-Average*	4	19.1	2	9.5	0	0.0	1	4.8	0	0.0
	Average	16	76.2	17	80.9	11	52.4	17	80.9	15	71.4
	A-Average	1	4.8	2	9.5	9	42.9	2	9.5	5	23.8
	WA-Average	0	0.0	0	0.0	1	4.8	1	4.8	1	4.8
Girls (n=36)	*B-Average*	6	16.7	7	19.4	2	5.6	2	5.6	1	2.8
	Average	19	52.8	25	69.4	15	41.7	26	72.2	22	61.1
	A-Average	8	22.2	4	11.1	10	27.8	7	19.4	10	27.8
	WA-Average	3	8.3	0	0.0	9	25.0	1	2.8	3	8.3
Chi-square statistic		3.2392		0.3475		0.7906		0.1083		0.2194	
p-value		0.0719		0.5555		0.3739		0.7420		0.6395	

ULC (ss): Upper-limb coordination scale score; RSA (ss): Running speed and agility scale score; Balance (ss): Balance scale score; Bilateral (ss): Bilateral coordination scale score; Body Co (SD): Body Coordination standard score; %: Percentage of the BOT 2 descriptive category of the participant group; B-Average: Below average; A-Average: Above average; WA-Average: Well above average

Table 3.5 represents the Pearson correlation coefficients between anthropometric data and gross motor components for the total participant group. The correlations vary between -0.2 and 0.2 and can therefore be labelled as "small"; none of the correlations is statistically significant (Hinke et al., 2003).

Table 3.5 Pearson correlation coefficients between anthropometric data and gross motor components for the total participant group (N=57)

		ULC (ss)	**RSA (ss)**	**Balance (ss)**	**Bilateral (ss)**	**Body Co (SD)**	**Body Co %**
Height (cm)	*r*	-0.0044	0.1329	-0.1331	-0.0496	-0.1257	-0.1843
	p	0.9739	0.3243	0.3236	0.7142	0.3515	0.1699
Weight (kg)	*r*	-0.0506	0.0332	-0.0035	-0.0733	-0.0543	-0.1132
	p	0.7088	0.8062	0.9796	0.5877	0.6885	0.4017
BMI (kg/m²)	*r*	-0.0839	-0.0929	0.1915	-0.0373	0.1020	0.0843
	p	0.5349	0.4920	0.1535	0.7827	0.4504	0.5330
UAC (cm)	*r*	-0.0431	0.0522	0.1251	0.1405	0.1377	0.0705
	p	0.7504	0.6996	0.3539	0.2973	0.3070	0.6022
Z-score Height-for-age	*r*	0.0158	0.2335	-0.0333	0.0825	0.0167	-0.0631
	p	0.9073	0.0804	0.8060	0.5419	0.9019	0.6411
Z-score Weight-for-age	*r*	-0.0350	0.1121	0.1063	0.0502	0.0897	0.0169
	p	0.7960	0.4064	0.4311	0.7104	0.5069	0.9006
Z-score BMI	***r***	-0.0763	-0.0892	0.1986	-0.0341	0.1103	0.0910
	p	0.5726	0.5094	0.1386	0.8013	0.4140	0.5007

ULC (ss): Upper-limb coordination scale score; RSA (ss): Running speed and agility scale score; Balance (ss): Balance scale score; Bilateral (ss): Bilateral coordination scale score; Body Co (SD): Body Coordination standard score; Body Co %: Body Coordination percentage; UAC: Upper-arm circumference; Z BMI: Z-scores for Body Mass Index

3.5 Discussion

The anthropometric profile for the participant group compiled from this study showed a mean average height of 107.3 cm, weight of 17.3 kg, BMI of 15.03 kg/m² and upper-arm circumference of 15.6 cm. According to WHO (2016), the preferred height for 5-year-old boys are 110.0 cm and for girls 109.4 cm. The preferred BMI for 5-year-old boys are 15.2 kg/m² and for girls 15.3 kg/m². Compared to WHO guidelines (2016), the participant group's anthropometric data is slightly below the expected standards. Two (3.5%) out of the 57 participants were underweight and nine (15.5%) were stunted.

In South Africa, the prevalence of stunting in low-resourced environments has been widely researched across the provinces. In the North West province 4.53% girls (n=397) and 4.06% boys (n=419) in Grade one were reported to be stunted (Kruger et al., 2014). Low-resourced schools of quantile one to three status have a 3.88% – 10.7% higher rate of stunting than schools in quantile four and five (Kruger et al., 2014). In Mpumalanga, 18% of learners between the ages of one and four years old (n=671) were reported as being stunted in 2010 (Kimani-Murage et al., 2010). In Johannesburg and Soweto, 213 from 1186 (18%) learners younger than three years were stunted (Willey et al., 2009). In Bloemfontein in the Free State, 4% of Grade one learners from a sample population of 187 were stunted (Brits et al., 2013). Although the current study had a small participant group, a high percentage of stunting was recorded, echoing the results from Mpumalanga, Johannesburg and Soweto. The results of the study under discussion was also slightly higher than the results from the North West and Bloemfontein. Unfortunetly, no new data could be found on more recent studies reporting on stunting in South Africa.

Regarding the gross motor proficiency profile of the participant group, 17.5% of the participants showed below average upper-limb coordination. A slightly higher percentage has been reported in the findings of Dighe et al. (2017) in India, where 26.13% of 111 five- to seven-year olds had below average upper-limb coordination and 8.11% performed on a well below average level. Dighe et al. (2017) have explained that low height and weight, as well as short limb length could be a possible factor explaining why learners struggle with upper-limb coordination activities.

These researchers also expressed the importance of age, stating that older learners perform better than younger learners in activities requiring coordination (Dighe et al., 2017). Chatterjee et al. (1992) found that coordination skills should be mature by the ages of 12- to 15 years. This statement has also been echoed by Hadzovic, Ilic, & Veljkovic (2020) and their findings regarding the upper-limb coordination of participants in the first and third grade. The participants included 79 children between the ages of seven and nine years old, all from the same primary school in Serbia (Hadzovic et al., 2020). The main focus of the results were how age impacted the different coordination subtest of the BOT-2 (Hadzovic et al., 2020). Using the Cohen criterion the impact maturation on the selected subtests were evaluated and found that age had an effect on how well a subtest was performed (Hadzovic et al., 2020). The current study also found that more boys (76.2%) tested in the average category for upper-limb coordination than girls (52.8%). Pienaar and Kemp (2014) noted a gender difference in Grade 1 learners regarding upper-limb coordination mean standard scores, with boys (mean=8.2) performing better than girls (mean=7.6).

A large number of participants in the current study portrayed above average (33.3%) and well above average (17.5%) balance skills. These findings tie in with previous literature stating that learners from low-socioeconomic environments have above average balance skills (Morley et al., 2015; Pienaar & Kemp, 2014). Fjørtoft (2004) found that the balancing skills of learners are affected by the type of environment they find themselves in. The more ever changing an environment is, the better a child's balance skills will be (Fjørtoft, 2004). Learners from low-resourced environments develop balancing skills in accordance with their environment (lack of roads, rocks and trees to climb on and over) and reap the reward.

Lastly, no significant correlations were found between anthropometric and gross motor profiles. A possible reason for this could maybe be that this population group's anthropometric data was only slightly lower than average child according to the WHO standards (2016) and that the impact this could have had on the motor performance was not large enough.

In correspondence to our findings, Van der Walt et al. (2020) reported an association between low height/weight and manual dexterity, while Meylia et al. (2020) also reported significant correlations between stunting and fine motor skills, but not between stunting and gross motor skills. Other literature has, however, recorded correlation between stunting and impaired motor development (Subasinghe & Wijesinghe, 2006; Pienaar, 2019). In the North West Province of South Africa, the motor proficiency abilities of 816 Grade 1 learners (4.29% stunted, 4.29% wasted and 7.35% underweight) were tested using the Bruininks-Oseretsky Test of Motor Proficiency, short form (Pienaar, 2019). In this study, learners who were stunted (3.68, $p<0.01$) and wasted (2.74, $p=0.0034$) showed poor performance in the motor proficiency tasks (Pienaar, 2019). In the study of Pienaar (2019), manual dexterity, upper-limb coordination and strength are identified as sub-components that stunted and wasted learners struggled with, when compared to their well-nourished peers.

Subasinghe and Wijesinghe (2006:5) evaluated 100 three to four-and-a-half-year-old pre-schoolers in Sri-Lanka with the early screening inventory for preschool learners. Their study reported that fine and gross motor skills were negatively affected by stunting and wasting. Another study done by Komaini and Mardela (2016) reported that kindergarten learners in Indonesia who are stunted, showed fundamental movement skills that were less adequate than those of the non-stunted learners. A recent study conducted in Bangladesh on 236 six-month- old; 212 15-month-old; and 189 24-month-old learners indicated a correlation between stunting and impaired motor skills (Nahar et al., 2020). Although conducted on younger learners than our study, their results revealed that stunted learners had significantly poorer motor skills than non-stunted learners ($p<.001$). According to the z-score results, the fine- ($p=.039$) and gross ($p<.001$) motor skills of stunted learners were lower than those of nun-stunted learners (Nahar et al., 2020). Lower fine motor skill levels were observed in stunted boys ($p=.027$) when compared to stunted girls (Nahar et al., 2020).By finding no correlation between stunting and motor proficiency, our study was in accordance with one or two studies, but contradicting to most other studies. A possible reason for most other studies reporting a correlation between stunting and motor proficiency could be that they had much larger sample groups than the current study had, which could increase the amount of data available.

These studies also used different assessment tools, for example the BOT-2 Ed. short form instead of selected composites (as used in this study), or they made use of a screening form; for example, the Bayley Scales of Infant and Toddler Development-III. The participants' ages were also slightly younger or older compared to our study, where a developmental factor could have influenced the reported correlations.

3.6 Conclusion

Based on the anthropometric profile, it is alarming that 15.5% of the participants showed stunted growth, and that the group also portrayed below expected height, weight and BMI for age. The motor proficiency profile identifies upper-limb coordination and running speed and agility as gross motor skills that participants from a low-resourced environment struggled with, while their balance skills were mainly on or above standard.

3.7 Limitations and Recommendations

Research limitations encountered was mainly the impact of Covid-19 on the daily operations of the South African school system. Schools reopened for the 2021 academic year 2 weeks after the initial opening day, and the number of learners that could attend school per day were limited. Participants were new to the school environment at time of data collection, which could have affected their performance.

Based on the findings, it is recommended that more in-depth research on young learners's motor proficiency and nutritional status are conducted. Future research should also specifically include larger sample sizes from low-resourced environments. Information in this regard can lead to nutritional interventions if stunting or any other malnutrition is identified. Practically, school systems can benefit from the respective anthropometric and motor proficiency profiles by addressing motor delays early on and aiding learners in their motor development and nutritional status. Also, the work relationship between professionals specializing in motor development and dieticians can be empowered to further promote child development.

Acknowledgements

Sincere gratitude is expressed to Prof R Schall for the statistical analysis of the data. We would also like to acknowledge and thank the 2021 B. Biokinetics fourth-year students for their assistance in collecting the data. Lastly, thank you to the Post-Graduate School of the University of the Free State for funding a writing dyad workshop.

3.8 References

Bardid, F., Rudd, J.R., Lenoir, M., Polman, R. & Anderson, D.I. (2015). Cross-cultural comparison of motor competence in children from. *Frontiers in Psychology*, 6: 1–8.

Brits, H., Augustyn, R., Bezuidenhout, E., Cillie, M., Vuuren, R.J.V. & Joubert, G. (2013). The nutritional status of Grade 1 pupils, in Bloemfontein, South Africa and its association with socio-demographic data. *African Journal of Primary Health Care and Family Medicine*, 5(1): 1–5.

Bronfenbrenner, U. (1977). Toward an experimental ecology of human development. *American Psychologist*, 32(7): 513–531.

Bruininks, R. H., Bruininks, B. D. (2005). *Bruininks-Oseretsky Test of Motor Proficiency* (2nd ed.). Minneapolis, MN: Pearson Assessment.

Centre for Disease Control and Prevention (2021). As retrieved from www.cdc.gov>assessing>bmi>learnerss_bmi. Accessed 2021.

Chatterjee, S., Mondal, A. and Das, N. (1992) Physical and Motor Fitness level of Indian School going Boys. *Journal of sports Med. Phys. Fitness*, (2)33.

Department of Transport. (2017). Chapter 3. Demographics and Socio-Economic Status. 1–12.

Dighe, A.D., Dhote, S., Palekar, T., Pande, A. & Yengde, P. (2017). Assessment of upper limb coordination using Bruininks-Oseretsky Test of Motor Proficiency, 2nd edition (BOT-2), in 5-15 years' school going children. *International Journal of Healthcare and Biomedical Research*, (April Volume 3): 62–69.

Donnelly, J.E., Hillman, C.H., Etnier, J.L., Lee, S., Tomporowski, P., Lambourne, K. & Szabo-Reed, A.N. (2017). Physical activity, fitness, cognitive function, and academic achievement in children: A systematic review. *Medicine and Science in Sports and Exercise*, (48): 1197-1222.

Fjørtoft, I. (2004). Landscape as Playscape: The Effects of Natural Environments on Children s Play and Motor Development. *Child & Youth services*, 14(2): 1–24.

Gabbard, C.P. (2008). Lifelong Motor Development, 5th Ed. San Francisco, CA: Pearson Benjamin Cummings.

Hadzovic, M., Ilic, P., & Veljkovic, A. A. (2020). Differences in the Upper-Limb Coordination of Primary School Children. *Baltic Journal of Sport and Health Sciences*, *1*(116) 1-9. https://doi.org/10.33607/bjshs.v1i116.897

Kambas, A., Michalopoulou, M., Fatouros, I.G., Christoforidis, C., Manthou, E., Giannakidou, D., Venetsanou, F., Haberer, E., Chatzinikolaou, A., Gourgoulis, V. & Zimmer, R. (2012). The relationship between motor proficiency and pedometer-determined physical activity in young children. *Pediatric Exercise Science*, 24(1): 34–44.

Kelly Y, Sacker A, Schoon I, Nazroo J. (2006) Ethnic differences in achievement of developmental milestones by 9 months of age: the Millennium Cohort Study. *Dev Med Child Neurol*, 48: 825-830.

Kimani-Murage, E.W., Kahn, K., Pettifor, J.M., Tollman, S.M., Dunger, D.B., Gómez-Olivé, X.F. & Norris, S.A. (2010). The prevalence of stunting, overweight and obesity, and metabolic disease risk in rural South African children. *BMC Public Health*, 10(1): 158.

Komaini, A. & Mardela, R. (2018). Differences of Fundamental Motor Skills Stunting and Non Stunting Preschool Children in Kindergarten in North Padang. IOP *Conference Series: Materials Science and Engineering*, 335(1): 6–11.

Kruger, G., Pienaar, A.E., Coetzee, D. & Kruger, S.H. (2014). Prevalence of stunting, wasting and underweight in grade 1-learners: The NW-CHILD study. *Health SA Gesondheid*, 19(1): 1–7.

Li, S. J., Wu, Y. Y., Li, W., Wang, S. J., & Fan, Y. M. (2018). Ultrastructural observation in a case of mucinous nevus. *JDDG - Journal of the German Society of Dermatology*.

Magill, R.A. (2013). Motor Learning and Control: Concepts and Applications, 10th Ed. New York, NY: McGraw-Hill, p. 1-480.

Meylia, K.N., Siswati, T., Paramashanti, B.A. & Hati, F.S. (2020). Fine motor, gross motor, and social independence skills among stunted and non-stunted children. *Early Child Development and Care*, 1–8.

Morley, D., Till, K., Ogilvie, P. & Turner, G. (2015). Influences of gender and socioeconomic status on the motor proficiency of children in the UK. *Human Movement Science*, 44: 150–156.

Nahar, B., Hossain, M., Mahfuz, M., Islam, M.M., Hossain, M.I., Murray-Kolb, L.E., Seidman, J.C. & Ahmed, T. (2020). Early childhood development and stunting: Findings from the MAL-ED birth cohort study in Bangladesh. *Maternal and Child Nutrition*, 16(1): 12.

Nourbakhsh, P. (2006). Perceptual-motor abilities and their relationships with academic performance of fifth grade pupils in comparison with Oseretsky Scale. *Kinesiology*, 38(1): 40–48.

Payne, V.G. & Isaacs, L.D. (2001). *Human Motor Development: a Lifespan Approach*. Boston: McGraw-Hill.

Piek, J, Baynam, G. & Barrett, N. (2006). The relationship between fine and gross motor ability, self-perceptions and self-worth in children and adolescents. *Hum Mov Sci*; 25:65–75.

Pienaar, A.E. (2009). Kinderkinetics: an investment in the total well-being of children, *South African Journal for Research in Sport, Physical Education and Recreation,* 31(1): 49–67.

Pienaar, A.E. (2019). The association between under-nutrition, school performance and perceptual motor functioning in first-grade South African learners: The north-west child health integrated with learning and development study. *Health SA Gesondheid*, 24: 1–10.

Pienaar, A.E. & Kemp, C. (2014). Motor proficiency profile of grade 1 learners in the North West province of South Africa: NW-CHILD study. *South African Journal for Research in Sport, Physical Education and Recreation*, 36(1): 167–182.

SAS Institute Inc (2017). *SAS/STAT 14.3 User's Guide*. Cary, NC: SAS Institute Inc

Schoemaker, M.M. & Kalverboer, A.F. (1994). Social and affective problems of children who are clumsy: How early do they begin? *Adapted Physical Activity Quarterly,* 11(2): 130–140.

Skinner, R. & Piek, J. (2001). Psychosocial implications of poor motor coordination in children and adolescents. *Hum Mov Sci*; 20:73–94.

Subasinghe, S.M.L. & Wijesinghe, D.G.N. (2006). The Effect of Nutritional Status on Cognitive and Motor Development of Pre-School children. *Tropical Agricultural Research*, 18: 1–9.

UNICEF (2020). What you need to know about malnutrition and feeding children https://www.unicef.org/southafrica/stories/what-you-need-know-about-malnutrition-feeding-learners. Accessed 2021

UNICEF. (2019). Children, food and nutrition: The state of the world children. Retrieved from by https://www.unicef.org/media/63016/file/SOWC-2019.pdf. Accessed 2021.

Ulrich, B. (1987) Perceptions of physical competence, motor competence, and participation in organized sport: their interrelationships in young learners. *Res Q Exerc Sport*, 58: 57–67.

Van der Walt, J., Plastow, N.A. & Unger, M. (2020). Prevalence of motor skill impairment among grade R learners in the west coast district of South Africa. *South African Journal of Education*, 40(1): 1–8.

Venetsanou, F. & Kambas, A. (2010). Environmental Factors Affecting Preschoolers' Motor Development. *Early Childhood Education Journal*, 37(4): 319–327.

Wassenberg, R., Kessels, A.G.H., Kalff, A.C., Hurks, P.P.M., Jolles, J., Feron, F.J.M., Hendriksen, J.G.M., Kroes, M., Beeren, M. & Vles, J.S.H. (2005). Relation between cognitive and motor performance in 5- to 6-year-old children: Results from a large-scale cross-sectional study. *Child Development*, 76(5): 1092–1103.

Willey, B.A., Cameron, N., Norris, S.A., Pettifor, J.M. & Griffiths, P.L. (2009). Socio-economic predictors of stunting in preschool children - A population-based study from Johannesburg and Soweto. *South African Medical Journal*, 99(6): 450–456.

World Health Organization (2016). Retrieved from https://www.who.int/. Accessed 2020.

WHO Multicentre Growth Reference Study Group (2006) Assessment of differences in linear growth among populations in the WHO Multicentre Growth Reference Study. *Acta Paediatrica Supplement*, 450: 56–65.

World Health Organisation (2016). Charts of stunting prevalence under children. https://www.who.int/nutrition/healthygrowthproj_stunted_videos/en/. Accessed 2021.

Zere, E. & McIntyre, D. (2003). Inequities in under-five child malnutrition in South Africa. *International Journal for Equity in Health*, 2: 1–10.

Zottarelli, L.K., Sunil, T.S. & Rajaram, S. (2007). Influence of parental and socioeconomic factors in stunting in children under 5 years in Egypt. *Eastern Mediterranean Health Journal*, 13(6): 1330–1342

.

Chapter Four: Article Two

The effect of gross motor stimulation on gross motor proficiency of Grade R learners in a low-resourced environment

Table of Contents

Abstract

Within the South African school context, Grade R learners need to acquire a basic level of gross motor and perceptual motor proficiency before they are promoted to Grade 1. Using a cluster-randomised design, this study aimed to evaluate the impact of a gross motor intervention programme on the gross motor proficiency of Grade R learners in a town in the Southern Free State, South Africa. The intervention, a gross motor stimulation programme, was implemented by the teachers using a handmade gross motor apparatus and specific gross motor activities set out by a movement specialist. Gross motor proficiency was measured using The Bruininks-Oseretsky Test of Motor Proficiency, second edition (BOT-2). Using the ANCOVA statistical measurement, the pre-test results and post-test results were compared. No statistically significant differences were found between the intervention and control groups during the post-test. Small increases in the standard mean of the running speed and agility and upper-limb coordination subtests were noted. Recommendations are made based on the results and limitations.

Key words: gross motor intervention, motor proficiency

4.1 Introduction

Within the South African school context, Grade R learners have certain basic gross motor and perceptual motor skills they need to master before being promoted to Grade 1 (CAPS, 2011). Proficiency in the following motor skills is needed: running, jumping, hopping, skipping and rolling to name a few, while these tie in with the expected standards stipulated in the CAPS document (Ayers, 2005; CAPS, 2011). Motor proficiency is the ability to perform sound motor skills by making use of the relationship between muscle groups to create meaningful movements (Gabbard, 2008; Magill, 2011). When addressing the motor proficiency of Grade R learners, it is essential to look at how they are supposed to move; how they interact with each other and within their environment; and how their environment is typically shaped.

In the current study, the interaction between the child and their environment is set in a low-resourced setting. Morley, Till, Ogilvie and Turner (2015) conducted a study on learners ages 4- to 7-years old in the United Kingdom to determine the correlation between motor proficiency and low socio-economic status (SES). Morley et al. (2015) consequently report that learners from high SES environments portrayed much better fine and gross motor skills, compared to their low- and middle-SES environment counterparts. In South Africa, Pienaar and Kemp (2014) reported on the difference in motor proficiency between Grade 1 learners from low socio-economic and high socio-economic environments. Pienaar and Kemp (2014) found that 69.27% of high socio-economic learners and only 38.98% of low socio-economic learners' results showed an average score, and concluded that 58.73% of low socio-economic learners' results were below average.

Literature indicate that motor interventions are needed and can be beneficial to support the motor development and motor proficiency of learners in low-resourced environments. Motor development and motor proficiency have been aided by Kinderkineticits' (paediatric exercise scientist) physical and gross motor programmes, as an intervention strategy to improve gross motor and perceptual motor skills (Pienaar, Van Rensburg & Smit, 2011). Logan et al. (2012) have echoed the importance of gross motor intervention programmes at a young age.

After investigating the different intervention programmes from across the world, Logan et al. (2012) found that the general statistical length and time of the motor intervention studies were summarized as six to 15 weeks and 480 to 1 440 minutes of intervention time. Different intervention approaches are used to conduct motor interventions, and the bottom-up perceptual motor approach is specifically used for learners between the ages of five- and seven years old (Auxter et al., 2012:123). The perceptual motor intervention approach specifically aims to improve the building blocks of motor skills and sets out to address any shortcomings in those building blocks (Auxter et al., 2012:123). This approach can consequently also be beneficial to Grade R learners, due to the fact that it is age appropriate and that the fundamentals of motor skills are addressed while delays can be corrected early on.

In Belgium, the Multimove for kids programme was presented to 1123 participants (ages three to eight years old) as a way to evaluate the effectiveness of a community program to address fundamental movement skills in children (Bardid, Lenoir, Huyben, De Martelaer, Seghers, Goodway & Deconinck, 2017). The participants were divided into a control (n=491) and experimental group (n=523) (Bardid et al., 2017). The intervention programme consisted of a 30-week programme of one lesson of 60 minutes per week and was presented by a trained instructor (Bardid et al., 2017). Participants had to attend 21 lessons to be eligible for post-testing (using the Test of Gross Motor Development second edition) (Bardid et al., 2017).

In the results the object control ($p < 0.001$) and locomotor ($p < 0.001$) scores of the intervention group were higher than those of the control group (Bardid et al., 2017).

A study done in South Africa focused on the effect of a motor development programme on the gross motor skills and cognitive function of four- to six-year-old learners (Draper et al., 2012). Researching the effect of the Little Champs intervention programme on gross motor skills, Draper et al. (2012) tested 118 participants with the Test of Gross Motor Development, second edition. The experimental group then received an intervention session of 45-60 minutes once a week for eight months, while the control group was offered the opportunity to participate in the Little Champs programme after the study (Draper et al., 2012:141).

Learners in the experimental group portrayed significantly better locomotor ($p<0.005$) and object control ($p<0.01$) skills compared to the control group.

From the literature, it is evident that exposure to ample early gross motor stimulation opportunities, such as motor development programmes, are advantageous to young learners, especially in low-resourced environments. The standards set by Grade 1 curriculums will be more achievable if learners had the correct and meaningful exposure to gross motor development. The aim of this study was therefore to evaluate the impact of a gross motor stimulation intervention programme on the gross motor proficiency of Grade R learners in a low-resourced environment in the Southern Free State of South Africa.

4.2 Materials and methods

4.2.1 Study design

A cluster-randomised, pre-test, gross motor stimulation (as a means of intervention), post-test research design was used for this study. The pre- and post-test were used to create motor proficiency profiles of the Grade R learners in order to evaluate the effect of the intervention.

4.2.2 Participants

All study participants (N=57) were from one school in a low-resourced environment in a town in the Southern Free State, South Africa. The participant group was randomly divided into an experimental (n=18) and control (n=39) group for the purpose of the gross motor stimulation, where one class made up the experimental group, and the other two classes the control group.

This study made use of the Grade R teachers at the applicable school to conduct the intervention. If the teachers provided consent to participate and if they were trained on how to implement the gross motor stimulation during the workshop, they could present the intervention. Participants for this study were included after consent was received from the parents and the participant completed an assent form.

Participants with physical disabilities that prevented them to perform the intervention activities were excluded, as well as if they were older than seven years or absent on the day of post-testing. Learners of the correct age (four- to six-years old), but in the special needs class, also did not form part of this study.

4.2.3 Procedure

Pre-Test

All 57 Grade R learners were tested with the BOT-2 selected subtests during the pre-testing. Pre-testing took place during a scheduled free-play period and was conducted by qualified Kinderkineticists and fourth-year B. Biokinetics students.

Teacher Workshop

A teacher workshop was conducted by the researcher to introduce the gross motor stimulation equipment and procedure to the teachers (n=3). This workshop aimed to equip the teacher in the use of the handmade apparatus (and accompanying activity list), which formed part of the study's gross motor stimulation intervention.

Intervention: Gross motor stimulation

Learners in the experimental group (n=18) received the gross motor stimulation intervention for 18-weeks. The timeline included nine weeks of intervention, followed by a two-week school holiday, where-after the intervention was conducted for another nine weeks (from the 18-weeks intervention, only 15-weeks had active lesson presentation, due to three weeks that was lost due to Covid-19 outbreaks). Learners were divided into three smaller groups (three groups of six) to ensure more meaningful exposure. The smaller groups then rotated during three days of the week (Tuesday, Wednesday and Thursday) to ensure that each learner received two stimulation periods a week. Activities exposed to were alternated between the two sessions per learner per week, using the first 10 and the last 10 activities of the gross motor stimulation activity list. A daily hour of free play from 11:45 to 12:45 (as indicated on the classroom schedule) was used. The Grade R teachers were responsible for presenting the activities to the experimental group.

Post-Test

From the 57 Grade R learners that were tested during pre-testing, only 49 learners were tested with the BOT-2 during the post-testing. Post-testing took place during a scheduled free-play period and was conducted by qualified Kinderkineticists and fourth-year B. Biokinetics students.

4.3 Measurements

4.3.1 Bruininks-Oseretsky Test of Motor Proficiency, second edition (BOT-2)

The motor proficiency of participants was determined by using the Bruininks-Oseretsky Test of Motor Proficiency, second edition (BOT-2; Bruininks & Bruininks, 2005).The BOT-2 is a standardized test measuring motor proficiency in individuals between the ages of 4- and 21-years old, and tests gross- and fine motor skills. The test is divided into four composites, namely: fine manual control, manual coordination, body coordination, and strength and agility (Bruininks & Bruininks, 2005).

The composites are further divided into 8 subtests (fine motor precision; fine motor integration; manual dexterity; bilateral integration; balance; running speed and agility; upper-limb coordination; and strength). As the focus of this study was on gross motor proficiency, only four of the subtests were used, namely bilateral integration, balance, running speed and agility, and upper-limb coordination. The raw scores obtained by participants were converted to corresponding point scores, and then to scale scores and standard scores. Using these scores, the descriptive categories could be determined for each subtest. The descriptive categories (based on standard score ranges) of the BOT-2 include well below average (30 or less), below average (31-40), average (41-59), above average (60-69) and well above average (70 or greater). According to Bruininks and Bruininks (2005), the reliability for the subtests are quite high with a range between the high 0.70 to the low 0.80, and the validity correlation of the BOT-2 subtests being 0.30 and 0.40.

4.3.2 Gross motor stimulation programme

Twenty gross motor activities accompanied by a handmade apparatus, an activity list, as well as activity cards were used to apply gross motor stimulation during the intervention period. The handmade gross motor apparatus was specifically designed by the researcher to be a convenient way of delivering gross motor stimulation to young learners.

The gross motor activities and apparatus were selected and set up based on the fundamental movement skills and motor proficiency ability levels learners of this age should be able to accomplish. This was done by making use of the CAPS document's specified intended Life Skills (Physical Education) outcomes for Grade R learners. Each activity card describes and illustrates the activity in an understandable manner. The apparatus was made of a car tyre, which acts as the base of the handmade apparatus. The tyre is covered in a net on one side and has handles made of rope to conveniently carry, move or manipulate the apparatus.

During presentation of the gross motor stimulation programme the teachers were also encouraged to ask for adaptions of the activities as the participants progressed.

4.3.3 Data collected

Point scores for each of the following subtests were collected, then converted to scale scores: Bilateral integration (subtest four), Balance (subtest five), Running speed and agility (subtest six), and Upper-limb coordination (subtest 7).

The BOT-2 makes use of scale scores to describe how far a learner's point score is from the mean point score of learners of the same age (Bruininks & Bruininks 2005). Standard scores have excellent psychometric properties and are used to describe a learner's level of proficiency on the selected composites. In the current study's case, the scale scores from balance and bilateral integration were combined separately to form the standard score for body coordination (Bruininks & Bruininks, 2005).

The descriptive categories for all the aforementioned aspects were also included, by making use of the broad ranges of scale scores and standard scores to derive these categories.

4.3.4 Statistical analysis

Data was captured in Microsoft Excel by the researchers that collected the data. A Biostatistician analysed the data (SAS:2017). Quantitative variables were summarized using descriptive statistics (mean, SD, minimum, Q1, median, Q3, maximum). Categorical variables were summarized using frequencies and percentages. Quantitative, descriptive statistics were calculated for the pre-test data and the post-test data, both overall and per group (control and experimental).

Comparison of experimental and control groups

The experimental and control groups were compared with respect to the post-test data using analysis of covariance (ANCOVA) with the post-test value as dependent variable; gender and group (experimental vs. control) as independent variables; and the corresponding pre-test values (both sum score and scale score) as covariates. From these ANCOVA, least squares mean values of the dependent variables were calculated for each group (experimental and control), as well as the "experimental – control" difference in mean values and a 95% confidence interval (CI) for the difference. The associated F-test and p-value for the mean difference are also reported.

4.3.5 Ethical Considerations

Ethics clearance and consent (UFS-HSD2020/0141/2605) was obtained from all involved bodies, including the Health Science Research Ethics Committee (HSREC) of the University of the Free State, the Free State Department of Education, the principal, teachers, parents and learners. All data collection procedures adhered to the Declaration of Helsinki (Li et al., 2018). During testing, each child received a participant number. The hard copy data and electronic version were kept in a secure location and electronic data was password protected.

4.4 Results

The participant group consisted of 49 Grade R learners with a mean age of 5.24 years (SD.±0.33), where 30 were girls (61.22%) and 19 were boys (38.78%).

Table 4.1 Descriptive data of motor component scale scores for both pre-test and post-test.

Motor component variable	Statistic	Pre-Test scale score		Post-Test scale score	
		Control	**Experiment**	**Control**	**Experiment**
BSS	*Mean*	19.1	19.1	20.0	18.7
	StD	5.5	6.7	4.1	5.1
RSS	*Mean*	14.9	15.1	17.9	16.9
	StD	4.1	2.9	3.9	4.1
USS	*Mean*	15.9	15.5	17.7	17.8
	StD	5.5	5.1	6.0	3.1
BCSS	*Mean*	16.1	16.5	17.7	15.6
	StD	4.3	3.1	5.2	4.4
BodyComp %	*Mean*	63.3	68.3	75.2	62.0
	StD	27.4	26.3	24.2	27.4

BSS: balance scale score; **RSS**: running speed and agility scale score; **USS**: upper limb coordination scale score; **BCSS**: bilateral coordination scale score; **BodyComp%**: Body Coordination Composite percentage; **StD**: Standard deviation.

Table 4.1 summarizes the data of the motor component scale scores for the pre-test and post-test. Small improvements can be noticed from the pre-test to the post-test values for the running speed and agility (RSS) and upper-limb coordination subtests (USS), with the control group improving in running speed and agility from 14.9 to 17.9 and the experimental group improving from 15.1 to 16.9. Upper-limb coordination increased from 15.9 to 17.7 in the control group and from 15.5 to 17.8 in the experimental group. Decreases were noted in balance and bilateral coordination in the experimental group. The control group improved in all of the subtests from pre- to post-testing.

Table 4.2 presents the comparison of the experimental and control group with regard to the post-test data using ANCOVA. No statistically significant differences between the experimental and control groups were noted, with the control group mean values generally being slightly higher than those of the experimental group.

Table 4.2 Comparison of Experimental and Control groups (Analysis of Covariance)

Variable	Group Means[1]		Mean difference[1]: Experimental – Control		
	Experimental	Control	Point Estimate	95% Confidence Interval	p-value[2]
BSS	18.6	19.9	-1.4	-4.2 to 1.5	0.3331
RSS	16.9	17.9	-0.9	-3.5 to 1.6	0.4542
USS	17.9	17.6	0.3	-2.6 to 3.2	0.8160
BCSS	15.8	17.9	-2.1	-4.9 to 0.7	0.1324
BodyComp	62.5	76.5	-13.9	-29.3 to 1.3	0.0717

BSS: balance scale score; **RSS**: running speed and agility scale score; **USS**: upper limb coordination scale score; **BCSS**: bilateral coordination scale score; **BodyComp**: Body Coordination Composite

[1]Least squares means, point estimate and 95% confidence interval for the mean difference "Experimental – Control" from an analysis of covariance of post-test values, fitting gender and group (experimental vs control) as factors, and the corresponding pre-intervention values (both sum and standard score) as covariates.

[2]p-value for F-test of the null-hypothesis that the mean difference is 0 (that is, null-hypothesis of no difference between experimental and control groups), from the analysis of covariance.

4.5 Discussion

This study used an original 18-week gross motor intervention programme designed by the researcher. The purpose of this gross motor programme was to evaluate the impact that such a programme could have on the specific participant group's gross motor proficiency.

In addition to this aim, the designed gross motor stimulation programme also assisted the teachers in delivering weekly, age appropriate, and CAPS aligned gross motor stimulation to learners in a structured way during the physical education period. No statistically significant differences were observed when comparing the post-test data of the control and experimental groups. Most other intervention studies do, however, report significant improvements after participation in motor interventions (Brian, Goodway, Logan & Sutherland; 2017; Burns, Fu, Fang, Hannon, & Brusseau 2017; Draper et al., 2012; Pham, Wawrzyniak, Cichy, Bronikowski & Rokita, 2021). The current study was, however, unique and a discussion will follow comparing this study to others and observing possible reasons for the non-significant results.

Although not significant, the current study noted slight improvements in participants' running speed and agility and upper-limb coordination subtests from the pre- to the post-test. Both the control group and experimental groups showed similar improvements, whereas the control group performed slightly better than the experimental group in the running speed and agility subtest. In correlation, the findings of Bellow, Davies, Courtney, Gavin, Johnson and Boles (2017) reported that upper-limb coordination's mean increased from 13.2 to 13.4 for the total participant group after an intervention period (Bellows et al., 2017). The upper-limb coordination and running speed and agility of 250 pre-school learners, from Colorado in the United States of America, between the ages of three- and five-years old were measured pre- and post-intervention (Bellows et al., 2017). For the subtests running speed and agility, as well as balance and strength, the results were not statistically significant between the baseline testing and post-intervention testing between the control and experimental groups, and therefore results were reported as one group (Bellows et al., 2017).

In the current study, decreases were noted in balance and bilateral coordination in the experimental group. Balance decreased from 19.1 to 18.7 and bilateral coordination decreasing from 16.5 to 15.6. No statistically significant improvements were noted when the control and experimental group's post-test data was compared; however, the control group's means were somewhat better than that of the experimental group. In agreement with our study, Bellows et al. (2017) also indicated a decrease in the mean score of balance between the baseline testing and post-intervention testing for their complete sample group.

Although the current study's results did not yield any statistically significant changes or improvements, much was learned from the methodology. Comparisons will be drawn from the current study and studies that could be found with similar methodological trait to highlight methodological similarities, which could have consequently led to the non-significant results.

When comparing to the Bellows et al. (2017) reported similar findings to that of the current study, and a few common characteristics are highlighted. Firstly, the Mighty Moves intervention was presented by the classroom teachers, who completed reflections by themselves weekly (Bellows et al., 2017). This corresponds with the current study, where the Grade R teachers were responsible for presenting the gross motor stimulation after completing the training workshop. Secondly, the Mighty Moves intervention was also 18-weeks in duration and consisted of an experimental (n=143) and control group (n=107) (Bellows et al., 2017). The Mighty Moves intervention sessions comprised 15-20 minutes per day for four days a week, which accumulated to 72 sessions, and were presented in the class (Bellows et al., 2017). The current study had a smaller participant group and an intervention time of two 30-minute sessions a week for 18 weeks. Boiling down to similar amount of intervention time. Thirdly, both the current study and Bellows et al. (2017) conducted studies with participant groups from low socio-economic environments and used the BOT-2 Ed.

Another study that followed the same suit as that of our study was the SKIP programme designed by Brian et al. (2017). This programme targeted fundamental movement skills of learners between the ages of 3- and 6-years old in the United States of America.

The SKIP programme's intervention consisted of two lessons per week, 30 minutes per session for 6-weeks (Brian et al., 2017). The current study had two 30-minute lessons a week for 18-weeks per learner, having a longer intervention period but with similar lesson time. As with the current study, the SKIP programme equiped teachers to deliver the programme. The SKIP programme had two, 30-minute pre-training sessions prior to the program being started (Brian et al., 2017), whereas the current study had one teachers' training workshop for two hours. The only difference between the two studies is that the SKIP programme still had a primary invesitagtor present at each session, while the current study's main researcher had check-ins every two weeks with the teachers. The primary investigator in the study of Brian et al. (2017) was available to either answers questions, assist with demonstration difficulties or to conduct a feedback session. The SKIP programme reported significant improvements in object control skills, following the intervention. The main difference between the current study and the SKIP program was the way the teachers were monitored, and with the current study not having such a strict monitoring system, results were impacted.

The Comprehensive School Physical Activity Program (CSPAP) was implemented in a low socio-economic environment and contradictory to our findings, yielded positive results (Burns et al., 2017). This study was conducted on participants slightly older than the current study, where participants had a mean age of 8 years and four months (Burns et al., 2017). Participants were all from different ethnic backgrounds, but all from low socio-economic environments in the United States's Mountain West Region (Burns et al., 2017). The participants were evaluated before and after a 12- week intervention period, with the Test for Gross Motor Development 2nd edition (TGMD 2nd ed) (Burns et al., 2017).

The intervention consisted of three ways of receiving the gross motor stimulation programme: firstly, one structured, 50-minute physical education period presented by an employed physical activity leader (Burns et al., 2017). Secondly, activities were implemented in two recess periods of 15-minutes every day by the employed physical activity leader (Burns et al., 2017). Lastly, classroom teachers where encouraged to present 10-minute physical activity breaks during class time (Burns et al., 2017).

The results indicated that all of the gross motor skills in the TGMD 2nd Ed. (locomotor and ball skills) improved from the baseline testing to the post-testing (Burns et al., 2017). Locomotor skills' standard mean improved from 8.2 to 10.6; ball skills improved from 8.6 to 9.0; and the total test score for the TGMD 2nd Ed., improved from 16.8 to 19.6 (Burns et al., 2017). The impact that each way of intervention, provided by Burns et al. (2017), had on the results was not discussed. Although, when comparing the above-mentioned study's results with the current study, it was evident that the expertise and monitoring of the intervention by the employed physical activity leader contributed to the positive results reported.

By comparing our study findings with findings of similar studies, it became apparent that the success of an intervention program can be influenced by many factors, and that support to teachers presenting these interventions is vital. The concept of teacher-driven interventions in South Africa, with sufficient support from movement specialists, should be further explored, as positivie results of these types of interventions could be seen through the research of Brain et al. (2017) and Bellows et al. (2017).

4.6 Conclusion

Although this study's results did not yield any statistical significance, immense knowledge was gathered in regards to how to improve gross motor development in schools in low socio-economic environments. It became evident that in order to elicit positive results regarding gross motor stimulation, a specialist's hand is needed during the intervention. However, even though this study did set out to equip teachers to provide adequate stimulation, it should be recognised that there is a need and opportunity to aid teachers or schools with gross motor stimulation. A deeper look is needed into the South African school curriculum on how to prioritize gross motor development in low-resourced environments.

4.7 Limitations and Recommendations

Covid-19 had a large impact on this study. Due to the pandemic, teachers experienced high volumes of work, reducing their time to implement the intervention, while their high workload also negatively impacted their willingness and eagerness to present the intervention programme. Furthermore, the time set out for physical education (time that would have been used for the study) was predominantly used for learners eating the meal they receive at school. The Covid-19 pandemic also lead to schools closing on short notice due to outbreaks, causing less time available for the presentation of the intervention.

Practically it is recommended that primary schools prioritize the involvement of a movement specialist, such as a Kinderkineticist, to conduct gross motor stimulation to young, developing learners. In low-resourced environments where movement specialists, for instance a Kinderkineticist, might not present, teachers should still be equipped to present gross motor stimulation to aid the motor development of young learners. Work-schedule-wise, it is advised that the physical education period should be used as intended. Teachers should therefore receive assistance in time management to ensure that the eating of meals and hygiene practices take place during specific allotted times, and not during the physical education period.

During the intervention the teachers were non-compliant in completing the participants' attendance log. Therefore learners who missed more than six intervention sessions could not excluded, which could have affected the results.

The control group improved in all of the gross motor subtest when the pre- and post-test data was compared. Possible explanations for this could be that the control and experimental group were from one school and the children could have told about and showed each other the activities. Another possible reason could be that the teachers presented the activities to all the children.

The control group was much larger than the experimental group, presenting with more data. It is recommended that the control and experimental groups be from different schools.

For future research, it is recommended to re-implement the intervention when the schooling calendar can no longer be affected by Covid-19.

As the current study included only one school with a limited number of participants, similar research in low-resourced environments across South Africa should also be implemented to increase the generalizability of results.

Lastly, in order for teacher-lead motor interventions to be successful, teachers need to be involved in decision-making and their suggestions and needs should be taken into consideration during the planning phase of such interventions.

Teachers should also be made aware of the value that improved motor competence can have on learners's other developmental domains, such as academics and social interaction. This would increase teachers' willingness and commitment to present and prioritise motor interventions. Consequently, if the aforementioned can be achieved, supervision needed from movement specialists can be lessened and interventions might be of more value to the learners in areas where movement specialists are not present.

Acknowledgements

Sincere gratitude is expressed to Prof R Schall for the statistical analysis of the data. We would also like to acknowledge and thank the 2021 B. Biokinetics fourth-year students for their assistance in collecting the data. Lastly, thank you to the Post-Graduate School of the University of the Free State for funding a writing dyad workshop.

4.8 References

Auxter, D., Pyfer, J., & Huettig, C. (2012). Principles and Methods of Adapted Physical Education and Recreation. Boston: Mc Graw Hill.

Ayers, J., A. (2005) Sensory Integration and the child. Understanding hidden sensory challenges. WPS Publish America. (1) 24; (6) 99.

Bellows, L.L., Davies, P.L., Courtney, J.B., Gavin, W.J., Johnson, S.L., & Boles, R.E. (2017). Motor skill development in low-income, at-risk pre-schoolers: A community-based longitudinal intervention study. *Journal of Science and Medicine in Sport*, *20*(11), 997–1002. https://doi.org/10.1016/j.jsams.2017.04.003

Brian, A., Goodway, J.D., Logan, J.A., & Sutherland, S. (2017). SKIPing with teachers: an early years' motor skill intervention. *Physical Education and Sport Pedagogy*, *22*(3), 270–282. https://doi.org/10.1080/17408989.2016.1176133

Bruininks, R.H. & Bruininks, B. D. (2005). *Bruininks-Oseretsky Test of Motor Proficiency* (2nd ed.). Minneapolis, MN: Pearson Assessment.

Burns, R.D., Fu, Y., Fang, Y., Hannon, J.C., & Brusseau, T. A. (2017). Effect of a 12-Week Physical Activity Program on Gross Motor Skills in Children. *Perceptual and Motor Skills*, 124(6): 1121–1133. https://doi.org/10.1177/0031512517720566

CAPS (2011) *see* National Curriculum Statement Curriculum and Assessment Policy Statement.

Draper, C.E., Achmat, M., Forbes, J. & Lambert, E.V. (2012). Impact of a community-based programme for motor development on gross motor skills and cognitive function in preschool children from disadvantaged settings. *Early Child Development and Care*, 182(1): 137–152.

Gabbard, C.P. (2008). *Lifelong Motor Development*, 5th Ed. San Francisco, CA: Pearson Benjamin Cummings.

Li, S.J., Wu, Y.Y., Li, W., Wang, S.J., & Fan, Y.M. (2018). Ultrastructural observation in a case of mucinous nevus. *JDDG - Journal of the German Society of Dermatology*, *16*(6), 778–780. https://doi.org/10.1111/ddg.13528

Logan, S.W., Robinson, L.E., Wilson, A.E. & Lucas, W.A. (2012). Getting the fundamentals of movement: A meta-analysis of the effectiveness of motor skill interventions in children. *Child: Care, Health and Development*, 38(3): 305–315.

Magill, R.A. (2011). *Motor Learning and Control: Concepts and Applications*, 9th Ed. New York, NY: McGraw-Hill,

Morley, D., Till, K., Ogilvie, P. & Turner, G. 2015. Influences of gender and socioeconomic status on the motor proficiency of children in the UK. *Human Movement Science*, 44: 150–156.

Pienaar, A.E. & Kemp, C. (2014). Motor proficiency profile of grade 1 learners in the North West province of South Africa: NW-CHILD STUDY. *South African Journal for Research in Sport, Physical Education and Recreation*, 36(1): 167–182.

Pienaar, A.E., Van Rensburg, E. & Smit, A. (2011). Effect of a Kinderkinetics programme on components of children's perceptual-motor and cognitive functioning. *South African Journal for Research in Sport, Physical Education and Recreation*, 33(3): 113–128.

Pham, V.H., Wawrzyniak, S., Cichy, I., Bronikowski, M. & Rokita, A. (2021). Brainballs program improves the gross motor skills of primary school pupils in Vietnam. *International Journal of Environmental Research and Public Health*, 18(3): 1–8.

SAS Institute Inc (2017). *SAS/STAT 14.3 User's Guide*. Cary, NC: SAS Institute Inc

Chapter Five: Conclusion

5.1 Summary

The research aims strived to answer three important aspects relating to the gross motor proficiency of Grade R learners in a town in the Southern Free State, South Africa. Firstly, to establish the levels of motor proficiency and anthropometric profiles of these learners. Secondly, using the anthropometric data and participants' motor proficiency levels, the possible effect of stunting on motor proficiency was investigated. Thirdly, the effectiveness of a gross motor intervention programme on the gross motor proficiency of these learners was evaluated.

As permitted by the Senate of the University of the Free State (Bloemfontein campus) this dissertation is presented in article format. In Chapter One the background information, problem statement and justification for the study is given, as well as the illustration for the layout of the study. The dissertation also comprises of a literature review in Chapter Two and two research articles in Chapter Three and Chapter four. The articles will be presented for possible publication in accredited peer-review journals. In Chapter Five, the summary, conclusion, limitations and recommendations of the study are presented. A detailed introduction in Chapter One included the problem statement based on the research questions and the aims of the study. Chapter One put forth a summary of the structure of the study, including the methodology and procedures.

In Chapter Two, the current literature on the importance of adequate gross motor development, the impact of a low socio-economic environment on nutrition and motor development, as well as the different intervention approaches were investigated. Firstly, the importance of motor development was discussed. Secondly, theories on the interaction between the environments a child is raised in and the child was looked into. This study also explored low-resourced environments and the impact that these areas have on child malnutrition and motor development. Child nutrition is discussed, especially stunting as a form of malnutrition and the impact that stunting has on motor development. Thirdly, different gross motor intervention programmes and their level of success was investigated. Also, specifically motor interventions presented in South Africa and interventions presented by teachers were of importance and were investigated. Lastly, the motor development of the typical Grade R learner in South Africa was elaborated on.

In Chapter Three, the first article can be found, with the title: "*Gross motor proficiency, anthropometry and stunting of Grade R learners in a low-resourced environment, South Africa"*. The first outcome of this study was to determine the gross motor proficiency of Grade R learners in a town in the Southern Free State, South Africa. Motor proficiency was evaluated using the Bruininks-Oseretsky Test of Motor Proficiency, second edition selected subtests. The motor proficiency profile of the participant group (n=57) identified upper-limb coordination (17.5%) and running speed and agility (15.7%) as gross motor skills that participants from a low-resourced environment struggled with. Balance skills (50.8%) were mainly on or above standard for these learners. Based on gender, no statistically significant differences were found with regard to the motor proficiency subtests evaluated. Also, as part of this article, participants' anthropometric measurements were captured, in order to determine factors such as the influence of stunting on gross motor proficiency. Based on the anthropometric profile 15.5% (n=9) of the participants showed stunted growth. The group also portrayed below expected height, weight and body mass index for age compared to the World Health Orginazation standards. No statistically significant correlations were found, when comparing the anthropometric profile to that of the motor proficiency profile. In conclusion, learners from low-resourced enivironments portrayed balancing skills sufficient for their age, but however are at greater risk for malnutrition.

Chapter Four includes Article Two with the title: "*The effect of gross motor stimulation on gross motor proficiency of Grade R learners in a low-resourced environment"*. This article aimed to evaluate the impact of a gross motor intervention programme on the gross motor proficiency of Grade R learners in a low-resourced town in the Southern Free State, South Africa. A pre-test, post-test study design was used and motor proficiency was evaluated using the BOT-2 Ed. selected subtests. The intervention was 18-weeks long and presented by the teachers on a weekly basis. After post-testing was concluded, no statistically significant differences were found between the intervention and control groups. Small increases in the standard mean of the running speed and agility and upper-limb coordination subtests were noted. The control group did however outperform the intervention group although not statistically significant. In conclusion, knowledge was gained in regard to the involvement of teachers in presenting a motor intervention. Recommendations are made based on the results and limitations.

5.2 Conclusions

5.2.1 Research aim one

Research question 1:

What is the gross motor proficiency of Grade R learners in a low-resourced environment in the Southern Free State of South Africa?

Hypothesis: The gross motor profiency levels of Grade R learners are expected to be below the norms for their age group.

The hypothesis is rejected due to the results indicating that the motor proficiency profile of the Grade R learners where statistically in accordance with their pier group standard, according to the BOT-2 norms..

The participants (n=57) from this low-resourced environment's motor proficiency profile identified upper-limb coordination (17.5%) and running speed and agility (15.7%) as gross motor skills that participants struggled with. Balancing skills have been identified as a gross motor skill that participants from this environment seem to be proficient in, with 50.8% of the participants scoring mainly on or above standard. With regards to the motor proficiency profiles, no statistically significant gender differences were found.

5.2.2 Research aim two

Research question 2:

What do participants' anthropometric measurement profiles look like, in view of determining the influence of stunting on gross motor proficiency?

Hypothesis: The anthropometric measurements of Grade R learners are expected to be below the healthy norms and may indicate stunting.

The hypothesis is rejected. The anthropometric profile of the participant group yielded results slightly below the standard norms, however the presence of stunting did not have a statistically significant correlation with gross motor performance.

The anthropometric profile indicated that participants had a mean average height of 107.3 cm, weight of 17.3 kg, BMI of 15.03 kg/m² and upper-arm circumference of 15.6 cm. The WHO's set out preferred standards for height for five-year-old childern, and the standards are 110.0 cm for boys and for girls 109.4 cm (WHO:2016). The preferred BMI for five-year-old-boys are 15.2 kg/m² and for girls 15.3 kg/m². When the participant group's anthropometric data was compared to the WHO (2016) guidelines, the current study's participants' values were slightly below the expected standards. After the anthropometric profiles were compared to the WHO (2016) norms for malnutrition, two (3.5%) out of the 57 participants were underweight and nine (15.5%) were stunted. No statistically significant correlation was found between stunting and motor proficiency.

5.2.3 Research aim three:

Research question 3:

What is the impact of a gross motor stimulation on the gross motor proficiency of Grade R learners in a low-resourced environment in the Southern Free State of South Africa?

Hypothesis: The gross motor stimulation will have a positive effect on the motor proficiency of the Grade R learners.

The hypothesis is rejected due to the gross motor stimulation not having a statistical significant result when the impact of the intervention programme was analysed.

When comparing the post-test data between the intervention and control groups, no statistically significant differences were found. In regards to the standard mean, small increases where noted in regards to the running speed and agility (control = 14.9 vs 17.9) (experimental = 15.1 vs 16.9) and upper-limb coordination (control = 15.96 vs 17.1) (experimental = 15.5 vs 17.8) subtests. Upper limb-coordination was also the subtest that the participant grouped struggled with the most during the first aim of the study. It is encouraging to see an improvement. The control group also showed an improvement in their gross motor subtests, although not statistically significant.

5.3 Limitations and Recommendations

Limitations encountered during this research study included:

- Firstly, the impact of Covid-19 on the daily operations of the South African school system. Schools reopened for the 2021 academic year two weeks after the initially planned date, and the number of learners that could attend school per day was limited. Due to Covid-19, the type of gross motor exposure learners had during their Grade RR year was very limited and could be a contributing factor to their results during the pre-test.
- Secondly, the intervention programme was affected by the Covid-19 pandemic by schools having to close on short notice due to outbreaks. From the 18-weeks set out for the intervention, the participants only received 15-weeks of active lesson presentation. Two weeks were lost due to the Covid-19 outbreak and one week of lessons missed in general due to teachers not being able to present or other factors.
- The sample size of participants used in this study was relatively small. All of the participants were also from one school that could also affected the results.
- The willingness and eagerness of the teachers involved to diligently present the motor stimulation program was another hurdle. In these trying times with Covid-19, even though they had sufficient training in the intervention, their schedules

were full and they struggled time-wise to implement the intervention. Also, in the physical education period (thus presentation time of the intervention) learners sometimes had their lunch meal provided by the Department of Education.

- During the intervention the teachers were not compliant in completing the participants' ttendance log. Therefore no child could be excluded on the basis of being absent for too many intervention sessions.
- Although the researcher strived to equip teachers in a low resourced environment (where there are very little to no movement specialists) to present the gross motor stimulation programme independently, limitations did occur. Even though a logbook was used to record the sessions and general comments, the accuracy is brought into question. Only the teachers will truly know how accurate, diligent and precise the programme was presented.

Recommendations for this study include:

- A consideration should be made to re-implement the intervention when the schooling calendar cannot be affected by Covid-19. This should not only lead to greater benefits for the learners, but also to gain more accurate research findings.
- More knowledge is needed regarding this type of demographic group. Per recommendation a larger sample size in more low-resourced areas in South Africa. This could lead to nutritional interventions if stunting or any other forms of malnutrition are identified. Also, by having information on the respected anthropometric and motor proficiency profiles, the school system can address motor delays early on. This can lead to aiding learners in their motor development and nutritional status. Movement specialists and dieticians can also take hands to further promote child development in a holistic manner.
- It is recommended that the general attendance register signed by the teachers every morning be used to aid the researchers in regards to who is absent when. This will also lesson the work for the teacher due to not having to complete a separate list for the intervention programme

- It is recommended that before the start of a school year when the class schedules and curriculum are finalised, a specific and achievable time period must be set out for physical education, with adequate time to implement movement-related activities and allocate another timeslot for learners to eat their lunch.

5.4 References

World Health Organization (2016). Retrieved from https://www.who.int/

WHO Multicentre Growth Reference Study Group. 2006. Assessment of differences in linear growth among populations in the WHO Multicentre Growth Reference Study. Acta Paediatrica Supplement. 450, 56–65.

World Health Organisation. Charts of stunting prevalence under learners (2016). https://www.who.int/nutrition/healthygrowthproj_stunted_videos/en/

List of appendices:

Appendix A

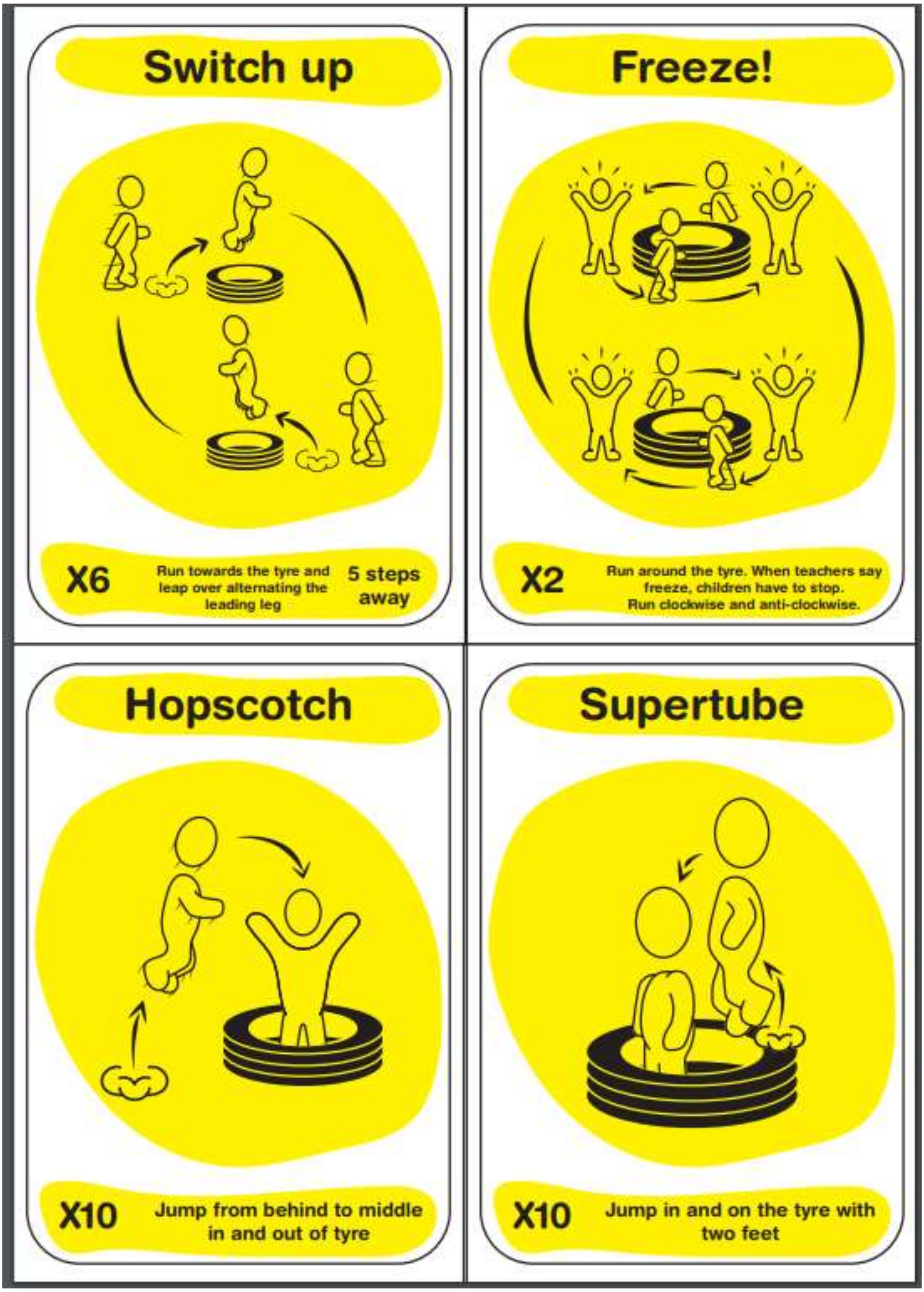
Activity List Gross motor activities		
1.	*Starting position:* *Action:*	Stand 5 steps away from the tyre. Run up towards the tyre and leap over it. Leap back and forth, alternating the leading leg. Repeat 6 times.
2.	*Starting position:* *Action:*	Stand next to the tyre. Run around the tyre. When teachers say freeze, learners have to stop. Run clockwise and anti-clockwise. Repeat 2 times each direction.
3.	*Starting position:* *Action:*	Stand outside the tyre, close to it. Jump (two feet, from behind to middle) in and out of tyre. Repeat 10 times.
4.	*Starting position:* *Action:*	Stand inside the tyre with the net grid of the tyre facing down. Jump (two feet) on and off the tyre. Jumping "off" would mean jumping in the middle of the tyre, while jumping "on" would mean one foot on each side of the top part of the tyre. Repeat 10 times.
5.	*Starting position:* *Action:*	Stand feet apart on the tyre. Catch and throw the bean bag to the teacher who is standing 10 steps away. (Both hands) Repeat 10 times.

6.	*Starting position:* *Action:*	Stand 8 – 10 steps away from the tyre. Throw bean bag into tyre. (One hand) Repeat 10 times.
7.	*Starting position:* *Action:*	Stand 3 steps away from the tyre. Throw the medium sized ball against the net and catch ball again (apparatus positioned in an upright position leaning against a wall). Repeat 10 times.
8.	*Starting position:* *Action:*	Stand 15 steps away from the tyre, with the tyre being in front of the learners. Race one child at a time placing the colour pipes in the colour hole that is on the net. Carry on until all colours are placed.
9.	*Starting position:* *Action:*	Stand 15 steps away from the tyre, with the tyre being in front of the learners. Place a pipe with either the x or o in the net (one child at a time), playing knots and crosses with x's and o's on pipes. Continue until three x's or o's are in a row (vertically, diagonally or horizontally).
10.	*Starting position:* *Action:*	Stand 5 steps away from the tyre Hop the medium sized ball with the aim to land the ball inside the tyre. Therefore, bounce the ball once before it reaches the tyre and drops into it. Repeat 10 times.

11.	*Starting position:* *Action:*	Two learners stand across from each other, 15 steps apart. Roll the tyre to each other back and forth. Repeat 10 times per child.
12.	*Starting position:* *Action:*	Two learners strand across from one other with the tyre in the middle. The tyre being 15 steps away from each of them. All of the x and o pipes are in the centre of the tyre. Run towards the tyre and grab one pipe at a time and take it back to the starting point. See which child can get the most. Continue until all the pipes are taken.
13.	*Starting position:* *Action:*	Start with a pile of x and o pipes, 10 steps away from the tyre. Balance the pipes on their index fingers (making a fist with the index fingers sticking out) and walk to the tyre, placing the pipe inside the tyre and then repeating the action. Carry on until all the pipes are in the tyre.
14.	*Starting position:* *Action:*	Start 6 – 10 steps away from tyre with a bean bag in hand. The teacher rolls the tyre in front of the child so that it passes the child in a horizontal manner. Attempt to throw the bean bag in the passing tyre. Tyre may be rolled from left to right or from right to left. Repeat 10 times.
15.	*Starting position:* *Action:*	Two learners stand across from one other with the tyre in the middle. The tyre being 3 – 5 steps away from each of them. Hop a medium sized ball to each other using the net side of the tyre. Repeat 10 times per child.

16.	*Starting position:* *Action:*	One child stands on the tyre with the medium sized ball and the other one is 10 steps in front of the tyre. The child without the ball runs towards the child with the ball and catches the ball being thrown to him/her. Repeat 10 times per child.
17.	*Starting position:* *Action:*	Two learners strand across from one other with the tyre in the middle. The tyre being 15 steps away from each child. In the centre of the tyre are all of the x and o pipes. Gallop towards the tyre and grab one pipe at a time, take it back to the starting point. See which child can get the most. Carry on until all pipes are removed.
18.	*Starting position:* *Action:*	Stand 5 – 10 steps away from the teacher. Catch and throw the medium sized ball, thrown by the teacher. Repeat 10 times.
19.	*Starting position:* *Action:*	Stand inside the tyre with the net grid of the tyre facing down. Jump (two feet) on and off the tyre while catching the ball. Jumping "off" would mean jumping in the middle of the tyre, while jumping "on" would mean one foot on each side of the top part of the tyre.
20.	*Starting position:* *Action:*	Stand 3 steps away from the tyre. Throw the medium sized ball against the net (apparatus positioned in an upright position leaning against a wall) and catch ball again. Before catching the ball clap hands. Repeat 10 times.

Appendix B: Activity cards



Bounce in

X10 — Bounce the ball into the tyre — 5 steps away

Team roll

X10 — Roll the tyre to each other (two children) — 15 steps away

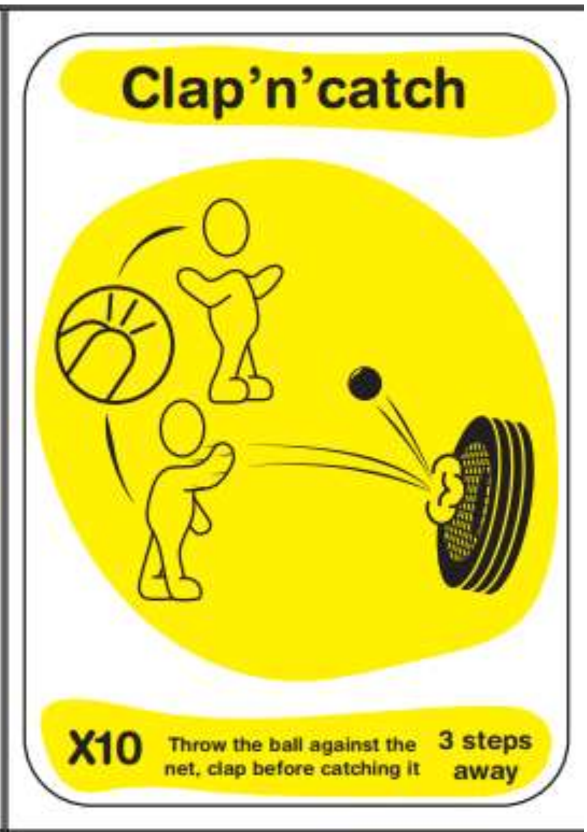
Retrieve!

Retrieve all the pipes from the tyre until all are colected — 15 steps away

Balance

Balance pipes on index finger and place inside the tyre — 10 steps away


Up & in
X10
Jump in and on the tyre whilst catching the ball when jumping in


Clap'n'catch
X10
Throw the ball against the net, clap before catching it
3 steps away


Colour in
Race one child at a time placing the colour pipes in the net
15 steps away


Grab'em
Gallop towards the tyre taking one pipe at a time until all are retrieved
15 steps away

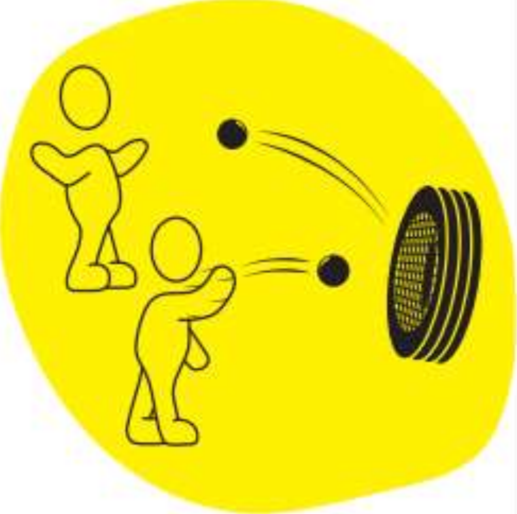
Catch!

X10 Catch and throw the bean bag to the teacher using two hands — **10 steps away**

Bullseye!

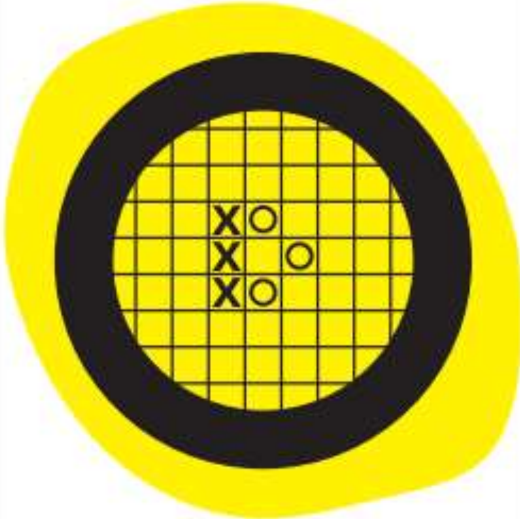
X10 Throw the bean bag into the tyre using one hand — **8 steps away**

Nothing but net



X10 Throw the ball against the net and catch it again — **3 steps away**

Tic-Tac-Toe



Place X's and O's in the net until three are placed in a row — **15 steps away**

Aim in

X10 Throw the bean bag through the tyre rolled by the teacher **6 steps away**

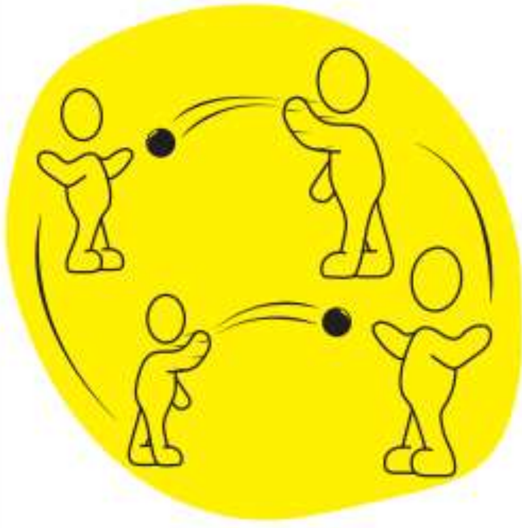
One bounce

X10 Children hop the ball on the net towards each other **5 steps away**

Eye on the ball

X10 Run and catch the ball thrown by child on the tyre. Take turns **10 steps away**

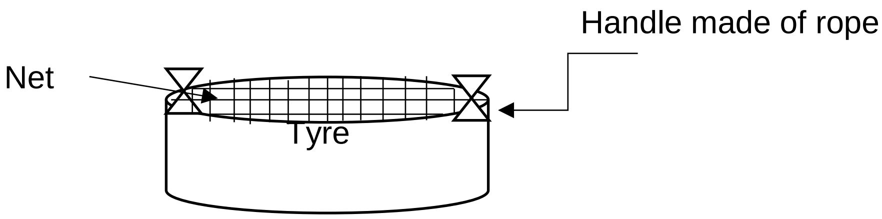
Pass back



X10 Catch and throw the ball thrown by the teacher **5 steps away**

Appendix C: Handmade gross motor apparatus design

The base of the apparatus:

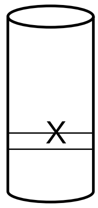


Extra:

1 x Bean bag

1 x Medium Ball

12 x PVC pipes with colour strips and knot and crosses stickers



Appendix D: Photo of handmade gross motor apparatus

Photo: Handmade gross motor apparatus

Photo: Handmade gross motor apparatus with PVC pipes, bean bags and ball.

Appendix E: Week schedule with corresponding activities for gross motor stimulation

WEEKS TERM ONE:	ACTIVITIES TO BE PRESENTED
Week 1	1-10
Week 2	11-20
Week 3	1-10
Week 4	11-20
Week 5	1-10
Week 6	11-20
Week 7	1-10
Week 8	11-20
Week 9	1-10
WEEKS TERM TWO	ACTIVITIES TO BE PRESENTED
Week 10	11-20
Week 11	1-10
Week 12	11-20
Week 13	1-10
Week 14	11-20
Week 15	1-10
Week 16	11-20
Week 17	1-10
Week 18	11-20

Appendix F: Groups and day of the week division

	First 30min	Second 30min
Tuesday	Group 1 (6 participants)	Group 2 (6 participants)
Wednesday	Group 3 (7 participants)	Group 1 (6 participants)
Thursday	Group 2 (6 participants)	Group 3 (7 participants)

Appendix G: Complete proposed weekly gross motor stimulation schedule

Week:	Activities	Group, activity and day of the week division		
Term One:				
Week 1: 25 Jan – 29 Jan	1-10	Tue:	Group 1: 1-5	Group 2: 1-5
		Wed:	Group 3: 1-5	Group 1: 6-10
		Thu:	Group 2: 6-10	Group 3: 6-10
Week 2: 1 Feb – 5 Feb	11-20	Tue:	Group 1: 11-15	Group 2: 11-15
		Wed:	Group 3: 11-15	Group 1: 16-20
		Thu:	Group 2: 16-20	Group 3: 16-20
Week 3: 8 Feb – 12 Feb	1-10	Tue:	Group 1: 1-5	Group 2: 1-5
		Wed:	Group 3: 1-5	Group 1: 6-10
		Thu:	Group 2: 6-10	Group 3: 6-10
Week 4: 15 Feb – 19 Feb	11-20	Tue:	Group 1: 11-15	Group 2: 11-15
		Wed:	Group 3: 11-15	Group 1: 16-20
		Thu:	Group 2: 16-20	Group 3: 16-20
Week 5: 22 Feb – 26 Feb	1-10	Tue:	Group 1: 1-5	Group 2: 1-5
		Wed:	Group 3: 1-5	Group 1: 6-10
		Thu:	Group 2: 6-10	Group 3: 6-10
Week 6: 1 Mar – 5 Mar	11-20	Tue:	Group 1: 11-15	Group 2: 11-15
		Wed:	Group 3: 11-15	Group 1: 16-20
		Thu:	Group 2: 16-20	Group 3: 16-20

Week 7: 8 Mar -12 Mar	1-10	Tue:	Group 1: 1-5	Group 2: 1-5
		Wed:	Group 3: 1-5	Group 1: 6-10
		Thu:	Group 2: 6-10	Group 3: 6-10
Week 8: 15 Mar – 19 Mar	11-20	Tue:	Group 1: 11-15	Group 2: 11-15
		Wed:	Group 3: 11-15	Group 1: 16-20
		Thu:	Group 2: 16-20	Group 3: 16-20
Week 9: 22 Mar – 26 Mar *	1-10	Tue:	Group 1: 1-5	Group 2: 1-5
		Wed:	Group 3: 1-5	Group 1: 6-10
		Thu:	Group 2: 6-10	Group 3: 6-10
2-week school holiday Term two				
Week 10: 13 Apr – 16 Apr	11-20	Tue:	Group 1: 11-15	Group 2: 11-15
		Wed:	Group 3: 11-15	Group 1: 16-20
		Thu:	Group 2: 16-20	Group 3: 16-20
Week 11: 19 Apr – 23 Apr	1-10	Tue:	Group 1: 1-5	Group 2: 1-5
		Wed:	Group 3: 1-5	Group 1: 6-10
		Thu:	Group 2: 6-10	Group 3: 6-10
Week 12: 26 Apr – 30 Apr *	11-20	Tue:	Group 1: 11-15	Group 2: 11-15
		Wed:	Group 3: 11-15	Group 1: 16-20
		Thu:	Group 2: 16-20	Group 3: 16-20
Week 13: 3 May – 7 May	1-10	Tue:	Group 1: 1-5	Group 2: 1-5
		Wed:	Group 3: 1-5	Group 1: 6-10
		Thu:	Group 2: 6-10	Group 3: 6-10

Week 14: 10 May – 14 May	11-20	Tue:	Group 1: 11-15	Group 2: 11-15
		Wed:	Group 3: 11-15	Group 1: 16-20
		Thu:	Group 2: 16-20	Group 3: 16-20
Week 15: 17 May – 21 May	1-10	Tue:	Group 1: 1-5	Group 2: 1-5
		Wed:	Group 3: 1-5	Group 1: 6-10
		Thu:	Group 2: 6-10	Group 3: 6-10
Week 16 24 May – 28 May	11-20	Tue:	Group 1: 11-15	Group 2: 11-15
		Wed:	Group 3: 11-15	Group 1: 16-20
		Thu:	Group 2: 16-20	Group 3: 16-20
Week 17 31 May – 4 Jun	1-10	Tue:	Group 1: 1-5	Group 2: 1-5
		Wed:	Group 3: 1-5	Group 1: 6-10
		Thu:	Group 2: 6-10	Group 3: 6-10
Week 18 7 Jun – 11 Jun	11-20	Tue:	Group 1: 11-15	Group 2: 11-15
		Wed:	Group 3: 11-15	Group 1: 16-20
		Thu:	Group 2: 16-20	Group 3: 16-20

* Indicates a public holiday: If a gross motor stimulation session is on the same day as a public holiday, the session will only move to the Monday or Friday of that week.

Appendix H: Workshop – Teachers survey

Survey Handmade gross motor apparatus			
Please read the questions carefully and mark with an X. Also please comment or further explain your answer in the "comment" column.			
Question:	Yes:	No:	Comment:
1. Is the activity list clearly set out?			
2. Are the activities understandable?			
3. Are the activities implementable?			
4. Does the schedule indicate when and what should be done during the intervention period?			
5. Do you feel comfortable using the apparatus with the learners?			
6. Do you think the learners would enjoy the activities?			
7. Do you think any of the activities are too easy?			
8. Do you think any of the activities are too difficult?			

Appendix I: Teacher's facilitating log

Date:	Name and Surname:	Signature:	Comments:

Appendix J: Absent log of participants

Date of absence:	Name and Surname:	Session missed:	Comments:

The reason for including the participant name is it would be difficult to make use of the participant number for the teachers.

Appendix K: Ethical clearance letter

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA

UFS·UV
HEALTH SCIENCES
GESONDHEIDSWETENSKAPPE

Health Sciences Research Ethics Committee

24-Nov-2021

Dear **Miss Chanté Mathews**

Ethics Number: UFS-HSD2020/0141/2605-0005

Ethics Clearance: **The effect of gross motor stimulation on gross motor proficiency of Grade R learners in a low resourced environment**

Principal Investigator: **Miss Chanté Mathews**

Department: **Exercise and Sport Sciences Department (Bloemfontein Campus)***

Submission Page

SUBSEQUENT SUBMISSION APPROVED

With reference to your recent submission for ethical clearance from the Health Sciences Research Ethics Committee. I am pleased to inform you on behalf of the HSREC that you have been granted ethical clearance for your request as stipulated below:

- Deviation report

The HSREC functions in compliance with, but not limited to, the following documents and guidelines: The SA National Health Act. No. 61 of 2003; Ethics in Health Research: Principles, Structures and Processes (2015); SA GCP(2006); Declaration of Helsinki; The Belmont Report; The US Office of Human Research Protections 45 CFR 461 (for non-exempt research with human participants conducted or supported by the US Department of Health and Human Services- (HHS), 21 CFR 50, 21 CFR 56; CIOMS; ICH-GCP-E6 Sections 1-4; International Council for Harmonisation (ICH) Harmonised Guideline, Integrated Addendum to ICH E6(R1), Guideline for Good Clinical Practice (GCP) E6(R2), 2016, SAHPRA Guidelines as well as Laws and Regulations with regard to the Control of Medicines, Constitution of the HSREC of the Faculty of Health Sciences.

For any questions or concerns, please feel free to contact HSREC Administration: 051-4017794/5 or email EthicsFHS@ufs.ac.za.

Thank you for submitting this request for ethical clearance and we wish you continued success with your research.

Yours Sincerely

Prof. A. Sherriff
Chairperson : Health Sciences Research Ethics Committee

Health Sciences Research Ethics Committee
Office of the Dean: Health Sciences
T: +27 (0)51 401 7795/7794 | E: ethicsfhs@ufs.ac.za
IRB 00011992; REC 230408-011; IORG 0010096; FWA 00027947
Block D, Dean's Division, Room D104 | P.O. Box/Posbus 339 (Internal Post Box G40) | Bloemfontein 9300 | Sc
Africa
www.ufs.ac.za

*** Please note: this is the most recent ethical approval letter. An amendment had to be made when post-testing dates changed.**

Appendix L: Letter from the Department of Education

education
Department of Education
FREE STATE PROVINCE

Enquiries: KK Motshumi
Ref: Research Permission: Mathews CE assisted by C Bonafede, E de Waal, K Mpeko, J Mabina, R Lamprecht and C du Toit
Tel. 051 404 9283 / 9221 / 079 503 4943Email: K.Motshumi@fseducation.gov.za

C.E Mathews
12 Sangiro Street
Langehovenpark
Bloemfontein, 9301

Dear Ms C.E Mathews

APPROVAL TO CONDUCT RESEARCH IN THE FREE STATE DEPARTMENT OF EDUCATION

1. This letter serves as an acknowledgement of receipt of your request to conduct research in the Free State Department of Education.

   Topic: The effect of gross motor stimulation on gross motor proficiency of Grade R learners in a low resourced environment. .

   List of schools involved: Madikgetla Primary school

2. **Target Population**: 75 Grade R Learners and 3 Grade R teachers in Madikgetla Primary School.

3. **Period of research**: From date of signature of this letter until 30 September 2020. Please note that the department does not allow any research to be conducted during the fourth term (quarter) of the academic year. Should you fall behind your schedule by three months to complete your research project in the approved period, you will need to apply for an extension.

4. The approval is subject to the following conditions:

   4.1 The collection of data should not interfere with the normal tuition time or teaching process.

   4.2 A bound copy of the research document or a CD, should be submitted to the Free State Department of Education, Room 319, 3rd Floor, Old CNA Building, Charlotte Maxeke Street, Bloemfontein.

   4.3 You will be expected, on completion of your research study to make a presentation to the relevant stakeholders in the Department.

   4.4 The ethics documents must be adhered to in the discourse of your study in our department.

5. Please note that costs relating to all the conditions mentioned above are your own responsibility.

Yours sincerely

DR JEM SEKOLANYANE
CHIEF FINANCIAL OFFICER

DATE: 23/03/2020

RESEARCH APPLICATION C.E MATHEWS AND OTHERS AS INDICATED ABOVE, PERMISSION 04 03 2020 XHARIEP DISTRICT
Strategic Planning, Policy & Research Directorate
Private Bag X20565, Bloemfontein, 9300 - Room 318, Old CNA Building, 3rd Floor, Charlotte Maxeke Street, Bloemfontein
Tel: (051) 404 9283 / 9221 **Fax:** (086) 6678 678

Appendix M: Letter of consent for parents

M.1 Parental consent Afrikaans

OUER TOESTEMMINGSVORM:

TITLE VAN NAVORSINGSPROJEK:

Groot motoriese stimulasie om groot motoriese vaardigheid van Graad R leerlinge in ŉ lae hulpbron omgewing te verbeter

Geagte ouer

U kind word uitgenooi om deel te wees van ‘n navorsingsprojek wat deur Chanté Mathews gedoen gaan word. Neem asseblief ‘n oomblik om die inligting hieronder rakende die projek te lees.
Indien u enige vrae het, kontak asseblief die navorser, die Graad R juffrou of die skoolhoof. Dit is baie belangrik dat u gelukkig is en duidelik verstaan waaroor die projek handel.
Neem ook asseblief kennis, u kind se deelname is totaal en al vrywillig en u mag deelname weier. Indien u nee sê, sal dit nie u kind in enige manier nadelig beïnvloed nie. U kind is ook welkom om enige tyd gedurende die studie te onttrek, al het u toestemming gegee dat hy/sy kan deelneem.

Waaroor handel hierdie studie?

Hierdie navorsingsprojek is spesifiek daarop gemik om die grootmotoriese vaardigheid van Graad R-leerders in 'n omgewing met lae hulpbronne te bepaal. Tweedens is dit daarop gemik om die grootmotoriese vaardigheid van Graad R-leerders in hierdie omgewing positief te beïnvloed deur middel van grootmotoriese stimulasie.

Dit behels dat u kind aan 'n projek deel gaan neem waar hoe goed hulle aktiwiteite doen, soos vang, gooi en balanseer, gemeet gaan word.

'n Ander deel van hierdie studie is dat u kind geweeg gaan word, hulle lengte gemeet word, asook die omtrek van hul bo-arm geneem word. Hierdie inligting sal help te bepaal of eksterne faktore 'n invloed sal hê op die manier hoe u kind beweeg. Ten einde hierdie grootmotoriese vaardighede te help verbeter, word aktiwiteite met sommige van hulle (die eksperimentele groep) gedoen met behulp van 'n grootmotoriese stimuleringsapparaat wat deur die navorser ontwerp is.

Na afloop van die tyd wat vir die aktiwiteite uiteengesit is, sal die kinders gevra word om die grootmotoriese take te herhaal om te sien of daar verbetering is.

Wie sal met u kind werk?
Veldwerkers wat gekwalifiseerde Kinderkinetici en of vierdejaar Biokinetika studente insluit, gaan die kinders evalueer. ‘n Tolk gaan ook teenwoordig wees gedurende die evaluering. Die tolk se rol sal wees die take aan die kinders in hul huistaal te verduidelik.
Die Graad R juffrouens gaan die grootmotoriese stimulasie aanbied gedurende skool ure (11:45 tot 12:45 vrye spel uur), terwyl die navorser of die vierdejaar Biokinetika studente beskikbaar sal wees, indien die juffrou hulp nodig het.

Vertroulikheid:
Alle persoonlike inligting gaan vertroulik gehou word. U kind se naam sal nêrens op enige vorms verskyn nie en sal ook nie bekend gemaak word in die navorsingsresultate nie.

Risiko:
Daar is geen risiko’s bekend om aan hierdie studie deel te neem nie.

Voordele deur om aan hierdie studie deel te neem:

- ‘n Algemene assessering van die Graad R groep gaan aan die skoolhoof verskaf word.

- U kind mag dalk ook stimulasie ontvang gedurende die intervensie periode, en indien nie, gaan hul toegang hê tot die grootmotoriese stimuleringsprogram- en apparaat, na afhandeling van die studie.
- Die grootmotoriese stimuleringsapparaat sal aan die skool geskenk word om verdere grootmotoriese stimulasie te bevorder.

Wat sal gebeur in die onwaarskynlike geval dat daar een of ander vorm van besering plaasvind as gevolg van deelname aan hierdie navorsingstudie?
Die navorsers is gekwalifiseer en opgelei in Noodhulp en sal aandag kan gee aan klein beserings as dit gedurende die evaluerings plaasvind. In die geval dat u kind tydens deelname aan die grootmotoriese program beseer word, sal die skool se beseringsprotokol gevolg word en die navorser sal in kennis gestel word.

Vergoeding:
Deelname aan hierdie navorsingsprojek word opreg waardeer, maar dit bly vrywillig. Neem asseblief kennis dat geen vergoeding toegestaan sal word vir deelname nie. Daar is geen kostes van u kant af nodig vir die deelname van u kind aan die studie nie.

Is daar enige iets anders waarvan u moet kennis dra?
U kan Dr Elna de Waal by 082 550 9916 kontak indien daar enige verdere vrae is of indien u enige probleme tee kom.
Indien u enige klagtes of bekommernisse het wat nie voldoende deur die navorser aangespreek is nie, kan u die *Health Sciences Research Ethics Committee* by 051-401 7794/5 kontak.
Vir u eie rekord sal u ‘n kopie van hierdie inligting en die toestemmingsbrief ontvang

Navorser: Chanté Mathews
Kontak nommer: 0764807892

- Verklaring deur ouer:

Deur hieronder te teken gee ek, …………………………………..…………. toestemming dat my kind ……....……………………………… aan die studie: Grootmotoriese stimulasie om groot motoriese vaardigheid van Graad R leerlinge in 'n lae hulpbron omgewing te verbeter, mag deelneem.

Ek verklaar die volgende:

- Ek het die volgende inligting en toestemmingsbrief gelees, of dit is aan my gelees en dit is geskryf in 'n taal waarin ek gemaklik en vlot is.
- Ek het 'n geleentheid gehad om vra te vrae en al my vrae is voldoende beantwoord.
- Ek verstaan dat deelname vrywillig is en dat ek nie onder druk geplaas was sodat my kind moet deelneem nie.
- Ek mag kies dat my kind die studie enige tyd moet verlaat en sal nie gepenaliseer of benadeel word nie.

Geteken by (plek) ....….......……………….. op (*datum*) …………....……….. 20...

....

Handtekening van ouer Handtekening van getuie

Dui asseblief u huistaal aan: ________________________________

M.2 Parental consent English

PARENT CONSENT FORM:

TITLE OF THE RESEARCH PROJECT:

Gross motor stimulation to improve the gross motor proficiency of Grade R learners in a low resourced environment

Dear Parent

Your child is being invited to take part in a research project by Chanté Mathews. Please take some time to read the information below, which will explain the details of this project.

Please ask the researcher, Grade R teachers or principal any questions about any part of this project that you do not fully understand. It is very important that you are happy and that you clearly understand what this project is about.

Also, your child's participation is entirely voluntary and you are free to decline their participation. If you say no, this will not affect your child negatively in any way whatsoever. Your child is also free to withdraw from the study at any point, even if you do agree for them to take part.

What is this research study all about?

This research project will specifically aim to determine the gross motor proficiency of Grade R learners in a low resourced environment. Secondly, it will aim to positively influence the gross motor proficiency of Grade R learners in a low resourced environment, by means of gross motor stimulation.

What this means is that your child will partake in a project where how well they perform gross motor tasks like catching, throwing and balancing will be measured. Another part of this study is that your child will be weighed, their height will be measured, and their upper arm circumference will be taken.

This forms part of determining if external factors will have an influence on how they move. Then to help improve these gross motor skills, activities will be done with some of them (the experimental group) using a gross motor stimulation apparatus that was designed by the researcher.

After the time that was set out for the activities has gone by, the learners will be asked to redo the gross motor tasks to see if there is any improvement.

Who will be working with your child?
Field workers including qualified Kinderkineticists and / or fourth-year Biokinetics students will evaluate the learners. A translator will also be present during testing to aid in giving instruction regarding the testing to your child in their home language.
The Grade R teachers will present the gross motor stimulation during school hours (11:45 to 12:45 free-play hour), while the researcher or fourth-year Biokinetics students will be present to assist the teachers if they need help.

Confidentiality:
All personal information will be kept confidential. Your child's name will not be used on any forms and will not be made public in the research findings.

Risks:
There are no known risk for participating in this study.

Benefits of participating in this study:

- A general assessment of the Grade R group will be given to the principal.
- Your child might also receive stimulation during the intervention period, and if they do not, will have access to the gross motor stimulation program after the study has been completed.
- The apparatus will be given to the school to further promote gross motor stimulation.

What will happen in the unlikely event of some form injury occurring as a direct result of your taking part in this research study?

The researchers are qualified and trained in First Aid and will be able to attend to minor injuries, if they occur during the testing. In the event that your child is injured while participating in the gross motor program, the schools protocol for injuries will be followed and the researcher will be notified.

Reimbursement:

Your participation in this research project is greatly appreciated but remains voluntary. Please note that no compensation is granted for the participation. There are no costs associated with the testing procedures.

Is there anything else that you should know or do?

You can contact Dr Elna de Waal at 082 550 9916 if you have any further queries or encounter any problems.

You can contact the Health Sciences Research Ethics Committee at 051-401 7794/5 if you have any concerns or complaints that have not been adequately addressed by your study doctor.

You will receive a copy of this information and consent form for your own records.

Researcher: Chanté Mathews

Contact number: 0764807892

- Declaration by participant

By signing below, I …………………………………..…………. agree that my child ……………………………………. may take part in a research study titled: *Gross motor stimulation to improve the gross motor proficiency of Grade R learners in a low resourced.*

I declare that:

- I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is voluntary and I have not been pressurised to have my child take part.
- I may choose that my child may leave the study at any time and will not be penalised or prejudiced in any way.

Signed at (*place*) ....…........……………….. on (*date*) …………...……….. 20...

....	....
Signature of parent	Signature of witness

Please indicate your home language: ______________________________

M.3 Parental consent Sesotho

FOROMO YA TUMELO YA MOTSWADI:

SEHLOOHO SA PROJEKE YA PATLISISO:

Bokgoni ba tlhabollo ya motsamao wa mmele kaofela (gross motor stimulation) ho ntlafatsa tlhabollo ya motsamao wa mmele kaofela ya baithuti ba Kereiti ya R sebakeng se se nang dirisose tse lekaneng

---

Motswadi ya Hlomphehang

Ngwana wa hao o memelwa ho nka karolo phuputsong ya boithuto ya Chanté Mathews. Ka kopo iphe nako ya ho bala tlhahisoleseding e ka tlase mona, e tla hlalosa dintlha tsa projeke ena.

Ka kopo botsa mofuputsi, matitjhere a Kereiti ya R kapa mosuwehlooho dipotso dife kapa dife tse mabapi le karolo efe kapa efe ya projeke ena tseo o sa di utlwisiseng ka botlalo. Ho bohlokwa haholo hore o thabe le hore o utlwisise ka ho hlaka seo projeke ena e leng mabapi le sona.

Hape, bonkakarolo ba ngwana wa hao ke ba boithaopo ka ho phethahala mme o na le tokelo ya ho hanela bonkakarolo ba bona. Haeba o re tjhe, sena se ke ke sa ama ngwana wa hao ka tsela e seng ntle jwang kapa jwang. Hape ngwana wa hao o lokolohile ho ka ikgula phuputsong ka nako efe kapa efe, esita leha o dumetse hore a nke karolo.

Phuputso ee ya patlisiso hantle e mabapi le eng?

Projeke ena ya phuputso e tla toba ka ho kgetholoha tlhabollo ya motsamao wa mmele kaofela (gross motor stimulation) ho lekanya tlhabollo ya motsamao wa mmele kaofela ya baithuti ba Kereiti ya R sebakeng se nang le dirisose tse lekaneng.

Bobeding, e tla tobana le ho susumetsa ka tsela e ntle bokgoni ba tlhasimollo ya motsamao wa mmele kaoela ya baithuti ba Kereiti ya R sebakeng se nang le dirisose tse lekaneng, ka tlhasimollo ya motsamao wa mmele kaofela.

Sena se bolela hore ngwana wa hao o tla nka karolo projekeng eo ho yona tekanyo ya katleho ya ho phethwa ha ditshebetso tsa tsamaiso ya mmele kaofela jwalo ka ho kapa, ho akgela le ho tsitsisa di tla methwa. Karolo e nngwe ya phuputso ena ke hore ngwana wa hao o tla methwa boima, botelele ba hae bo tla methwa, le modikoloho wa sephaka sa hae se hodimo bo tla methwa. Sena se theha karolo ya ho fumana haeba dintlha tse ka thoko di na le tshusumetso hodima motsamao wa hae. Jwale ho thusa ho ntlafatsa ditsebo tsena tsa motsamao wa mmele kaofela, mesebetsi e tla etswa le ba bang (sehlopha sa diekspherimente) ka ho sebedisa sesebediswa sa tlhabollo se radilweng ke mofuputsi.

Kamora hore nako e lekantsweng bakeng sa mesebetsi e fele, bana ba tla kotjwa ho pheta mesebetsi ya motsamao wa mmele kaofela ho bona hore na ho na le ntlafalo ya letho.

Ke mang ya tla sebetsa le ngwana wa hao?

Basebetsi ba hara setjhaba ba kenyeletsang barupelli ba motsamao wa mmele ba bana (di-kinderkineticist) le / kapa baithuti ba selemo sa bone ba thupello ya motsamao wa mmele ba bana (di-biokinetic) ba tla lekola bana. Mofetoledi hape o tla ba teng ho thusa ka ho fana ka ditaelo tse mabapi le diteko ho ngwana wa hao ka puo ya habo.

Matitjhere a Kereiti ya R a tla teka tlhabollo ya motsamao wa mmele kaofela nakong ya dihora tsa sekolo (hora ya ho bapala ya 11:45 ho fihla ka 12:45), moo mofuputsi kapa baithuti ba selemo sa bone ba thuto ya thupello ya motsamao wa mmele (Biokinetics) ba tla ba teng ho thusa matitjhere haeba a hloka thuso.

Sephiri:
Tlhahisoleseding yohle ya motho e tla bolokwa e le sephiri. Lebitso la ngwana wa hao le ke ke la sebediswa diforomong dife kapa dife mme le ke ke la pepeswa ditshibollong tsa patlisiso.
Menyetla ya kotsi:
Ha ho menyetla ya kotsi e tsejwang mabapi le ho nka karolo phuputsong ena.

Melemo ya ho nka karolo phuputsong ena:

- Tekanyo e akaretsang ya sehlopha sa Kereiti ya R e tla fanwa ho mosuwehlooho.
- Ngwana wa hao hape a ka nna a fumana tlhasimollo nakong ya kalafo mme haeba a sa e fumane, o tla kgona ho fihlella lenaneo la tlhasimollo kamora hore phuputso e fihle pheletsong.
- Disebediswa di tla fanwa ho sekolo ho kgothaletsa tlhasimollo ya motsamao wa mmele kaofela.

Ho tla etsahalang haeba ka sewelo ho ka ba le temalo e itseng e hlahang ka kotloloho ka lebaka la ho nka karolo ha hao phuputsong ee ya boithuto?
Bafuputsi ba na le mangolo le thupelo bakeng sa ho fana ka Thuso ya Pele mme ba tla kgona ho alafa dikotsi tse nyane, haeba di ka hlaha nakong ya teko. Haeba ngwana wa hao a lemetse nakong eo a nkileng karolo lenaneong la motsamao wa mmele kaofela, prothokole ya dikolo e tla latelwa mme mofuputsi o tla tsebiswa.

Dipuseletso tsa tjhelete:
Bonkakarolo ba hao projekeng ena ya patlisiso bo thoholetswa haholo mme bo dutse e le ba boithaopo. Ka kopo lemoha hore ha ho matshediso a tla lefuwa bakeng sa bonkakarolo. Ha ho ditjeo tse amanang le mekgwatshebetso ya diteko.

Na ho na le eng kapa eng e nngwe eo o lokelang ho e tseba kapa ho e etsa?
O ka ikopanya le Ngaka Elna de Waal ho 082 550 9916 haeba o na le dipotso tse ding kapa o thulana le mathata afe kapa afe.

O ka ikopanya le Komiti ya Boitshwaro ya Disaense tsa Dipatlisiso tsa Bophelo (Health Sciences Research Ethics Committee) ho 051 051-401 7794/5 haeba o na le dingongoreho dife kapa dife kapa ditletlebo tse sa rarollwang ka tsela e lekaneng ke Ngaka ya hao ya phuputso.

O tla fumana khopi ya tlhahisoleseding ena le foromo ya tumello bakeng sa hore o ipolokele yona.

Mofuputsi: Chanté Mathews

Nomoro ya boikopanyo: 0764807892

- Boikano ba monkakarolo

Ka ho saena ka tlase mona, Nna …………………………………..…………. ke dumela ho dumella ngwana wa ka …………………………………… ho nka karolo patlisisong ya phuputso e bitswang: *Tlhabollo ya motsamao wa mmele kaofela (gross motor stimulation) ho ntlafatsa bokgoni ba tlhabollo ya motsamao wa mmele kaofela ba baithuti ba Kereiti ya R sebakeng se nang le dirisose tse lekaneng*

Ke ikana hore:

- Ke badile kapa ke balletswe foromo ena ya tlhahisoleseding le tumello mme e ngotswe ka puo eo ke e tsebang hantle le ho phutholoha ka yona.
- Ke bile le monyetla wa ho botsa dipotso tsohle tsa ka mme di arabilwe ka tsela e lekaneng.
- Ke utlwisisa hore ho nka karolo phuputsong ena ke ka boithaopo mme ha ke a hatellwa hore ngwana wa ka a nke karolo.
- Nka nna ka kgetha hore ngwana wa ka a tswe phuputsong ka nako efe kapa efe mme nke ke ka fuwa kotlo kapa ka kena mathateng ka tsela efe kapa efe.

E saennwe (sebaka) ....….......…………….. ka la (mohla) …………...……….. 20...

....

Tshaeno ya motswadi Tshaeno paki

Ka kopo bontsha puo ya lapeng ya heno: ________________________________

Appendix N: Letter of consent for principal

N.1 Principal consent Afrikaans

DEELNEMER INLIGTINGSPAMFLET

Desember 2020

TITLE VAN NAVORSINGSPROJEK:

Grootmotoriese stimulasie om grootmotoriese vaardigheid van Graad R leerlinge in ’n lae hulpbron omgewing te verbeter

---

HOOFNAVORSER: Chanté Mathews

KONTAK NOMMER: 0764807892

Geagte Mev ...

My naam is Chanté Mathews en ek is ‘n Kinderkinetikus wat besig is met my Meestersgraad aan die Universiteit van die Vrystaat. Ek wil u uitnooi om deel te wees van hierdie navorsingsprojek. Die doel van die navorsing is om die motoriese vaardigheid van graad R-leerlinge te ondersoek en hul grootmotoriese vaardigheid te verbeter, deur middel van ‘n grootmotoriese stimulasie program met behulp van 'n handgemaakte grootmotoriese apparaat en aktiwiteite.

Neem ook asseblief kennis, u deelname is totaal en al vrywillig en u mag deelname weier. Indien u nee sê, sal dit u nie in enige manier nadelig beïnvloed nie. U is ook welkom om enige tyd gedurende die studie te onttrek, al het u aanvanklik ingestem tot deelname.

Hierdie studie het goedkeuring vanaf die *Health Sciences Research Ethics Committee* (HSREC) by die Universiteit van die Vrystaat en sal uitgevoer word volgens aanvaarde en toepaslike nasionale en internasionale etiese riglyne en beginsels, insluitend dié van die internasionale verklaring van Helsinki.

Motoriese vaardigheid is die manier waarop grootmotoriese take voltooi word. Grootmotories is die gebruik van die groot spiere in die liggaam om take uit te voer. Die toets wat gebruik gaan word om die leerlinge te evalueer is *Bruininks-Oseretksy Test of Motor Proficiency, second edition*. Hierdie toets sal die navorser in staat stel om die leerlinge se grootmotoriese vlak te meet volgens hul ouderdom. Nog ‘n belangrike deel van hierdie studie is dat die leerlinge se gewig, lengte en boarm omtrek gemeet gaan word, deur veldwerkers van die navorsingspan. Die rede hiervoor is om te bepaal of eksterne faktore ‘n invloed kan hê op hul motoriese vaardighede. Die rede waarom hierdie navorsing in 'n omgewing met 'n lae hulpbronne gedoen wil word, is om meer insig te kry oor die moontlike verband tussen lae sosio-ekonomiese omstandighede en grootmotoriese vaardighede. Trompsburg is geïdentifiseer as 'n omgewing met lae hulpbronne, en die ouderdomsgroep van die Graad R-leerders is geïdentifiseer as 'n belangrike fase waar kinders op baie ontwikkelingsgebiede gereed moet wees om die formele skoolomgewing te betree.

Die navorser wil nie net die leerlinge se grootmotoriese vaardigheid toets nie, maar wil ook daarna streef om hul motoriese vaardigheid op 'n positiewe manier te beïnvloed deur middel van 'n grootmotoriese stimuleringsprogram. Die navorser sal 'n handgemaakte motoriese apparaat voorsien met spesifiek ontwerpte grootmotoriese aktiwiteite (opgestel in ooreenstemming met CAPS Graad R-uitkomste) om grootmotoriese stimulasie toe te pas. Dit is waar die deelname van die onderwysers nodig is. As die onderwysers instem om aan die studie deel te neem, sal die navorser 'n werkswinkel vir hulle aanbied oor hoe die apparaat werk en hoe om die aktiwiteite te implementeer. Die taak van die Graad R onderwysers sal dan wees om hierdie aktiwiteite gedurende die vrye speeltyd van 11:45 tot 12:45 aan die leerders aan te bied. Onderwysers kan terugvoering aan die navorser gee rakende die vordering.

Hierdie terugvoer sal gebruik word om die onderwysers te help om die aktiwiteite aan te bied en struikelblokke te oorkom. Die navorser sal ook elke twee weke ‘n besoek aflê om die nodige terugvoer in te win en onderwysers te help. As deel van hierdie studie sal die graad R-leerders ewekansig in twee groepe verdeel word. Een klas sal grootmotoriese stimulasie ontvang en die ander twee klasse gaan geen ekstra stimulasie ontvang nie. Die groep wat tweedens genoem word, sal voortgaan met hul normale spel en deelname aan liggaamlike opvoeding. Afhangend van die skooltermyne van 2021, sal die stimulasie 'n periode van 17 weke duur. Die proses sal daarop gemik wees om die belangrikheid van motoriese ontwikkeling te beklemtoon en die onderwysers toe te rus om liggaamlike opvoeding en motoriese ontwikkeling by hierdie leerders te optimaliseer. Na voltooiing van die studie sal die groep wat nie aan die stimulasie deelgeneem het nie, die geleentheid kry om grootmotoriese stimulasie te ontvang. Om dit moontlik te maak, sal hierdie apparate by die skool bly en is die navorser beskikbaar om met die onderwysers te konsulteer terwyl hulle dit aan die tweede groep aanbied.

Na 'n periode van intervensie (17 weke van werk met die apparaat), word die leerders geherevalueer om te sien of daar verbetering was. Data sal gebruik word om te bepaal of die leerders se motoriese vaardighede verbeter het, veral na blootstelling aan die grootmotoriese stimuleringsprogram. Tolke sal help om die toetsaktiwiteite aan die leerders te verduidelik.

Data sal ingesamel word deur veldwerkers, insluitend gekwalifiseerde Kinderkinetici en vierdejaar Biokinetika-studente, tesame met tolke. Die inligting wat ingesamel word, sal op 'n rekenaar met 'n wagwoord gehou word. Die wagwoord is slegs beskikbaar vir die navorser en die studieleier. Die privaatheid van die leerders en hul uitslae sal ten alle tye nagekom word en data sal vertroulik gehou word. Om vertroulikheid te verseker, sal elke leerder 'n deelnemer-nommer ontvang tydens die insameling van data en hul name sal nie aan derde partye beskikbaar gestel word nie.

Is daar enige risiko verbonde aan deelname aan die studie?
Daar is geen risiko verbonde nie.

Wat sal gebeur in die onwaarskynlike geval dat daar een of ander vorm van besering sal plaasvind as gevolg van deelname aan hierdie navorsingstudie?

Die navorsers is gekwalifiseer en opgelei in Noodhulp en sal aandag kan gee aan klein beserings as dit gedurende die evaluerings plaasvind. In die geval dat u kind tydens deelname aan die grootmotoriese program beseer word, sal die skool se beseringsprotokol gevolg word en die navorser sal in kennis gestel word.

Voordele:

- Aan die einde van die studie sal die navorser aan u 'n algemene verslag verskaf rakende die Graad R groep se motoriese vaardigheidsvlak.
- Die navorser sal ook die apparaat, tesame met die lys aktiwiteite wat in hierdie navorsing gebruik is, aan die skool skenk. Dit bied aan al die Graad R-leerders 'n gelyke geleentheid om grootmotoriese stimulasie te ontvang.
- Daar is geen kostes verbonde aan die studie vir die skool, die onderwysers of die leerlinge nie.

Is daar enige iets anders waarvan u moet kennis dra?

U kan Dr Elna de Waal by 082 550 9916 kontak indien daar enige verdere vrae is of indien u enige probleme ervaar. Indien u enige klagtes of bekommernisse het wat nie voldoende deur die navorser aangespreek was nie, kan u die *Health Sciences Research Ethics Committee* by 051-401 7794/5 kontak. U sal 'n kopie van hierdie inligting en die toestemmingsbrief vir u eie rekords ontvang.

Indien u bereid is om aan hierdie studie deel te neem, teken asseblief die aangehegte toestemmingsverklaring.

Vriendelike Groete

____

Chanté Mathews

Hoofnavorser

0764807892

- Verklaring deur deelnemer:

Deur hieronder te teken stem ek, ……………………………….…………. in om deel te neem aan die volgende studie: Grootmotoriese stimulasie om grootmotoriese vaardigheid van Graad R leerlinge in ŉ lae hulpbron omgewing te verbeter.

Ek verklaar die volgende:

- Ek het die volgende inligting en toestemmingsbrief gelees, of dit is aan my gelees en dit is geskryf in ‘n taal waarin ek gemaklik en vlot is.
- Ek het ‘n geleentheid gehad om vra te vrae en al my vrae is voldoende beantwoord.
- Ek verstaan dat deelname vrywillig is en dat ek nie onder druk geplaas was om deel te moet neem nie.
- Ek mag enige tyd die studie verlaat en sal nie gepenaliseer of benadeel word nie.

Geteken by (*plek*) ....…......…………….. op (*datum*) …………...……….. 20...

....

Handtekening van Skoolhoof

N.2 Principal consent English

PARTICIPANT INFORMATION LEAFLET

December 2020

TITLE OF THE RESEARCH PROJECT:

Gross motor stimulation to improve the gross motor proficiency of Grade R learners in a low resourced environment

PRINCIPAL INVESTIGATOR: Chanté Mathews

CONTACT NUMBER: 0764807892

Dear Mrs …

My name is Chanté Mathews and I am a Kinderkineticist busy with my Master's degree at the University of the Free State. I would like to invite you to be part of this research project. The aim of the research is to investigate the motor proficiency of Grade R leaners as well as improve their gross motor proficiency, by means of gross motor stimulation using a handmade gross motor apparatus and activities.

Please take some time to read the information presented here, which will explain the details of this project and contact me if you require further explanation or clarification of any aspect of the study. Also, participation is entirely voluntary and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the Health Sciences Research Ethics Committee (HSREC) at the University of the Free State and will be conducted according to accepted and applicable National and International ethical guidelines and principles, including those of the international Declaration of Helsinki.

Gross motor proficiency is the way in which gross motor tasks are completed. Gross motor is the use of the large muscles in the body to perform tasks. The Grade R learners that give permission to be part of this study will all receive evaluations concerning their gross motor proficiency using the Bruininks-Oseretsky Test of Motor Proficiency, second edition (BOT-2). This evaluation will allow us to determine the learners' level of gross motor proficiency according to their age. Another important part of this study is that the learner's anthropometric data will be captured by the fieldworks during the pre-testing. Anthropometric data will include height, weight and upper arm circumference. Taking these measures will aid the researcher in determining if external factors have an impact on their motor proficiency. The reason for wanting to do this research in a low resourced environment, is to gain more insight on the possible relation between low socio-economic circumstances and gross motor proficiency. Trompsburg has been identified as a low resourced environment and the age group of the Grade R learners were identified as an important phase where learners need to be ready on many developmental domains to enter the formal school setting.

This project does not only want to test the learners' gross motor proficiency, but also strive to influence these learners' gross motor proficiency in a positive way by exposing them to gross motor stimulation using a handmade gross motor apparatus and activities. The researcher will be providing a handmade gross motor apparatus with specifically designed gross motor activities (set up in line with CAPS Grade R outcomes) to elicit gross motor stimulation. This is where the participation of the teachers are needed. If the teachers agree to partake in the study, the researcher will provide a workshop to them on how the apparatus works and how to implement the activities. The teachers' task will then be to present these activities to the learners in their free play time, from 11:45 to 12:45. Teachers may provide feedback to the researcher regarding the progression.

This feedback will be used to assist the teachers in presenting the activities and overcome obstacles. The researcher will also visit once every two weeks to gather the necessary feedback and assist teachers. As part of this study the Grade R learners will be randomly divided into two groups. One class will be receiving gross motor stimulation and the other two classes will not be receiving any additional stimulation. The group mentioned secondly will continue with their normal play and physical education participation. The stimulation will cover a period of 17 weeks, depending on the school terms of 2021. This process will aim to emphasise the importance of motor development and to equip the teachers with an aid to optimise physical education and motor development in these learners. After completion of the study, the group who did not partake in the stimulation will get the opportunity to receive gross motor stimulation. To enable this, these apparatuses will stay at the school and the researcher will be available to consult with the teachers while they present it to the second group.

After a period of intervention (17 weeks working with the apparatus) the learners will be retested to see if there was any improvement. Data will be used to determine if any improvement in the motor proficiency of the learners were the case, specifically after exposure to the gross motor stimulation program. All testing and explanation of test activities to learners will be aided by translators.

Data will be collected by field workers, including qualified Kinderkineticist and 4th year Biokinetics students, together with translators. The data collected will be kept on one computer with a password due to the fact that the privacy of the learners is vital to the researcher. The password will only be available to the researcher and the study leader. The privacy of the learners and their results will be respected at all times and data will be kept confidential. To ensure this, each learner will receive a participant number during data collection and names will not be made available to any third parties.

Are there in risks involved in your taking part in this research?
There are no risks involved.

What will happen in the unlikely event of some form injury occurring as a direct result of your taking part in this research study?

The researchers are qualified and trained in First Aid and will be able to attend to minor injuries, if they occur during the testing. In the event that your child is injured while participating in the gross motor program, the schools protocol for injuries will be followed and the researcher will be notified.

Benefits:

- At the end of the study the researcher will provide you with an overall report of the Grade R group's motor proficiency level.
- The researcher will also donate the apparatuses, together with the list of activities used in this research to the school. This provides all the Grade R learners an equal opportunity to receive gross motor stimulation.
- There will also be no costs involved for the school, teacher or learner taking part in this study.

Is there anything else that you should know or do?

- You can contact Dr Elna de Waal at 082 550 9916 if you have any further queries or encounter any problems.
- You can contact the Health Sciences Research Ethics Committee at 051-401 7794/5 if you have any concerns or complaints that have not been adequately addressed by your study doctor.
- You will receive a copy of this information and consent form for your own records.

If you are willing to participate in this study please sign the attached Declaration of Consent.

Yours sincerely

____

Chanté Mathews

Principal Investigator

0764807892

Declaration by participant

By signing below, I ………………………………..………… agree to take part in a research study entitled “Gross motor stimulation to improve the gross motor proficiency of Grade R learners in a low resourced environment”.

.

I declare that:

- I have read the attached information leaflet and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is voluntary and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.

Signed at (*place*) ....…......……………. On (*date*) …………...……….. 20…..

....

Signature of principal

N.3 Principal consent Sesotho

LEQEPHE LA TLHAHISOLESEDING YA MONKAKAROLO

Tšitoe 2020

SEHLOOHO SA PROJEKE YA PATLISISO:

Bokgoni ba tlhabollo ya motsamao wa mmele kaofela (gross motor stimulation) ho ntlafatsa tlhabollo ya motsamao wa mmele kaofela ya baithuti ba Kereiti ya R sebakeng se se nang dirisose tse lekaneng

---

MOFUPUTSI YA KA SEHLOOHONG: Chanté Mathews

NOMORO YA BOIKOPANYO: 0764807892

Mof. … ya hlomphehang

Lebitso la ka ke Chanté Mathews mme morupelli wa motsamao wa bana (Kinderkineticist), ke tshebetsong ya ho phetha lengolo la ka la thuto la kgerata ya Master's Yunivesithing ya Foreistata. Ke lakatsa ho o memela hore o nke karolo projekeng ena ya boithuto. Sepheo sa patlisiso ke ho fuputsa bokgoni ba motsamao wa mmele ba baithuti ba Kereiti ya R mmoho le ho ntlafatsa bokgoni ba bona ba motsamao wa mmele kaofela, ka tsela ya tlhasimollo ya mmele kaofela ho sebediswa sesebediswa le mesebetsi ya maiketsetso sa motsamao wa mmele kaofela.

Ka kopo iphe nako ya ho bala tlhahisoleseding e fanweng mona, e tla hlalosa dintlha tse feletseng ka projeke ena mme o ikopanye le nna haeba o hloka tlhakisetso kapa tlhalosetso e eketsehileng mabapi le ntlha efe kapa efe e amang phuputso.

Hape, bonkakarolo ke ba boithaopo ka ho phethahala mme o lokolohile ho ka hana ho nka karolo. Haeba o re tjhe, sena se ke ke sa o ama ka tsela e seng ntle jwang kapa jwang. Hape o lokolohile ho ka ikgula phuputsong ka nako efe kapa efe, esita leha o dumetse ho nka karolo.

Phuputso ena e fuwe tumello ke Komiti ya Boitshwaro ya Dipatlisiso tsa Disaense tsa Bophelo (Health Sciences Research Ethics Committee (HSREC)) ya Yunivesithi ya Foreistata mme e tla tsamaiswa ho latela melawana e amohelwang le ho sebetsa ya Naha le ya Matjhaba ya boitshwaro le maano, ho kenyeletswa le ya Phatlalatso ya Matjhaba ya Helsinki.

Bokgoni ba motsamao wa mmele kaofela ke tsela eo ditshebetso tsa tlhasimollo ya mmele kaofela di phethwang. Motsamao wa mmele kaofela ke tshebediso ya mesifa e meholo ya mmele ho phetha ditshebetso. Baithuti ba Kereiti ya R ba fanang ka tumello ya ho ba karolo ya phuputso ena kaofela ba tla fumana ditekolo tse mabapi le bokgoni ba bona ba motsamao wa mmele kaofela ka ho sebedisa *Bruininks-Oseretsky Test of Motor Proficiency*, kgatiso ya bobedi (BOT-2). Tekolo e tla re dumella ho fumana boemo ba bokgoni ba motsamao wa mmele kaofela ba moithuti ho latela dilemo tsa hae. Karolo e nngwe ya bohlokwa ya phuputso ke hore lesedi la moithuti la tekanyo ya dikarolo tsa mmele e tla nkuwa ke basebetsi ba setjhabeng nakong ya diteko tsa pele ho qalo. Lesedi la moithuti la tekanyo ya dikarolo tsa mmele le tla kenyeletsa botelele, boima le modikoloho wa sephaka. Ho nka ditekanyo tsena ho tla thusa mofuputsi ho fumana haeba dintlha tse ka thoko di bile le kamo ya letho hodima bokgoni ba bona ba motsamao wa mmele kaofela. Lebaka la ho batla ho etsa patlisiso ena sebakeng se se nang dirisose tse lekaneng, ke ho fumana lesedi le eketsehileng mabapi le kamamo e ka bang teng dipakeng tsa maemo a bophelo le moruo o tlase le bokgoni ba motsamao wa mmele kaofela. Trompsburg e tsebahaditswe jwalo ka sebaka se hlokang dirisose tse lekaneng mme sehlopha sa dilemo sa baithuti ba Kereiting ya R se tsebahaditswe e le mokgahlelo wa bohlokwa moo bana ba lokelang hore ba be ba hodile ho lekana bakeng sa dibopeho tse ngata tsa kgolo hore ba ka qala ho kena sekolo.

Projeke ena ha e batle feela ho leka bokgoni ba motsamao wa mmele wa moithuti kaofela, empa hape ho tsitlallela ho susumetsa bokgoni ba motsamao wa mmele kaofela ba baithuti bana ka tsela e molemo ya lenaneo la tlhasimollo ya mmele kaofela ka ho ba kenya tlhasimollong ya tsamaiso ya mmele kaofela ka ho sebedisa disebediswa le mesebetsi tsa maiketsetso tsa tsamaiso ya mmele kaofela. Mofuputsi o tla fana ka disebediswa tsa maiketsetso tsa motsamao wa mmele kaofela tse reretsweng ka ho kgetheha ditshebetso tsa motsamao wa mmele kaofela (hlophisa ho latela diphetho tsa CAPS Kereiti ya R Grade) ho fumana tlhasimollo ya motsamao wa mmele kaofela. Mona ke teng moo bonkakarolo ba matjhere kaofela bo hlokehang. Haeba matitjhere a dumela ho nka karolo phuputsong, mofuputsi o tla ba fa wekshopo e mabapi le ka moo sesebediswa se sebetsang ka teng le ka moo ba lokelang ho kenya tshebetsong mesebetsi ena. Tshebetso ya matitjhere e tla ba ho teka mesebetsi ho baithuti nakong ya bona ya ho bapala ho tloha ka 11:45 ho fihla ka 12:45. Matitjhere a ka nna a fana ka tlalehelo ho mofuputsi mabapi le kgatelopele.

Tlalehelo ena e tla sebediswa ho thusa matitjhere ho teka mesebetsi le ho rarolla ditshitiso. Mofuputsi hape o tla eta hang beke e nngwe le e nngwe ho bokeletsa tlalehelo e lekaneng le ho thusa matitjhere. E le karolo ya phuputso ena baithuti ba Kereiti ya R ba tla arolwa ka lotho dihlopheng tse pedi. Sehlopha se seng e tla ba se fumanang tlhasimollo ya motsamao wa mmele kaofela mme se seng e tla ba se sa fumaneng tlhabollo efe kapa efe ya tlatsetso. Sehlopha se boletsweng bobeding se tla tswela pele ka papadi ya sona ya tlwaelo le bonkakarolo thutong ya boikwetliso ba mmele. Tlhasimollo e tla nka nako ya dibeke tse 17, ho ipapisitswe le dihla tsa sekolo tsa 2021. Tshebetso ena e reretswe ho thathiseletsa bohlokwa ba kgolo ya motsamao wa mmele le ho hlomella matitjhere ka sethusi sa ho phethahatsa thuto ya boikwetliso ba mmele le kgolo ya motsamao wa mmele baithuting bana. Kamora ho phethela phuputso, sehlopha se sa nkang karolo tlhasimollong ya mmele se tla fumana monyetla wa ho fumana tlhasimollo ya mmele. Ho kgonahatsa sena, disebediswa di tla dula sekolong mme mofuputsi o tla fumaneha ho rerisana le matitjhere ha ba tlisa sehlopha sa bobedi.

Kamora nako ya thupelo (dibeke tse 17 ba sebedisa sesebediswa) baithuti ba tla etswa teko hape ho bona hore na ba bile le ntlafalo ya letho. Lesedi le tla sebediswa ho fumana haeba ho bile le ntlafalo ya letho bokgoning ba bona ba motsamao wa mmele wa baithuti, haholo kamora hore ba be lenaneong la tlhasimollo ya motsamao wa mmele kaofela. Diteko tsohle le ditlhaloso tsa mesebetsi ya teko ho baithuti di tla tshehetswa ka phetolelo ya puo.

Lesedi le tla bokeletswa ke basebetsi ba hara setjhaba, ho kenyeletswa morupelli wa motsamao wa mmele wa bana (Kinderkineticist) le baithuti ba Thuto ya Motsamao wa Mmele ba selemo sa bo-4, mmoho le bafetoledi ba puo. Lesedi le bokeletsweng le tla bolokwa khomphuteng ka phasewete ka lebaka la hobane sephiri sa baithuti se le bohlokwa ho mofuputsi. Phasewete e tla fumaneha feela ho mofuputsi le moetapele wa phuputso. Sephiri sa baithuti le diphetho tsa bona di tla hlomphuwa ka dinako tsohle mme di tla bolokwa ka lekunutu. Ho netefatsa sena, moithuti ka mong o tla fumana nomoro ya monkakarolo nakong ya pokeletso ya lesedi mme mabitso a ke ke a fumaneha ho batho bafe kapa bafe ba ka thoko.

Na ho na le dikotsi tse amehang ka ho nka karolo patlisisong ee?
Ha ho menyetla ya kotsi e amehang.

Ho tla etshalang haeba ka sewelo ho ka ba le temalo e itseng e hlahang ka kotloloho ka lebaka la ho nka karolo ha hao phuputsong ee ya boithuto?
Bafuputsi ba na le mangolo le thupelo bakeng sa ho fana ka Thuso ya Pele mme ba tla kgona ho alafa dikotsi tse nyane, haeba di ka hlaha nakong ya teko. Haeba ngwana wa hao a lemetse nakong eo a nkileng karolo lenaneong la motsamao wa mmele kaofela, prothokole ya dikolo e tla latelwa mme mofuputsi o tla tsebiswa.
Melemo:

- Qetellong ya phuputso mofuputsi o tla o fa tlalehlo e akaretsang ya boemo ba bokgoni ba motsamao wa mmele kaofela ya sehlopha sa Kereiti ya R.

- Mofuputsi hape o tla phallela sekolo ka disebediswa tsena, mmoho le lenane la mesebetsi e entsweng patlisisong ena ho sekolo. Sena se fa baithuti bohle ba Kereiti ya R monyetla o lekanang wa ho fumana tlhabollo ya motsamao wa mmele kaofela.
- Hape ho ke ke ha ba le ditjeo tse amehang bakeng sa sekolo, titjhere kapa moithuti ba nkileng karolo phuputsong ena.

Na ho na le eng kapa eng e nngwe eo o lokelang ho e tseba kapa ho e etsa?

- O ka ikopanya le Ngaka Elna de Waal ho 082 550 9916 haeba o na le dipotso tse ding kapa o thulana le mathata afe kapa afe.
- O ka ikopanya le Komiti ya Boitshwaro ya Disaense tsa Dipatlisiso tsa Bophelo (Health Sciences Research Ethics Committee) ho 051 051-401 7794/5 haeba o na le dingongoreho dife kapa dife kapa ditletlebo tse sa rarollwang ka tsela e lekaneng ke Ngaka ya hao ya phuputso.
- O tla fumana khopi ya tlhahisoleseding ena le foromo ya tumello bakeng sa hore o ipolokele yona.

Haeba o ikemiseditse ho nka karolo ka phuputsong ena, ka kopo saena Boikano ba Tumelo bo hoketsweng mona.

Ba hao ka boikokobetso

____

Chanté Mathews
Mofuputsi ya ka Sehloohong
0764807892

- Boikano ba monkakarolo

Ka ho saena ka tlase mona, Nna …………………………………..………… ke dumela ho nka karolo patlisisong ya phuputso e bitswang "Bokgoni ba tlhabollo ya motsamao wa mmele kaofela (gross motor stimulation) ho ntlafatsa tlhabollo ya motsamao wa mmele kaofela ba baithuti ba Kereiti ya R ba sebakeng se se nang dirisose tse lekaneng"

.

Ke ikana hore:

- Ke badile pampitshana ya tlhahisoleseding e hoketsweng mona mme e ngotswe ka puo eo ke e tsebang hantle mme ke phutholohileng ka yona.
- Ke bile le monyetla wa ho botsa dipotso tsohle tsa ka mme di arabilwe ka tsela e lekaneng.
- Ke utlwisisa hore ho nka karolo phuputsong ena ke ho etsa ka boithaopo mme ha ke a hatellwa hore ke nke karolo.
- Nka kgetha ho tswa phuputsong ka nako efe kapa efe mme nke ke ka fuwa kotlo kapa ka kena mathateng ka tsela efe kapa efe.

E saennwe (*sebaka*) ....…......……………. Ka (*letsatsi*) …………...……….. 20…..

....

Tshaeno ya mosuwehlooho

Appendix O: Letter of consent for teachers

O.1 Teachers consent Afrikaans

ONDERWYSER TOESTEMMINGBRIEF

TITLE VAN NAVORSINGSPROJEK:

Grootmotoriese stimulasie om grootmotoriese vaardigheid van Graad R leerlinge in ’n lae hulpbron omgewing te verbeter

Geagte Juffrou

U word uitgenooi om deel te wees van ‘n navorsingsprojek wat deur Chanté Mathews gedoen gaan word. Neem asseblief ‘n oomblik om die inligting hieronder rakende die projek te lees.

Indien u enige vrae het, kontak asseblief die navorser of die skoolhoof. Dit is baie belangrik dat u gelukkig is en duidelik verstaan waaroor die projek handel.
Neem ook asseblief kennis, u deelname is totaal en al vrywillig en u mag deelname weier. Indien u nee sê, sal dit u nie in enige manier nadelig beïnvloed nie. U is ook welkom om enige tyd gedurende die studie te onttrek, al het u aan die begin toestemming gegee om deel te neem.

Waaroor handel hierdie navorsingsprojek?

Hierdie navorsingsprojek is spesifiek daarop gemik om die grootmotoriese vaardigheid van Graad R-leerders in 'n omgewing met lae hulpbronne te bepaal. Tweedens is dit daarop gemik om die grootmotoriese vaardigheid van Graad R-leerders in hierdie omgewing positief te beïnvloed deur middel van grootmotoriese stimulasie.

Motoriese vaardigheid is die manier waarop grootmotoriese take voltooi word. Grootmotories is die gebruik van die groot spiere in die liggaam om take uit te voer.

Die toets wat gebruik gaan word om die leerlinge te evalueer is *Bruininks-Oseretksy Test of Motor Proficiency, second edition*. Hierdie toets sal die navorser in staat stel om die leerlinge se grootmotoriese vlak te meet volgens hul ouderdom. Nog ‘n belangrike deel van hierdie studie is dat die leerlinge se gewig, lengte en bo arm omtrek gemeet gaan word. Die rede hiervoor is om te bepaal of eksterne faktore ‘n invloed kan hê op hul motoriese vaardighede.

Die navorser wil nie net die leerlinge se grootmotoriese vaardigheid toets nie, maar wil ook hul motoriese vaardigheid op 'n positiewe manier beïnvloed deur middel van 'n grootmotoriese stimuleringsprogram. Die navorser sal 'n handgemaakte motoriese apparaat voorsien met spesifiek ontwerpte grootmotoriese aktiwiteite (opgestel in ooreenstemming met CAPS Graad R-uitkomste), om grootmotoriese stimulasie te bewerkstellig.

Dit is hier waar u deelname as onderwyser nodig is:

Indien u instem om aan die studie deel te neem, sal die navorser 'n werkswinkel aanbied oor hoe die apparaat werk en hoe om die aktiwiteite te implementeer met behulp van die lys van aktiwiteite en “cue cards”. U taak is dan om hierdie aktiwiteite drie keer per week aan die leerders voor te lê in hul vrye speeltyd van 11:45 tot 12:45 vir die hele intervensieperiode. Al die betrokke onderwysers sal beurte kry en u sal dus nie elke week aktiwiteite aanbeid nie. 'n Tydskedule word aan u voorsien en dit sal ook tydens die werkswinkel uiteengesit word. Die grootmotoriese stimuleringsessies is 30 minute lank, een sessie sluit die eerste vyf aktiwiteite van die week in en die res van die aktiwiteite word in die tweede sessie uitgevoer. Die navorser sal elke twee weke ‘n besoek aflê om vrae te beantwoord. Daar sal ook elke tweede week 'n vierdejaarstudent beskikbaar wees. U as onderwyser sal die kontakinligting van die navorser hê en toegelaat word en aangemoedig word om haar te kontak indien nodig.

Vertroulikheid:

U persoonlike inligting sal privaat bly en nie in enige van die navorsingsbevindinge gebruik word nie, of in enige van die resultate gepubliseer word nie.

Vergoeding:

U deelname sal opreg waardeer word, maar dit is belangrik om te weet dat daar geen betalings aan u gemaak sal word vir deelname nie.

Voordele deur om deel te neem:

U kennis oor die grootmotoriese funksies sal verbreed word en u sal leer van nuwe maniere om speeltyd meer effektief te struktureer en toepaslik te maak vir die leerlinge se ouderdom.

Wat sal gebeur in die onwaarskynlike geval dat daar een of ander vorm van besering sal plaasvind as gevolg van deelname aan hierdie navorsingstudie?

In die geval dat 'n kind beseer word terwyl hy/sy met die apparaat werk, kan die skoolprotokol rakende 'n beseerde kind gevolg word en die navorser moet daarvan in kennis gestel word.

Is daar enige iets anders waarvan u moet kennis dra?

U kan Dr Elna de Waal by 082 550 9916 kontak indien daar enige verdere vrae is of indien u enige probleme tee kom.

Indien u enige klagtes of bekommernisse het wat nie voldoende deur die navorser aangespreek was nie, kan u die Health Sciences Research Ethics Committee by 051-401 7794/5 kontak.

U sal ‘n kopie van hierdie inligting en die toestemmingsbrief vir u eie rekords ontvang.

Die navorser

____

Chanté Mathews

Kontak nommer: 0764807892

- Verklaring deur deelnemer:

Deur hieronder te teken stem ek, …………………………………..…………. in om deel te neem aan die volgende studie: Grootmotoriese stimulasie om grootmotoriese vaardigheid van Graad R leerlinge in ŉ lae hulpbron omgewing te verbeter.

Ek verklaar die volgende:

- Ek het die volgende inligting en toestemmingsbrief gelees, of dit is aan my gelees en dit is geskryf in 'n taal waarin ek gemaklik en vlot is.
- Ek het 'n geleentheid gehad om vra te vrae en al my vrae is voldoende beantwoord.
- Ek verstaan dat deelname vrywillig is en dat ek nie onder druk geplaas was om deel te moet neem nie.
- Ek mag enige tyd die studie verlaat en sal nie gepenaliseer of benadeel word nie.

Geteken by (*plek*) ....…........…………….. op (*datum*) …………...……….. 20...

....
Handtekening van deelnemer Handtekening van getuie

O.2 Teachers consent English

Teacher's Consent Form

TITLE OF THE RESEARCH PROJECT:

Gross motor stimulation to improve the gross motor proficiency of Grade R learners in a low resourced environment

---

Dear Teacher

You are being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask the researcher or principal any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how you could be involved. Also, your participation is entirely voluntary and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

What is this research study all about?

This research project will specifically aim to determine the gross motor proficiency of Grade R learners in a low resourced environment. As well as to positively influence the gross motor proficiency of Grade R learners in a low resourced environment, by means of gross motor stimulation.

Motor proficiency is the way in which gross motor tasks are completed. Gross motor is the use of the large muscles in the body to perform tasks. The type of test which will be used to evaluate this is the Bruininks-Oseretksy Test of Motor Proficiency, second edition. This test will allow the researcher to determine the gross motor level of learners according to their age. Another important part of this study is that the learners' height, weight and upper arm circumference will be measured. The reason for this is to determine if external factors have an impact on their motor proficiency.

The researcher does not only want to test the learners' gross motor proficiency, but also want to strive to influence these learners' motor proficiency in a positive way by means of a gross motor stimulation program. The researcher will be providing a handmade gross motor apparatus with specifically designed gross motor activities (set up in line with CAPS Grade R outcomes) to elicit gross motor stimulation.

This is where the participation of you as the teacher is needed.

If you agree to partake in the study the researcher will provide a workshop on how the apparatus works and how to implement the activities using the list of activities and cue cards. Your task will then be to present these activities twice a week to the learners in their free play time from 11:45 to 12:45, for the whole intervention period. A time schedule will be provided to you and this will also be explained during the workshop. The gross motor stimulation sessions will be 30 minutes long, session one including the first five activities of the week and session two the remainder. The researcher will visit you every two weeks to check in and answer any questions you might have. There will also be a 4th year student available during every second week. You as the teacher will have the researcher's contact information and will be allowed and encouraged to contact her if the need be.

Confidentiality:

Your personal information will remain private and will not be used in any of the research findings, or be published in any of the results.

Reimbursement:

Your participation will be greatly appreciated, but it is important to know that no payments will be made to you for participating.

Benefits of participating:

Your knowledge on gross motor function will be broaden and you will learn of new ways to structure playtime more effectively and age appropriately.

What will happen in the unlikely event of some form injury occurring as a direct result of your taking part in this research study?
In the event that a child is injured while working with the apparatus, the schools protocol regarding an injured child can be followed and the researcher should please be notified.

Is there anything else that you should know or do?
You can contact Dr Elna de Waal at 082 550 9916 if you have any further queries or encounter any problems.
You can contact the Health Sciences Research Ethics Committee at 051-401 7794/5 if you have any concerns or complaints that have not been adequately addressed by your study doctor.
You will receive a copy of this information and consent form for your own records.

The researcher

____

Chanté Mathews
Contact number: 0764807892

- Declaration by participant

By signing below, I ……………………………………..…………. agree to take part in a research study entitled *“Gross motor stimulation to improve the gross motor proficiency of Grade R learners in a low resourced environment”.*

I declare that:

- I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is voluntary and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.

Signed at (*place*) ....…........…………….. on (*date*) …………...……….. 20...

....	....
Signature of participant	Signature of witness

O.3 Teachers consent Sesotho

Foromo ya Tumelo ya Titjhere

SEHLOOHO SA PROJEKE YA PATLISISO:

Tlhabollo ya motsamao wa mmele kaofela (gross motor stimulation) ho ntlafatsa bokgoni ba tlhabollo ya motsamao wa mmele kaofela ba baithuti ba Kereiti ya R sebakeng se se nang dirisose tse lekaneng

Titjhere e Hlomphehang

O memelwa ho nka karolo projekeng ya patlisiso. Ka kopo iphe nako ya ho bala tlhahisoleseding e fanweng mona, e tlang ho hlalosa dintlha tse feletseng tsa projeke ena. Ka kopo botsa mofuputsi kapa mosuwehlooho dipotso dife kapa dife tse mabapi le karolo efe kapa efe ya projeke ena tseo o sa di utlwisiseng ka botlalo. Ho bohlokwa haholo hore o ikgotsofatse ka botlalo hore o utlwisisa se hlokwang ke phuputso ena le ka moo o ka amehang. Hape, bonkakarolo ba hao ke ba boithaopo ka ho phethahala mme o na le tokelo ya ho hana ho nka karolo. Haeba o re tjhe, sena se ke ke sa o ama ka tsela e seng ntle jwang kapa jwang. Hape o lokolohile ho ka ikgula phuputsong ka nako efe kapa efe, esita leha o dumetse ho nka karolo.

Phuputso ee ya patlisiso hantle e mabapi le eng?

Projeke ya phuputso e tla toba ka ho kgetholoha ho fumana bokgoni ba tlhabollo ya motsamao wa mmele kaofela (gross motor stimulation) ba baithuti ba Kereiti ya R sebakeng se nang le dirisose tse lakeneng. Mmoho le ho susumetsa ka tsela e ntle bokgoni ba tlhasimollo ya motsamao wa mmele ya baithuti ba Kereiti ya R sebakeng se nang le dirisose tse lekaneng, ka tsela ya tlhasimollo ya mmele kaofela.

Bokgoni ba motsamao ke tsela eo ditshebetso tsa tlhasimollo ya mmele kaofela di phethwang. Motsamao wa mmele kaofela ke tshebediso ya mesifa e meholo ya mmele ho phetha ditshebetso. Mofuta wa teko e tla sebediswa ho lekola sena ke *Bruininks-Oseretksy Test of Motor Proficiency*, kgatiso ya bobedi.

Teko ena e tla dumella mofuputsi ho fumana boemo ba motsamao wa mmele kaofela ba baithuti ho latela dilemo tsa bona. Karolo e nngwe ya phuputso ena ke hore botelele ba baithuti, boima ba mmele le modikoloho wa sephaka se hodimo di tla methwa. Lebaka la sena ke ho fumana haeba dintlha tse kantle di ba le kamo ya letho bokgoning ba motsamao wa mmele ya bona.

Patlisiso ena ha e batle ho leka bokgoni ba motsamao wa memele wa moithuti kaofela, empa hape e batla ho tsitlallela ho susumetsa bokgoni ba motsamao wa mmele kaofela ba baithuti bana ka tsela e molemo ya lenaneo la tlhasimollo ya mmele kaofela. Mofuputsi o tla fana ka disebediswa tsa maiketsetso tsa motsamao wa mmele kaofela tse reretsweng ka ho kgetheha ditshebetso tsa motsamao wa mmele kaofela (e lekantsweng ho latela diphetho tsa CAPS Kereiti ya R Grade) ho fumana tlhasimollo ya motsamao wa mmele kaofela.

Mone ke teng moo bonkakarolo ba hao jwalo ka titjhere bo hlokehang.

Haeba o dumela ho nka karolo phuputsong mofuputsi o tla fana ka wekshopo e mabapi le ka moo sebediswa se sebetsang ka teng le ka moo o lokelang ho kenya tshebetsong mesebetsi ka ho sebedisa lenane la ditshebetso le dikarete tsa tshupiso. Tshebetso ya rona jwale e tla ba ho teka mesebetsi habedi ka beke ho baithuti nakong ya bona ya ho bapala ho tloha ka 11:45 ho fihla ka 12:45, bakeng sa nako yohle ya thuto. Tlhophiso ya nako e tla fanwa ho wena mme sena se tla hlaloswa nakong ya wekshopo. Diseshene tsa tlhabollo ya mmele kaofela di tla nka metsotso e 30 ka botelele, seshene ya pele e kenyeletsa ditshebetso tse hlano tsa beke mme seshene ya bobedi e nka nako e setseng. Mofuputsi o tla o etela dibeke tse ding le tse ding tse pedi ho hlahloba le ho araba dipotso dife kapa dife tseo o ka bang le tsona. hape ho tla ba le moithuti wa selemo sa bo-4 ya fumanehang nakong ya beke e nngwe le e nngwe ya bobedi. Wena jwalo ka titjhere o tla ba le tlhahisoleseding ya boikopanyo ya mofuputsi mme o tla dumellwa le ho kgothaletswa ho ikopanya le yena ha ho hlokeha.

Sephiri:

Tlhahisoleseding ya botho e tla dula e le lekunutu mme e ke ke ya sebediswa ho dife kapa dife tsa ditshibollo tsa patlisiso, kapa ho phatlalatswa ho diphetho dife kapa dife.

Dipuseletso tsa tjhelete:

Bonkakarolo ba hao bo tla thoholetswa haholo, empa ho bohlokwa ho tseba hore ha ho ditefo tsa letho tse tla etswa ho wena bakeng sa bonkakarolo.

Melemo ya ho nka karolo:

Tsebo ya hao e mabapi le tshebetso ya motsamao wa mmele kaofela e tla pharalatswa mme o tla ithuta ditsela tse ntjha tsa ho hlophisa nako ya ho bapala ka tsela e atlehileng le ho feta le e tsamaellanang le dilemo tsa bona ka tshwanelo.

Ho tla etshalang haeba ka sewelo ho ka ba le temalo e itseng e hlahang ka kotloloho ka lebaka la ho nka karolo ha hao phuputsong ee ya boithuto?

Haeba ho etsahala hore ngwana wa hao a lemale ha a ntse a sebedisa sesebediswa, prothokole ya sekolo e mabapi le ngwana ya lemetseng e ka latelwa mme mofuputsi o tlameha ho tsebiswa ka kopo.

Na ho na le eng kapa eng e nngwe eo o lokelang ho e tseba kapa ho e etsa?

O ka ikopanya le Ngaka Elna de Waal ho 082 550 9916 haeba o na le dipotso tse ding kapa o thulana le mathata afe kapa afe.

O ka ikopanya le Komiti ya Boitshwaro ya Disaense tsa Dipatlisiso tsa Bophelo (Health Sciences Research Ethics Committee) ho 051 051-401 7794/5 haeba o na le dingongoreho dife kapa dife kapa ditletlebo tse sa rarollwang ka tsela e lekaneng ke mofuputsi wa hao.

O tla fumana khopi ya tlhahisoleseding ena le foromo ya tumello bakeng sa hore o ipolokele yona.

Mofuputsi

____

Chanté Mathews

Nomoro ya boikopanyo: 0764807892

- Boikano ba monkakarolo

Ka ho saena ka tlase mona, Nna ……………………………….…………. ke dumela ho nka karolo patlisisong ya phuputso e bitswang "*Bokgoni ba tlhabollo ya motsamao wa mmele kaofela (gross motor stimulation) ho ntlafatsa tlhabollo ya motsamao wa mmele kaofela ya baithuti ba Kereiti ya R ba sebakeng se se nang dirisose tse lekaneng".*

Ke ikana hore:

- Ke badile kapa ke balletswe foromo ena ya tlhahisoleseding le tumello mme e ngotswe ka puo eo ke e tsebang hantle le ho phutholoha ka yona.
- Ke bile le monyetla wa ho botsa dipotso tsohle tsa ka mme di arabilwe ka tsela e lekaneng.
- Ke utlwisisa hore ho nka karolo phuputsong ena ke ho etsa ka boithaopo mme ha ke a hatellwa hore ke nke karolo.
- Nka kgetha ho tswa phuputsong ka nako efe kapa efe mme nke ke ka fuwa kotlo kapa ka kena mathateng ka tsela efe kapa efe.

E saennwe (sebaka) ....…........…………….. ka la (mohla) …………....……….. 20...

....

Tshaeno ya monkakarolo Tshaeno paki

Appendix P: Letters of assent for learners

P.1 Child Assent Afrikaans

DEELNEMER INLIGTING PAMFLET EN INSTEMMINGSBRIEF

Februarie 2021

TITLE VAN NAVORSINGSPROJEK:

Grootmotoriese stimulasie om groot motoriese vaardigheid van Graad R leerlinge in 'n lae hulpbron omgewing te verbeter

Beste Leerling

U word gevra om saam met Chanté Mathews (Kinderkinetikus) en 'n paar van haar werkvriende te speel as deel van haar projek.

Jy sal gevra word om 'n lys aktiwiteite te voltooi.
Jy sal gevra word om te:

- Spring
- Vang
- Gooi
- En nog vele meer

Dit gaan meet hoe goed jou spiere 'n sekere taak kan doen en hoe goed jou lyfie beweeg.
Ons gaan ook meet hoe lank jy is, hoeveel jy weeg en hoe groot jou bo arm spier is.

Die hele tyd wat jy speel gaan daar ‘n persoon wees wat jou taal verstaan. Hierdie persoon gaan jou help om die aktiwiteite te verstaan deur hoe jy dit moet doen dit vir jou te verduidelik.

Ons gaan ook vir mamma of pappa vra of dit reg is as jy aan die projek deelneem, maar ons wil by jou ook hoor of jy wil saam speel.
As jy wil saal speel, kleur die glimlag gesiggie in; en as jy nie wil saam speel nie, kleur jy die hartseer gesiggie in.

_________________________ ____________________

Naam van kind Datum

P.2 Child Assent English

PARTICIPANT INFORMATION LEAFLET AND ASSENT FORM

February 2021

TITLE OF THE RESEARCH PROJECT:

Gross motor stimulation to improve the gross motor proficiency of Grade R learners in a low resourced environment

Dear Learner

You are being asked to play alongside Chanté Mathews (Kinderkineticist) and some of her work friends, as part of her project.

You will be asked to complete a list of tasks.

You will be asked to:

- Jump
- Catch
- Throw
- And more

This will measure how good your muscles are at doing a certain job and how good your body moves.

We will also be measuring how tall you are, how much you weigh and how big your upper arm is.

At all times during play time a person who understands your language will be there. This person will help you to understand the tasks better and explain to you how to do the activities.

We will also be asking your parents if it is OK for you to take part in this study, but we also want to know if it is OK with you.
If you want to play as part of this study please mark the smiley face for yes or the sad face for no.

________________________ ____________________

Name of Child Date

P.3 Child Assent Sesotho

PAMPITSHANA YA TLHAHISOLESEDING YA MONKAKAROLO LE FOROMO YA TUMELLO

Hlakola 2021

SEHLOOHO SA PROJEKE YA PATLISISO:

Bokgoni ba tlhabollo ya motsamao wa mmele kaofela (gross motor stimulation) ho ntlafatsa tlhabollo ya motsamao wa mmele kaofela ba baithuti ba Kereiti ya R sebakeng se se nang dirisose tse lekaneng

Moithuti ya Ratehang

O kotjwa ho bapala mmoho le Chanté Mathews (Kinderkineticist) le metswalle e meng ya hae ya mosebetsing e le karolo ya projeke ya hae.

O tla kotjwa ho tlatsa lenane la ditshebetso.

O tla kotjwa ho:

- Tlola
- Tshwara
- Akgela
- Le tse ding

Sena se tla metha hore na mesifa ya hao e sebetsa hantle hakae ho etsa mosebetsi o itseng le hore metsamao ya mmele wa hao e metle hakae.

Hape re tla metha hore o motelele bo bokae, hore o boima bo bokae le hore sephaka sa hao se hodimo se boholo bo bokae.

Ka dinako tsohle tsa ho bapala motho ya utlwisisang puo ya hao o tla ba teng. Motho enwa o tla o thusa ho etsa mesebetsi hantle ho feta le ho o hlalosetsa hore ditshebetso di etswa jwang.

Hape re tla botsa batswadi ba hao hore na ho lokile hore o ka nka karolo phuputsong ena, empa hape re batla ho tseba haeba ho lokile ho wena.
Haeba o batla ho bapala jwalo ka karolo ya phuputso ena ka kopo tshwaya sefahlelo se bososelang bakeng sa e kapa sefahleho se hlonameng bakeng sa tjhe.

________________________ ____________________

Lebitso la Ngwana Mohla

Appendix Q: Participant detail sheet

<table>
<tr><td colspan="3">Participant Details Sheet:</td></tr>
<tr><td colspan="3">Participant number:</td></tr>
<tr><td colspan="2">Date of Birth:</td><td>Age:</td></tr>
<tr><td colspan="2">School:</td><td>Home Language:</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td>Height:</td><td rowspan="2">Any previous treatment:</td><td rowspan="2">Any diagnoses’:</td></tr>
<tr><td>Weight:</td></tr>
<tr><td>Upper arm circumference:</td><td></td><td></td></tr>
</table>

Appendix R: Link to Child: care, health and development prescriptions

https://onlinelibrary.wiley.com/page/journal/13652214/homepage/forauthors.html