THE EFFECTS OF TWO VERSIONS OF THE GAMES FOR UNDERSTANDING APPROACH ON THE APPLICATION OF TACTICS, MOTOR SKILLS AND PHYSICAL FITNESS OF GRADE FOUR CHILDREN

by

Warren Grant Adams

Student No 3078401

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SUPERVISOR: Dr. S. Bassett

CO- SUPERVISOR: Prof ES Bressan

DECLARATION

I hereby declare that "The Effects of Two Versions of the Games-for-Understanding Approach on the Application of Tactics, Motor Skills and Physical Fitness of Grade Four Children" is my own work, that has not been submitted for any degree or examination in any other university, and that all the sources used or quoted have been indicated and acknowledged by means of complete references.

Warren G. Adams

Signature _____ Date: _____

Witness: _____

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ABSTRACT

The aim of this study was to determine the effects of participation in a single sport small-sided games (SSG) programme compared to a multi-sport SSG programme on the physical fitness, gross motor coordination, soccer skills and application of tactics during soccer games of grade four children from a disadvantaged community.

Two intact classes of boys and girls (n= 39 and n=40) participated in a six-week, 2x per week intervention programme. One class specialized in soccer and the other engaged in a diversified programme where they sampled hockey and team handball along with soccer. In terms of pedagogy, both classes followed a deliberate play model with its focus on intrinsic learning and non-intervention by a coach.

Data were collected during pre-, post- and retention test periods. Both boys' groups achieved significant improvements in their muscle endurance-push-ups, power and aerobic endurance on the retention test. Only the boys who participated in the multi-sport SSG programme achieved a significant improvement on their muscle endurance-sit-ups. The girls from both groups showed significant improvements in all physical fitness variables, with the exception of the girls in the muti-sport programme who did not achieve a significant improvement in their speed.

Significant improvements were experienced by all groups for gross motor coordination and soccer skills. The boys in the soccer SSG programme demonstrated improvements in both offensive and defensive tactics while the boys in the multi-sport SSG programme improved in the application of their defensive tactics only. The girls who participated in the soccer SSG programme also improved in their defensive tactics while the

girls who participated in the multi-sport SSG programme achieved improvements in their application of both offensive and defensive tactics.

The results of this study support proponents of the Developmental Model of Sport Participation as presented in current sport pedagogy literature, who claim that the physical and tactical benefits pre-pubescent children derive from participation in a diversified games programme will be similar to those benefits derived from participation in a specialized sport-specific game programme, providing the sports involved are late specialization sports. These results support the conclusion that it is not necessary for pre-pubescent children to specialize in a late specialization sport such as soccer in order to progress in their ability to play soccer. They can make similar progress if they participate in a diversified games programme that provides them with a broader experience with sports that have similar physical and tactical requirements.

Key Words: Developmental Model of Sport Participation; Deliberate Play; Sport Specialization; Sport Sampling; Sport Diversification

TABLE OF CONTENTS

Title page i

Declaration ii

Acknowledgements iii

Abstract iv

Chapter One: SETTING THE PROBLEM 1

Background 2

Specialization versus Diversification 2

Implications for Sport Pedagogy 3

Statement of the Problem 5

Aim of the Study 6

Objectives of the Study 7

Hypotheses 7

Delimitations 8

Significance of the Study 9

Ethical Statement 11

Definition of Terms 13

Specialization 13

Diversification 13

Games for Understanding 13

Implicit and Explicit Learning 13

Chapter Two: REVIEW OF LITERATURE 14

Specialization and Diversification in Relation to Athlete Development Pathways 15

The Long-Term Athlete Development Model 15

The Developmental Model of Sport Participation 21

The Foundations, Talent, Elite and Mastery Framework 26

Comments about Development Pathways 29

Two Critical Issues for Youth Sport 30

Specialization versus Diversification 31

Specialization 31

Diversification 33

Deliberate Practice and Deliberate Play 34

Deliberate Practice 35

Deliberate Play 36

Explicit and Implicit Learning 37

Comments about these Two Issues 39

Games-Centred Approaches 43

Games for Understanding Approaches 43

Games For Understanding, Transfer and Diversification 46

Research about Transfer of Tactical Understanding 47

Comments about Transfer and Diversification 48

Games For Understanding, Deliberate Play and Small-sided Games 49

Games For Understanding and Small-sided Games 50

Benefits of Small-sided Games 52

Comments about Deliberate Play and Small-sided Games 53

Concluding Remarks 54

Chapter Three: METHODOLOGY 57

Design 57

Procedures 58

Selection of Participants 58

Inclusion Criteria 59

Exclusion Criteria 60

Development of Test Protocols 61

Preparation for Testing 62

Pre-Tests 63

Small-sided Games Intervention Programmes 65

Post-tests and Retention Tests 66

Data Processing and Analysis 67

Physical Fitness, Gross Motor Coordination and Soccer Skills 67

Application of Tactics during Game Play 68

Validity of the Category Set 68

Games Analysis Sessions 69

Presentation of Results 72

Chapter Four: RESULTS 73

Descriptive Data 73

Analysis of Data 76

Hypothesis One 78

Within Group Changes for Boys' Physical Fitness 78

Boys' Gr 1 Soccer 78

Boys' Gr 2 Multi-sport 79

Interaction Effects for Boys' Physical Fitness 80

Between Group Differences for Boys' Physical Fitness 81
Within Group Changes for Girls' Physical Fitness 82
Girls' Gr 1 Soccer 82
Girls' Gr 2 Multi-sport 83
Interaction Effects for Girls' Physical Fitness 83
Between Group Differences for Girls' Physical Fitness 86
Response to Hypothesis One (Physical Fitness) 86
Hypothesis Two 87
Within Group Changes for Boys' Gross Motor Coordination 87
Boys' Gr 1 Soccer 88
Boys' Gr 2 Multi-sport 88
Interaction Effects for Boys' Gross Motor Coordination 88
Between Group Differences for Boys' Gross Motor Coordination 90
Within Group Changes for Girls' Gross Motor Coordination 90
Girls' Gr 1 Soccer 91
Girls' Gr 2 Multi-sport 91
Interaction Effects for Girls' Gross Motor Coordination 91
Between Group Differences for Girls' Gross Motor Coordination 91
Response to Hypothesis Two (Gross Motor Coordination) 92
Hypothesis Three 93
Within Group Changes for Boys' Soccer Skills 93
Boys' Gr 1 Soccer 93
Boys' Gr 2 Multi-sport 94
Interaction Effects between Boys' Soccer Skills 94
Between Group Differences for Boys' Soccer Skills 94
Within Group Changes for Girls' Soccer Skills 95
Girls' Gr 1 Soccer 95

Girls' Gr 2 Multi-sport 95
Interaction Effects for Girls' Soccer Skills 96
Between Group Differences for Girls' Soccer Skills 96
Response to Hypothesis Three (Soccer Skills) 96
Hypothesis Four 97
Games Analysis for Boys 97
Boys' Gr 1 Soccer 99
Boys' Gr 2 Multi-sport 99
Games Analysis for Girls 100
Girls' Gr 1 Soccer 101
Girls' Gr 2 Multi-sport 102
Response to Hypothesis Four (Application of Tactics) 102
Summary 103
In Terms of Physical Fitness 103
In Terms of Gross Motor Coordination 104
In Terms of Soccer Skills 105
In Terms of Application of Tactics 105

Chapter Five: DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS 106

Discussion 106
Physical Fitness 106
Gross Motor Coordination 109
Soccer Skills 110
Application of Tactics in the Soccer Small-sided Game 111
Conclusions 111
Limitations 112

Small-sided Games, Deliberate Play and Implicit Learning 115
Specialization versus Diversification 116
Concluding thoughts about Specialization, Diversification and Deliberate Play 116
Recommendations 117
For Professionals 118
For Future Research 118

REFERENCES 120

APPENDICES

Appendix A	Application and Institutional Approval	131
Appendix B	Information Letter to Parents/Guardians	133
Appendix C	Informed Consent	136
Appendix D	Assent Form	137
Appendix E	Test Protocols for Physical Fitness and Gross Motor Coordination	138
Appendix F	Test Protocols for Selected Soccer Skills	142
Appendix G	Playing Schedule and Rules of the Small-sided Games	145
Appendix H	Pictures from the Small-sided Games Intervention Programmes	148

LIST OF TABLES

Table 1	Examples from Maulden and Redfern's (1981) Categories of Games	4
Table 2	Côté and Fraser-Thomas' (2008) recommendations for the distribution of types of play and sport specialization/diversification during the different stages of development (p. 23)	41
Table 3	Examples of Games from the Four Different Categories	43
Table 4	Weekly schedule followed in the study	58
Table 5	Dependent Variables for Fitness, Gross Motor Coordination and Soccer Skills	61
Table 6	Schedule for Pre-testing during Weeks Three and Four	63
Table 7	Outline of Weekly Training Maintained for Weeks 6 to 11	65
Table 8	Category Set to Guide the Games Analysis of Invasion Games (adapted from Mitchell *et al*., 2006)	69
Table 9	The Simplified Category Set Used to Guide the Games Analysis	71
Table 10	Rating Scale used by Evaluators to Assess Children's Game Play	71
Table 11	Demographics of the Participants	73
Table 12	Changes in Boys' Physical Fitness within each Group	79
Table 13	Interaction Effects for Boys' Physical Fitness Variables	80
Table 14	Between Group Differences for Boys' Physical Fitness	81
Table 15	Changes in Girls' Physical Fitness within each Group	82
Table 16	Interaction Effects for Girls' Physical Fitness Variables	83
Table 17	Between Group Differences for Girls' Physical Fitness	86
Table 18	Summary of Significant Changes in Children's Physical Fitness	86

Table 19	Changes in Boys' Gross Motor Coordination within each Group	88
Table 20	Interaction Effects for Boys' Gross Motor Coordination Variables	89
Table 21	Between Group Differences for Boys' Gross Motor Coordination	90
Table 22	Changes in Girls' Gross Motor Coordination within each Group	90
Table 23	Interaction Effects for Girls' Gross Motor Coordination Variables	91
Table 24	Between Group Differences for Girls' Gross Motor Coordination	92
Table 25	Summary of Significant Changes in Children's Gross Motor Coordination	92
Table 26	Changes in Boys' Soccer Skills within each Group	93
Table 27	Interaction Effects for Boys' Soccer Skill Variables	94
Table 28	Between Group Differences for Boys' Soccer Skills	94
Table 29	Changes in Girls' Soccer Skills within each Group	95
Table 30	Interaction Effects for Girls' Soccer Skill Variables	96
Table 31	Between Group Differences for Girls' Soccer Skills	96
Table 32	Summary of Significant Changes in Children's Soccer Skills	97
Table 33	Results of the Games Analysis for the Boys	98
Table 34	Results of the Games Analysis for the Girls	100
Table 35	Summary of Significant Changes in Children's Application of Tactics	102

LIST OF FIGURES

Figure 1	The LTAD for early and late specialization sports (as adapted from Balyi *et al.*, 2013)	17
Figure 2	The three pathways in the DMSP and the relationship between deliberate play and deliberate practice at each stage (adapted from Côte & Fraser-Thomas, 2007)	22
Figure 3	The ossibility of an early engagement pathway in late specialization sports (adapted from Côte et al., 2007)	25
Figure 4	The FTEM Framework proposed by Gulbin *et al*. (2013a:5)	27
Figure 5	Different types of play associated with an explicit to implicit learning continuum	37
Figure 6	GFU approaches within a framework for thinking about content and coaching methodology for Invasion Games (adapted from Gréhaigne *et al*., 2005, p.105)	49
Figure 7	Boys' Height (cm)	74
Figure 8	Boys' Weight (kg)	74
Figure 9	Girls' Height (cm)	75
Figure 10	Girls Weight (kg)	75
Figure 11	Interaction Effects for Boys' Muscle Endurance (push-ups in 30secs)	80
Figure 12	Interaction Effects for Girls' Muscle Endurance (push-ups in 30secs)	84
Figure 13	Interaction Effects for Girls' Power (standing long jump cm)	84
Figure 14	Interaction Effects for Boys' Balance Beam Walk	89
Figure 15	Pre- to Post-Test Comparisons for Boys' Application of Offensive and Defensive Tactics	98

Figure 16 Pre- to Post-Test Comparisons for Girls' Application of Offensive and Defensive Tactics 101

Chapter One

SETTING THE PROBLEM

Specialization in youth sport has become an increasingly complex problem as more and more parents and sport federations are encouraging programmes that not only introduce children to a specific sport, but also involve them in serious training to the exclusion of participation in other sports (Gould, 2010). While acknowledging that some sports do require carefully managed specialized training as early as ages 5 to 6, the majority of sports can be regarded as late specialization sports because peak performance is only approached post-puberty (Coakley, 2010). Malina (2010) cautioned that specialization and the intensive training in the pre-pubescent years bring substantial risks to children's development that either must be carefully managed or avoided by taking what has been labelled the "diversification approach," in which children are encouraged to participate in a wide variety of different games and sports that can provide a sound basis for future specialization in a single sport. Gould (2010) concluded that questions about when to diversify participation across a variety of sports rather than specialize in a single sport and how much deliberate practice is optimal for children's sport development persist as critical issues in youth sport.

Attempts to describe how children progress from the initial learning of movement skills through to proficiency and then expertise in sport performance over the past 15 years have been centred around two different models, each of which deals with children's specialization in sport in a different way (Côté, Lidor & Hackfort, 2009). One model that has dominated professional discussions is the Long-term Athlete Development Model (LTAD) (Balyi, 2001; Balyi, Way & Higgs, 2013). The other model that has attracted research activity is the Developmental Model of Sport Participation (DMSP) (Côté, 1999; Côté & Fraser-

Thomas, 2007). Both models acknowledge the importance of specialization at some point during an individual's 'middle years' (ages 8 to 16) in order to achieve his/her sporting potential. Despite this common point of departure, there are important differences between the two models. For example, the LTAD Model is associated with following a sequence of sport-specific stages of development with the transitions between stages focused on the popular notion that ±10,000 hours of deliberate practice must be distributed over a number of years in order to become an expert (Williams & Hodges, 2005). The DMSP is focused on how the content of practice sessions and the coaching methods implemented to deliver that content should be recommended as the critical elements in the development of expertise relative to each phase, rather than investment of a number of hours in deliberate practice (Côté *et al*., 2009).

Background

Specialization versus Diversification

Sport specialization has been defined as participation in specific, intense training for a single sport at a competitive level (Baker, Cobley, & Fraser-Thomas, 2009). Differences of opinion surrounding when and how quickly to specialize are part of the emerging literature surrounding the specialization versus diversification debate. This debate will receive more attention in Chapter Two of this study. Both the LTAD model and the DMSP do acknowledge the necessity of specialization as part of the expert performance pathway, however, each model proposes a different balance between specific deliberate practice in a single sport and a more playful diverse approach that promotes practice in a variety of sports (Bridge & Toms, 2013).

In an effort to implement a systematic approach to talent development, some countries and national sport federations have promoted the adoption of the seven-stage Balyi and Hamilton (2004) version of the Long-term Athlete Development (LTAD) model as a guide for their youth sport development programmes (*e.g.* Canadian Sport for Life, 2008). Within this version, the time for specialization is labelled the Learn-to-Train Stage. This stage typically includes boys and girls between ages 9-12 years, although Balyi and Hamilton (2004) acknowledged that a variety of factors ranging from type of sport and environmental context might affect optimal ages for specialization. Even in those sports regarded as early specialization sports such as swimming and gymnastics, a specific phase for the transition from early learning of fundamental skills to practicing sport-specific skills is identified (Mattson & Richards, 2010).

From the perspective of the DMSP (Côté & Fraser-Thomas, 2007), the development of proficiency in a specific sport begins with a Sampling Phase (approximately ages 6 to 12) during which youth play a wide variety of modified games and sports. The Sampling Phase is then followed by the Specialization Phase (ages 13 to 15) where participation in several sports is pursued, and then participation narrows progressively to fewer sports until the individual chooses to commit to a single sport. This final phase is referred to as the Investment Phase (age 16+) where the focus is on deliberate practice in the chosen sport.

Implications for Sport Pedagogy

Tinning (2008) defined sport pedagogy as the integration of the study of curriculum, methods of teaching and learning as applied to sport. Because both the LTAD model and the DMSP consider children's patterns of growth and development in their recommendations about the content of practice sessions, it is not surprising that both refer to the value of small-sided games and modified sports as part of the youth sport curriculum. Small-sided games

(SSGs) have received special attention by educators since the early 1960s as developmentally appropriate content to support children's learning of the basic tactics of sport (Werner & Almond, 1990). Maulden and Redfern (1981) proposed that the games curriculum should be structured according to categories of games (Table 1).

Table 1: Examples from Maulden and Redfern's (1981) Categories of Games

Categories		
Net Games	**Batting Games**	**Running Games**
Tennis Volleyball	Cricket Baseball	Soccer Rugby Hockey

The rationale for the SSG approach was based on the premise that there are fundamentally different uses of space in each category based on different tactics needed for success. Two implications for the curriculum were drawn from this premise. First, the curriculum should include games from all categories because each category offers unique opportunities for physical, social and cognitive development. Second, games within the same category have similar tactics and there should be some positive transfer of understanding from one game to another (Werner & Almond, 1990).

According to Mitchell, Oslin and Griffin (2006), the cognitive development of children is critical during either the Learn-to-Train Stage (LTAD) or the Sampling Phase (DMSP). They advocated adoption of the Games-for-Understanding (GFU) approach to teaching methodology which was specifically developed to help children learn how to apply tactics in different types of games, in addition to developing the necessary motor skills and physical fitness needed to perform successfully. This approach is based on the presentation of SSGs within the same category with an emphasis on indirect teaching methods that

encourage children to think about what they want to do in a game and what their best options are for achieving their goals (den Duyn, 1996). The GFU approach is sometimes classified as a tactical model, and is contrasted to a technical model in which the learning of specific sport skills are presented in highly structured lessons prior to engagement in game play (Werner, Thorpe & Bunker, 1996). This contrast has been reduced in recent years as more has been learned about the relationship between explicit learning (associated with technical model) and implicit learning (associated with the tactical model), leading to an interest in pursuing hybrid models in which an appropriate mix of both types of methods is sought (Harvey & Jarrett, 2013).

Statement of the Problem

Despite the emerging research, there are many unresolved questions surrounding when and how to specialize in which sports (Baker *et al*., 2009). Specialization in a single sport is recognised as part of the player development path toward achieving elite level performance. There is consensus in the professional literature that sport specialization should be introduced somewhere between ages 8 to 13 for sports in the 'running games' category, however, it is not clear how quickly single-sport specialization should be pursued after the development of fundamental movement abilities (Balyi *et al*., 2013). In other words, does a diversity of sport experiences during a Sampling Phase as recommended in the DMSP, have any impact on ultimate proficiency in a single sport?

Gould (2010) identified a number of reasons why many children (and their parents) think that specialization in a single sport should happen as soon as possible:

- They hear stories about elite athletes who specialized at an early age.

- Peer group members who specialize in a single sport seem to be getting ahead in the sport and are selected for regional teams, etc.
- In Western society, specialization is part of the expectation that you shave to commit early and work hard in order to become good at one thing.

Coakley (2010) noted that in some societies parenting worth is tied to the success of one's children. Because sport provides highly visible evidence of a success, parents support the early sport specialization. Gould (2010) concluded that most of the conclusions about the benefits and detriments of sport specialization are based on general youth-sport literature and he called for research that focused on direct comparisons between children who specialize in one sport and children who play multiple sports.

Aim of the Study

The aim of this study was to determine the effects of participation in a single-sport (soccer) SSG unit and a multi-sport (soccer, hockey and team-handball) SSG unit on the physical fitness, general motor coordination, soccer skills and application of soccer tactics during game play, of grade four children from a disadvantaged community in the Western Cape. The results of this comparison would contribute to our understanding of when and how much specialization in a sport such as soccer is justified. This comparison, following participation in the two different versions of the GFU approach, would inform not only the specialization versus diversification debate, but also provide insight into potential for the transfer of fitness, skills and tactical understanding among games from the same category (Mitchell *et al*., 2006).

Objectives of the Study

The purpose of this study was to compare the effects of children's participation in a single-sport SSG version of the Games-for-Understanding approach to a multi-sport SSG version in terms of the value of deliberate play as a means to achieve benefits for children in terms of their physical fitness, gross motor coordination, motor skills and application of tactics during game play. Four objectives can be drawn:

1. To compare changes in the physical fitness outcomes for children who participated in the soccer SSG programme and children in the multi-sport SSG programme.

2. To compare changes in selected gross motor coordination outcomes between children who participated in the soccer SSG programme and children in the multi-sport SSG programme.

3. To compare changes in selected soccer skill outcomes between children who participated in the soccer SSG programme and children in the multi-sport SSG programme.

4. To compare changes in the application of selected tactics in soccer SSGs between children who participated in the soccer SSG programme and children in the multi-sport SSG programme.

Hypotheses

The following four hypotheses were formulated to correspond to the research objectives:

1. There will be no differences in selected physical fitness outcomes for children who participated in the soccer SSG programme and children in the multi-sport SSG programme.

2. There will be no differences in selected gross motor coordination outcomes for children who participated in the soccer SSG programme and children in the multi-sport SSG programme.

3. There will be no differences in selected soccer skill outcomes for children who participated in the soccer SSG programme and children in the multi-sport SSG programme.

4. There will be no differences found in the application of selected tactics in soccer SSGs for children who participated in the soccer SSG programme and children in the multi-sport SSG programme.

Delimitations

In the design and implementation of this study, the researcher included the following considerations:

- There was no control group because there were only two grade four classes in the primary school involved, and both participated in the small-sided games programmes. To test children from another school, even if it were in a community that was perceived to be similar, was not considered to be suitable. There were too many unknown factors that could influence the performances of children from another school, such as the school sport programme, previous sport experience of the children, and the support of the school principal for sport.

- The researcher chose to be the teacher for both versions of the SSG programmes for both the boys and the girls. This meant that while the boys had a same gender, same racial group teacher, the girls only shared racial grouping with the teacher. It is not known if the gender of the teacher had any effect for either group on the effectiveness of either of the games programmes since this was not a dimension that could be practically manipulated during this study.

- The SSGs in the multi-games programme were from soccer, hockey and team handball. The children knew nothing about team handball, but the researcher decided that having an invasion game emphasizing use of the feet (soccer), use of an implement (hockey) and use of the hands (team handball), provide the most diverse range of invasion games from a motor skills perspective.

Significance of the Study

Research is needed to help resolve the specialization versus diversification debate. Single sport specialization advocates contend that the multi-sport approach sacrifices the development of the physical fitness and motor skill abilities related to a single sport, and may not even achieve substantially different gains in tactical learning (Bridge & Toms, 2013). One dimension of the significance of this study is that it will contribute to this debate by comparing the results of a participation in a soccer unit to a multi-sport unit on the physical fitness, general motor coordination, motor skills and application of tactics. Specialization in a single-sport has been presumed in some youth sport development programmes as children enter the Learn-to-Train Stage (LTAD model), but there remains the suggestion that this stage should accommodate an initial Sampling Phase (DMSP) aimed at developing skills in a variety of sports before specialization in one sport is realised at the end of the stage (SportScotland, 2008).

A second dimension to the significance of this study is that it would contribute to an understanding of the impact of participation of SSGs within the GFU approach, which is based on the premise that children's tactical understanding and decision-making will develop more quickly when practiced under manageable circumstances (Griffin, Oslin & Mitchell, 1995). The game selected for the single-sport unit for this study were modified soccer and for the multi-sport unit, SSGs in soccer, hockey and team handball (all from the running games category). In other words, the possible transfer of tactical understanding between the single versus the multi-sport SSG experience was explored. Transfer of learning is one of the oldest topics in motor skill learning, but it has been predominately focused on transfer among different types of motor skill training programmes and different distributions of practice time within a programme (Magill, 2006).

The third dimension of the significance of this study is also based in its use of the GFU approach. The GFU approach offers a variety of teaching methods, including the promotion of implicit learning through participation in small-sided games with minimal interaction with a teacher/coach (Griffin *et al.*, 1995). The teacher/coach ensures that the children adhere to the rules of the game, but allows participation in the game itself to encourage the learning of tactics and skills. This focus on the SSG and implicit learning was a characteristic of this study. In situations where primary school teachers or other sport leaders without sport coaching knowledge are left to implement children's sport programmes, they are still able to hold the children accountable for playing by the rules of an SSG. With this situation in mind, the results of this study may be relevant to sport development efforts for children in minimal-resource environments.

This study compared the results of participation in small-sided soccer games versus participation in multi-sport small sided games on the application of soccer-specific tactics,

motor skills and physical fitness in order to determine if progress in specialising in soccer was adversely affected by a more diverse approach when working with children just entering the Learn to Train stage. If the multi-sport approach was found to be as effective as the single-game approach, then the results of this study would offer support for providing children with a variety of game experiences during their primary school years, rather than encouraging them to specialize in just one. This would provide them with a broader base of experience from which they could decide later if and when they want to focus all of their efforts into pursuing development in just one sport.

Ethical Statement

Permission to conduct this study was granted by the CHS Faculty's Higher Degrees Committee and Senate Higher Degrees at the University of the Western Cape. The following ethical considerations were applied to this study:

1. Both the children and their parents/guardians gave informed consent to participate and were reminded that participation was entirely free and voluntary. They were aware that withdrawal from participation could be done at any time without penalty.

2. Information for the children, parents and teachers was available in both English and Afrikaans, the two home languages of the children who attend the school. The researcher was fluent in both languages and communicated personally to each child in his/her language of choice. The group instructions for the game play sessions and the competitive game play days were in Afrikaans because that was the medium of instruction of the school.

3. The children and their parents/guardians were informed of the nature and purpose of the study, and that there were no harmful procedures involved. The video recording of the games was a non-invasive observational tool. The soccer skills test and the physical fitness test were straightforward and commonly used tests with children. The games lessons and competitive games did carry the normal level of risk of injury that children's active physical play always carries. However, both the researcher and the teachers were present at all training sessions and the rules for safe play were strictly enforced. First aid facilities were available at the school.

4. The researcher ensured that the video tapes and all test results were used for the purpose of this research only and that no reference was ever made by name to any child or the school in any presentation of the results. Anonymity was assured through the use of code numbers for each child, with the master list matching names with code numbers stored safely in a locked cabinet accessible only to the researcher.

5. The information acquired through this research project was shared with the children and their parents/guardians, the teachers and the principal. Results of the study will be published in an accredited journal and a peer reviewed journal.

6. If any child at any time appeared to be receiving negative comments or actions from classmates, the researcher dealt with the situation immediately as part of learning good sportsmanship. This can happen during games, and it is possible to use it as a "teachable moment" for the children involved. If the comments persisted, the researcher consulted with the teacher immediately to determine how to deal with the situation. If any child reported that he/she was not happy or

comfortable with anything that was happening in relation to the programme, the researcher consulted with the teacher immediately to determine how to deal with the situation.

Definition of Terms

Specialization

Specialization occurs when children limit participation to a single sport on a year round basis, with deliberate focus on training and development in that sport (Balyi *et a*l., 2013).

Diversification

Sport participation is characterised by involvement in different sports as well as a high amount of play-like practice that focuses little on deliberate practice activities (Moesch, 2011).

Games for Understanding (GFU)

The Games for Understanding approach is an approach to games teaching where cognitive and motor skill development are promoted within the situations of small-sided game play (Stolz & Pill, 2014).

Implicit and Explicit Learning

Implicit learning is defined as the non-intentional, automatic acquisition of knowledge and/or skills and explicit learning is the intentional acquisition of knowledge and/or skills which results in the ability to verbalize that knowledge (Magill, 2006).

Chapter Two

REVIEW OF LITERATURE

In order to understand the context of the specialization versus diversification debate, it is important to take a step back and look at the different theoretical perspectives on which the arguments are based.

This chapter begins with an overview of the most common models in sport pedagogy describing athlete development pathways from initial learning to expert performance, each of which deals with questions of when to specialize and/or diversify in a different way.

The second section presents two critical issues that interact when examining the specialization versus diversification debate:

1. When along the athlete development pathway should children begin to focus and specialize in a single sport versus continued participation in many sports?
2. What is the optimal relationship between deliberate practice (serious structured training driven by an adult) and deliberate play (child-driven opportunities to train and participate) as children progress along the development pathway?

The last section is focused on the how games-centred pedagogical approaches specifically for teaching/coaching youth team sports accommodate these two critical issues with special reference to soccer development opportunities for boys and girls ages 10 to 12.

Specialization and Diversification in Relation to Athlete Development Pathways

An athlete development pathway is the description of a sequence of sport performance outcomes clustered into steps/stages leading progressively toward the level of expert. Various models of athlete development have been proposed since the early 1980s. Gulbin, Morag, Corser, Morley and Weissensteiner (2013a) analysed eight different models of sport talent development before presenting their own Foundations, Talent, Elite and Mastery Framework (FTEM) developed to guide the Australian sport system. They acknowledged that the Long Term Athlete Development (LTAD) model (Balyi & Hamilton, 2004) and the Developmental Model of Sport Participation (Côté & Fraser-Thomas, 2007) are the most commonly used models, and then positioned their FTEM framework as an advancement in thinking about sport and athletes development pathways. The following sections describe the characteristics of each of these three approaches, with special attention to how each relates to this study.

The Long-term Athlete Development Model

The LTAD model developed by Balyi (2001) and later revised by Balyi and Hamilton (2004) to the Long Term Participant Development (LTPD) model has received substantial support in recent years. It draws heavily from a knowledge base of physical growth and development and exercise physiology (Gulbin *et al.,* 2013a). The rationale for the LTAD model is based on 10 basic assumptions (Balyi *et al*., 2013), three of which are of particular relevance to this study because they speak to the specialization versus diversification debate and the relationship between deliberate practice and deliberate play.

1. The 10- year rule: The 10 000 hours of training specified to reach elite level performance as necessary to become an expert/elite performer (Ericsson, Krampe

& Tesch-Römer, 1993), equates to approximately 10 years of deliberate practice in a single sport, *e.g.* 10 years of deliberate practice to become an expert soccer player. .

2. Trainability: Although the physiological systems can be trained at any time along the continuum of development, there are critical periods when certain movements and physical attributes can be optimally trained. These periods are regarded as windows of opportunity that are associated with deliberate practice. These periods should not be missed if an individual is to achieve his/her full sporting potential.
3. Specialization: Some sports require "early specialization" while other sports demonstrate better performance through "late specialization". Soccer is a late specialization sport and the LTAD model recommends at least two intermittent developmental stages between an Active Start (± age 6) and specialization in soccer in the Learn to Train stage (boys ages 9 to 12 and girls ages 8 to 11).

The pyramid-type design used in the LTAD model Balyi *et al.* (2013) has been set in a broader model that identified being "Active for Life" as the ultimate outcome for both recreational and competitive sport. When focused on competitive sport only, two different pathways were identified in which the number of participants decreases as the level of expertise increases (Figure 1). Sports in which top levels of performance must be achieved pre-puberty were categorized as early specialization sports. The pathway for early specialization sports (*e.g.* gymnastics, figure skating, diving) is presented in a four-stage model that recommends young children (± age 5) move immediately to the 'Train to Train' stage in their selected sport after basic movement experiences as infants and toddlers.

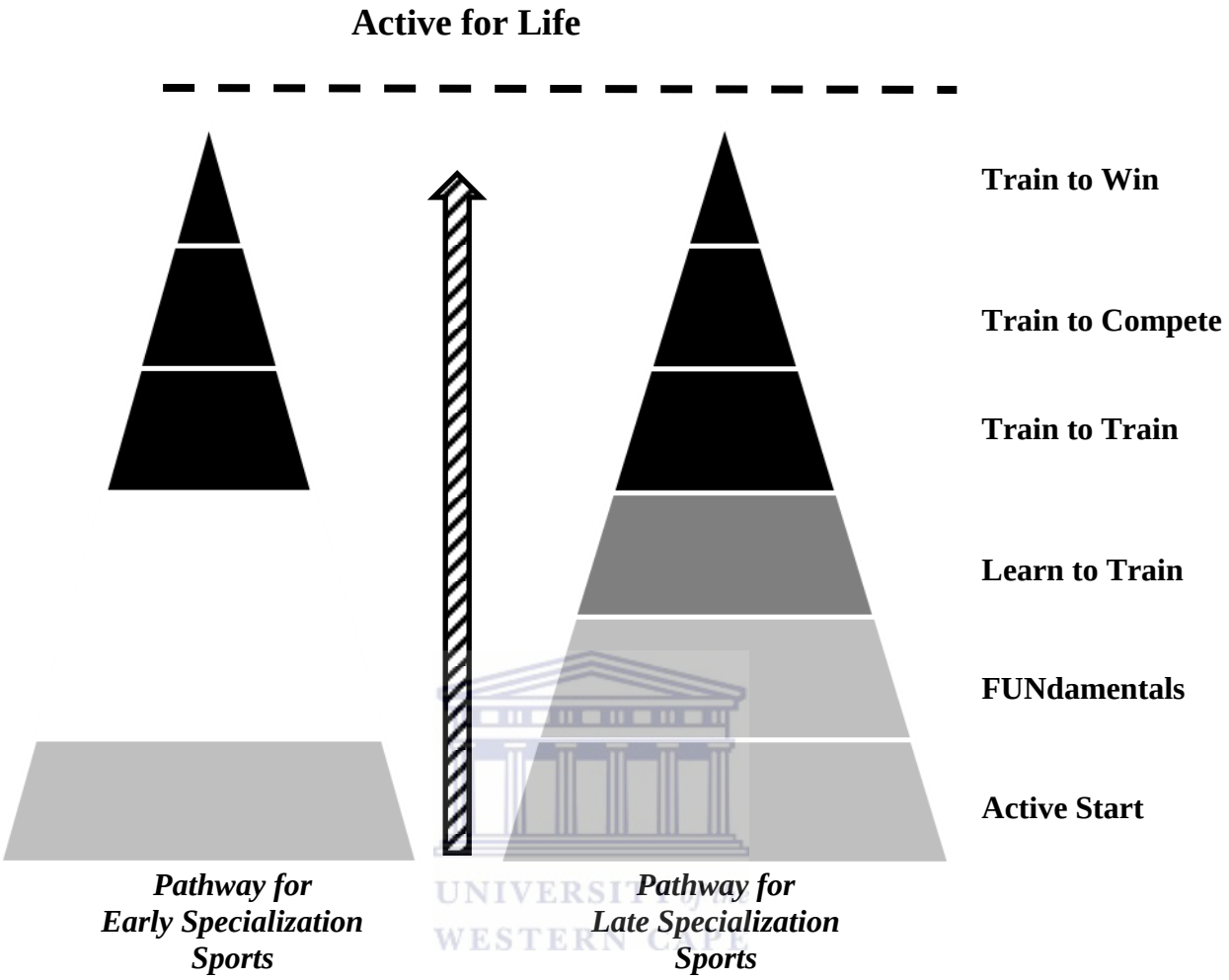

Figure 1: The LTAD for Early and Late Specialization Sports
(adapted from Balyi *et al.*, 2013)

Late specialization sports were defined as those sports in which top levels of performance are only achievable post-puberty. For late specialization sports (*e.g.* soccer and other team sports) a six-stage sequence was recommended. The Canadian Soccer Association's (2014) Long Term Player Development model provided descriptions for the soccer-related activities and approximate age ranges associated each of these stages (Canadian Soccer Association, 2014). The following stage-by-stage summary highlights their recommendations in relation to the critical issues of specialization and deliberate practice:

Stage 1 Active Start (boys and girls under 6)

- Introduce soccer-like games (no specialization, but soccer-focus part of programme) with emphasis on fun.
- Develop basic technical skills suitable for soccer during deliberate practice activities.

Stage 2 Fundamentals (boys ages 6 to 9 and girls ages 6 to 8yrs)

- Play 3v3 and 5v5 soccer games, balanced with an equal amount of time for focused skill practice.
- Deliberate practice of both technical and tactical skills, but keep fun element.

Stage 3 Learn to Train (boys ages 9 to 12 and girls ages 8 to 11)

- Disciplined soccer training sessions leading to 6v6 and 8v8 games in league play, but continue to emphasize fun.
- Repetitions crucial for technical skill development and players should have the opportunity to try all positions.

Stage 4 Train to Train (boys ages 12 to 16 and girls ages 11 to 15yrs)

- 8v8 versus 11v11 games in competitive league play (no 11v11 until age 13).
- Soccer training demands and loads increase and tactical awareness important with high volumes of deliberate practice.

Stage 5 Train to Compete (boys ages 16 to 23 and girls age 15 to 21)

- Soccer the primary sport with year-round play and training (with appropriate periods of rest and recovery), culminating in regional and national competition.
- Deliberate practice focused on refinement of technical skills by proficient players.

Stage 6 Train to Win (boys 19+ years old and girls 18+ years old)

- Soccer competition at the highest level from international competition to professional league play.
- Deliberate practice focused on the most intense training suitable for international winning performances.

Although it is common for sport federations to identify age ranges for each stage as in the example above summarised from soccer, research has shown that chronological age is not a very reliable indicator on which to base expectations about progressions through the stages because of the wide variation in rates of physical, cognitive and emotional development of children.. Balyi *et al.* (2013) recommended the periodic measurement of children to determine the onset of Peak Height Velocity (PHV) which is influenced by both genetics and environmental factors (climate, cultural & social), and to use it as a reference point for the design of training and competition programmes. It can also be noted that when a soccer federation applied the LTAD model to their conception of how to develop soccer players, they introduced technical skill instruction and deliberate practice in small sided soccer games quite early – in the second stage (FUNdamentals), although they repeatedly emphasized that

competition should be controlled and the emphasis should remain on children's enjoyment through to the Train to Train stage.

The LTAD has been criticized for its lack of longitudinal empirical evidence suggesting that it is primarily a theoretical model that prescribes step-by-step what youth need to do if they want to compete at top levels (Stewart, 2007). Ford *et al.* (2011) specifically questioned the 'windows of opportunity' principle that identifies critical periods during which specific kinds of training interventions will be particularly effective. Although acknowledging that children's motor development literature supports the development of fundamental movements and physical abilities, they found no evidence that the development of fundamentals is a prerequisite for later sport-specific expertise. For example, Graf *et al.* (2005) found no long-term impact of a successful physical literacy programme for young children in terms of their post-pubescent physical literacy.

The LTAD model as applied to youth sport development has served as a point of departure for other models based on children's physical growth and development. For example, the Youth Physical Development Model (YPDM) proposed by Lloyd and Oliver (2012) focused on the stage-by-stage development of the components of physical fitness which the authors stated are trainable throughout childhood. They expressed concern that the LTAD model implied that certain components of fitness should receive attention during specific developmental 'windows of opportunity' and that if a child did not engage in the appropriate training during a specific window, then their full potential would never be reached. They argued that there is insufficient evidence to document that the serious training of fitness components such as stamina, suppleness, speed and strength should be linked to identifiable periods in a child's growth, but rather advocated that fitness components receive continuous and appropriate training throughout the full physical development spectrum.

The Developmental Model of Sport Participation

Like the LTAD model, the DMSP of Côte and Fraser-Thomas (2007) identified three development pathways: one for recreational outcomes, one for competitive sport outcomes in early specialization sports and another pathway for late specialization sports (Figure 2). However, instead of basing progressive development on physical growth and development and physiological considerations, their work related to children's psycho-social development (Farrow, Baker & MacMahon, 2008). Early specialization sports were classified as those where participant decision-making is not very complex, despite the high demands for discipline and composure at the expert level. Late specialization sports were classified as those that require high levels of cognitive development and participant decision-making during performance, which brings high cognitive demand to the sport.

Baker, Côte and Abernethy (2003) explained that the pathway to expertise in late specialization sports could be seen as a progression from the sampling years to the specialization years and finally, if the individual is committed, to the investment years. Their research found that an emphasis on deliberate play was associated with the sampling years, a balance between deliberate play and deliberate practice was evident in the specialization years and the strict focus on deliberate practice was aligned with the level of expertise characteristic of the investment years.

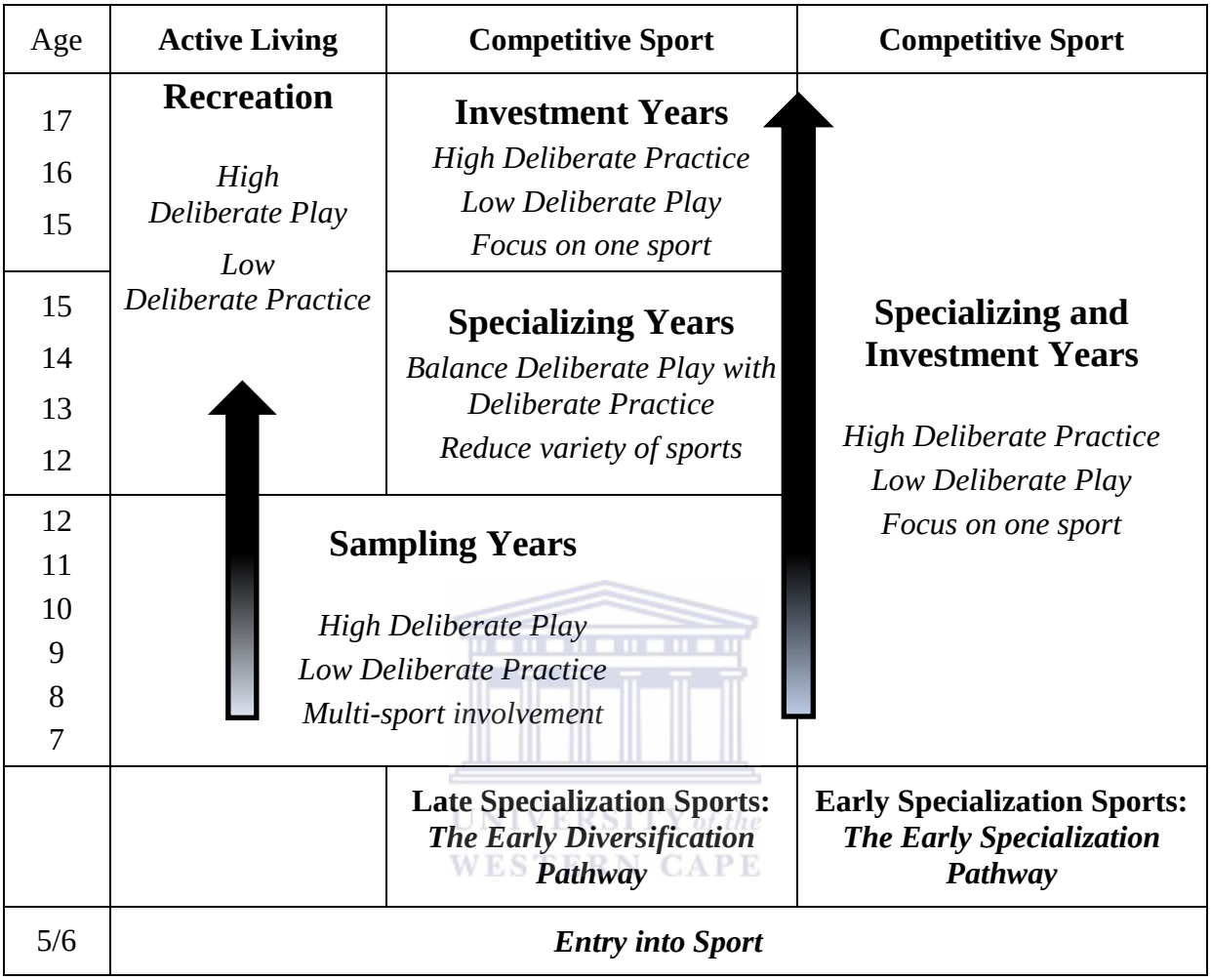

Figure 2: The Three Pathways in the DMSP and the Relationship between Deliberate Play and Deliberate Practice at Each Stage (adapted from Côte & Fraser-Thomas, 2007)

The following descriptions of each of these phases address only the issues of specialization versus diversification and the relationship between deliberate practice and deliberate play. These issues will receive greater attention in the next section of this chapter.

The Sampling Years (ages 6 to 12)

- Involvement in a number of sports is beneficial to the development of intrinsic motivation required during later phases (Stewart, 2007).
- Deliberate play allows children to experiment and be creative with the execution of movements without worrying about adults telling them the 'right way' to execute a skill (Farrow *et al.,* 2008).

The Specialization Years (ages 13 to 15)

- Children begin to focus on fewer sports and there is a shift from playing for fun to the pursuit of opportunities for serious competition (Stewart, 2007).
- There is also a shift from primarily deliberate play to more deliberate practice specifically designed to improve current levels of performance (Stewart, 2007).

The Investment Years (ages 16+)

- During this stage athletes make a definite commitment to training and performance in the single sport in which they strive to become an expert (Farrow *et al.,* 2008).
- This stage is characterized by high levels of deliberate practice in the sport selected for specialization (Stewart, 2007).

Ford and Williams (2008) drew three predictions from the DMSP and then tested them against the developmental histories of expert soccer players. The following is a summary of their predictions and their findings:

1. *Prediction:* Experts who had diversified sport experiences in their sampling years would report fewer soccer-specific hours to achieve expertise in soccer than experts who had taken part in fewer activities during their sampling years. *Findings:* There were no significant differences in the number of soccer-specific hours required to achieve expert level between the two groups.
2. *Prediction:* Experts who participated in a similar type of sport to soccer during their sampling years would need fewer hours to achieve expert performance than experts who did not. *Findings:* No significant differences were found in the number of hours required to achieve soccer expertise between the players who had participated in a similar sport and those who did not.
3. *Prediction:* The development pathway of the experts would show a progression from diversity to specialization to investment, with a growing focus on soccer as their primary sport. *Findings:* There was a significant increase in soccer-specific activities from the sampling to the specialization years, but not between the specialization and investment years.

The authors were clear that their study was not definitive and reflected the experiences of only 20 expert soccer players (Ford & Williams, 2008). They continued this line of research in their study of the development pathways of elite and sub-elite soccer players, finding that the importance of early diversification for late specialization sports was not totally supported (Ford, Ward, Hodges & Williams, 2009). Successful soccer players spent more playing and practicing soccer during the sampling years than the original DMSP recommended, leading them to propose an alternate pathway to late specialization sports which they labelled Early Engagement in which a focus on deliberate practice within a single sport was included earlier in the development pathway (Figure 3).

<table>
<tr><td>Age</td><td>Competition</td><td>Competition</td><td>Competition</td></tr>
<tr><td>17
16
15</td><td>Investment Years
High Deliberate Practice
Low Deliberate Play
Focus on one sport</td><td>Investment Years
High Deliberate Practice
Low Deliberate Play
Focus on one sport</td><td rowspan="3">Specializing Years
High Deliberate Practice
Low Deliberate Play
Focus on one sport only</td></tr>
<tr><td>15
14
13
12</td><td>Specializing Years
Balance Deliberate Play with Deliberate Practice
Reduce variety of sports</td><td>Specializing Years
Balance Deliberate Play with Deliberate Practice
Minimise variety of sports</td></tr>
<tr><td>12
11
10
9
8
7</td><td>Sampling Years
High Deliberate Play
Low Deliberate Practice
Multi-sport involvement</td><td>Early Engagement
Balance Deliberate Play with Deliberate Practice
Focus on one sport primarily</td></tr>
<tr><td></td><td>Early Diversification</td><td>Early Engagement</td><td>Early Specialization</td></tr>
<tr><td>5/6</td><td colspan="3">Entry into Sport</td></tr>
</table>

Figure 3: The possibility of an Early Engagement pathway in late specialization sports (adapted from Côté *et al*., 2007).

Trying to evaluate the impact of early sport involvement on later sporting success is beyond complicated. As Güllich and Emrich (2014) noted in their review of 19 studies, the pathways of truly elite players do not always match the pathways of advanced athletes whose careers have plateaued at a slightly lower level of expertise. Early specialization and early engagement may lead to accelerated success rates during first stages of a child's pathway to expertise, but may not be necessary to achieve a long-term goal of achievement at the senior elite level. They concluded that a much deeper understanding is required if we are to

understand the considerable variance in the practice and training histories of senior elite athletes particularly in those sports where peak performance is achieved post-puberty.

The Foundations, Talent, Elite and Mastery Framework (FTEM)

Gulbin *et al.* (2013a) reviewed eight different models for athlete development, including both the LTAD model and the DMSP. They criticized all of these models for promoting the notion of a predictable linear pathway from mass participation to top level performance. They not only disagreed with this thinking, but also felt that these types of models ignore the reality of late developers and athletes who transfer from other sports. They developed the FTEM framework for thinking about sport development pathways that is descriptive of multiple stages that may be experienced in sport development, but does not predict a specific pathway through those stages (Figure 4).

Their FTEM framework was presented as a multidisciplinary approach that promotes flexibility in thinking about various pathways and rates of development toward the achievement of sport expertise (Gulbin *et al.,* 2013a). The acronym represents four macro stages in sport development, each of which is divided into micro-stages: which are further differentiated into 10 micro phases.

Foundations: Develop fundamental movements and physical literacy.

F1 Early exposure to a variety of movement experiences during play.

F2 Refinement of movement through participation in play, practice and games that can be sport-specific or non-specific.

F3 Sport-specific training which can include competition, although emphasis is on personal improvement.

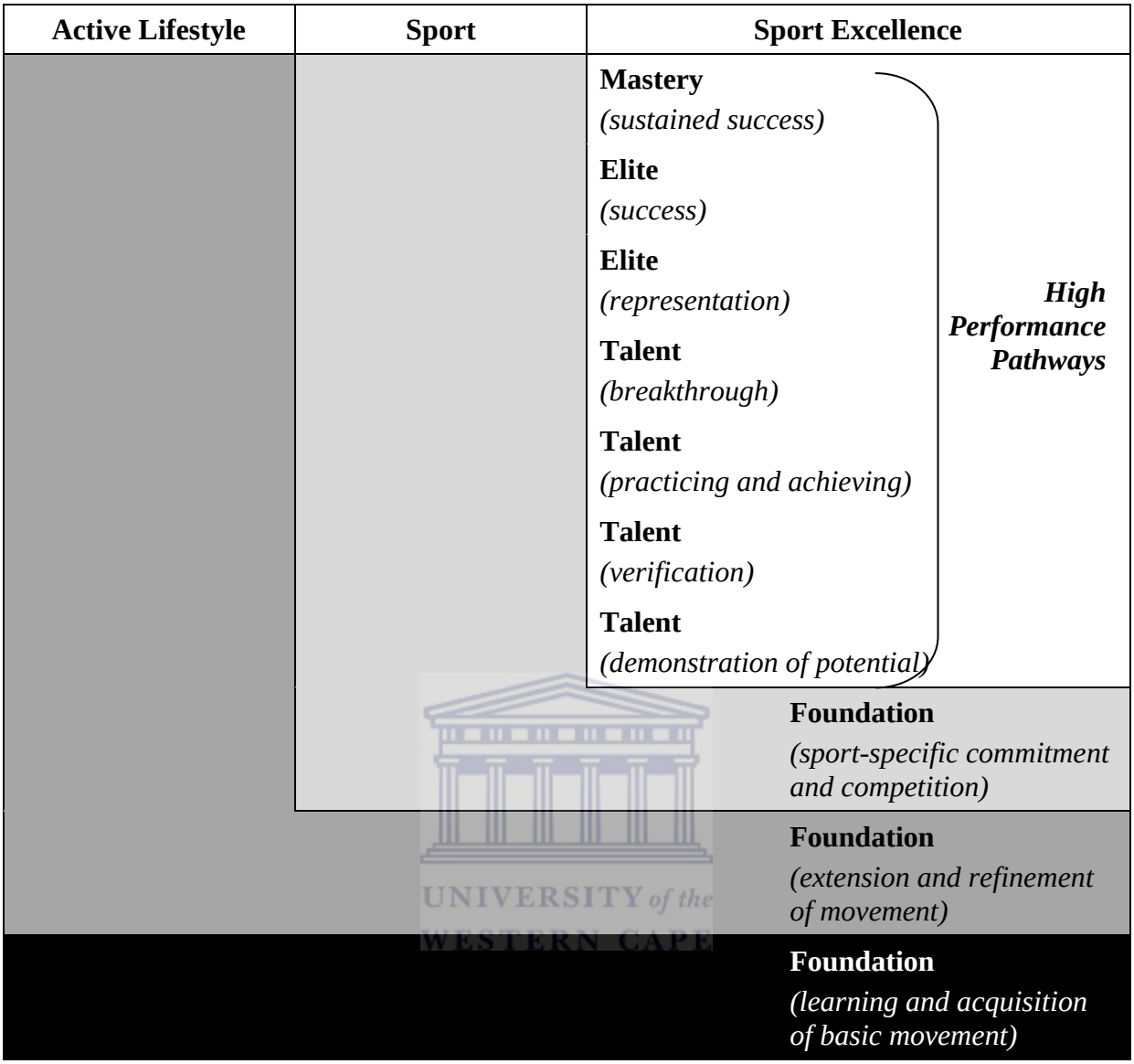

Figure 4: The FTEM framework proposed by Gulbin *et al.* (2013a: p. 5)

Talent: Maximise individual development while minimizing dropout

T1 The individual is noticed (subjectively) within the sport for sport-specific potential and commits to pursuing additional sport-specific development and competition opportunities.

T2 Evidence gathered during testing, competition analysis, etc., verifies that the individual has measureable attributes that support performance in a specific sport.

T3 High amounts of deliberate practice led by skilled coaches sustain improvement, although the rates of improvement differ among individuals.

T4 The athlete's performance standard reaches the level at which professional and financial support is made available as the athlete experiences a 'breakthrough' in terms of recognition within the sport.

Elite: The most advanced performers in a sport who achieve sustained national, international and/or professional success.

E1 The athlete competes at the highest level of completion in his/her sport

E2 The athlete receives recognition for excellence in his/her performances within the sporting community and from the broader public.

Mastery: Success in competition is sustained over an extended period, e.g. a number of years.

One interesting feature of this framework is that it recognizes that athletes can remain at F3 for a lifetime (Gulbin *et al.,* 2013a), ultimately landing on a pathway leading to recreation. No ages were proposed to accompany the framework, so a young gymnast might progress quickly through the various phases, or even skip some on his/her personal pathway, while it might take a young rugby player 10 years to go through each and every phase on his/her way to play for the national team. Athletes can also jump into a particular phase if they change sports because the framework is non-linear. This flexibility in thinking about

development pathways was supported by research competed by Gulbin, Weissensteiner, Oldenziel and Gagné (2013b). They explored the development pathways for 256 athletes within the Australian elite sport network. Among their findings were:

- Not all athletes entered their focus sport at the beginning phases of development, but rather entered at a higher level.
- Some athletes successfully switched to a new focus sport after having achieved moderate success in another sport (late bloomers).
- Some athletes successfully switched to a new focus sport after having achieved success in another sport, and achieved success in the new sport rapidly (talent transfer).

The FTEM framework leaves the timing for specialization (versus diversification) and the recommendations about the relationship between deliberate practice deliberate play up to sport-specific experts and the individual athlete.

Comments about Development Pathways

Is there an 'ideal pathway' to follow as youth progress from early engagement to expert performance? Gulbin *et al.* (2013a) questioned the validity of the concept of an ideal pathway, but both the LTAD and the DMSP supporters seemed to accept it. Stewart (2007) noted the following in her comparison of the Balyi and Hamilton's (2004) LTAD model and Côte and Fraser-Thomas (2007) DSMP:

- Both models include stages that propose a systematic progression from novice to expert level performance.
- Both models include a broad fundamental movement phase that involves young children participating in a variety of sports and discourages specialization and

competition prior to age 5. The DMSP uniquely proposed that diversification among sports during the sampling years is beneficial to achieving expertise in one sport in later years

- Both models recognize the progressive shift of emphasis from deliberate play to practice in the development of expertise.

Discussion of the progression in athlete development from diversification to specialization and from play to deliberate practice is common to almost all models (Ford *et al.* 2009), including the Gulbin *et al.* (2013a) framework. However, questions about when to diversify participation across a variety of sports rather than to specialize in a single sport and how much deliberate practice is optimal for children's sport development persist as critical issues in youth sport (Gould, 2010).

Two Critical Issues for Youth Sport

There is consensus that considerable sport-specific practice is required to achieve the level of expert in a specific sport (Bruce, Farrow & Raynor, 2013). All models describing pathways for athlete development suggest a point at which children begin to specialize more in one sport than others and their practice sessions become more serious and deliberately focused on performance improvement (Bridge & Toms, 2013). The LTAD positions this transition in the Learn to Train stage. Although the DMSP positions the transition in the Early Engagement Years, there is the suggestion that diversification of sport participation (variety of sports) during these years as well as the Sampling years may be beneficial for achieving ultimate success in late specialization sports (Côté & Vierimaa, 2014). Related to the issues surrounding specialization and diversification are questions about the role of deliberate practice and deliberate play in youth sport. Balyi *et al.* (2013) noted that deliberate practice is critical for the development of expertise and must accompany specialization. However, they

also stated that deliberate play is a critical part of children's development of fundamental sport skills and especially their ability to play games.

Because this study was concerned with grade four children and their involvement in soccer, the issues of specialization versus diversification as well as the relationship between deliberate practice and deliberate play impact directly on the pedagogy implemented in their sport development programmes, a deeper examination of these two issues was considered to be important.

Specialization versus Diversification

Following their search for milestones in youth sport development, Bruce *et al.* (2013) concluded that although there is a positive correlation between the hours of practice in a specific sport and the attainment of expertise in that sport, there remains a debate regarding the value of specialization compared to a diverse sport participation background for youth. Specialization was defined by Malina (2010) as "systematic training in a single sport at a relatively young age with the goal of attaining elite status" (p. 364). Diversification refers to involvement in a number of different sports (Wiersma, 2000).

Specialization

Baker *et al.* (2009) explained that specialization is characterized by an intensive involvement in a single sport, including a focus on performance improvement and competition. Both the LTAD model and the DMSP acknowledge that there are differences between early specialization (early engagement) and late specialization sports. Balyi and Hamilton (2004) defined late specialization sports as those in which high levels of performance are achieved only post-puberty in contrast to 'early specialization' sports such as gymnastics and swimming where high levels of performance are achieved pre-puberty.

Malina (2010) traced the trend toward early specialization in youth sport to the relative success of the systematic training systems for sport in the former communist countries. When coaches from the Eastern Block countries came to the West after the fall of the Berlin wall, they brought a scientific approach that ultimately evolved to the LTAD model. He cautioned that specialization and the intensive training it requires in the pre-pubescent years bring substantial risks to children's development that either must be carefully managed or avoided by taking a diversification approach. Those risks included the possibilities of:

- Social isolation from peers and missing opportunities for non-sport socialization
- Overdependence on others for support and a loss of control over one's own life.
- Burnout as a result of chronic stress to perform and efforts to achieve high expectations from parents, family, coaches, etc.
- Overuse injuries.

Gould (2010) reported that early specialization in youth sport has become an extremely serious problem. He identified a number of factors to explain why parents often support early specialization even in the 'late specialization sports.' For example:

- Fear that their child will fall behind his/her peers.
- Parents judge their parenting self-worth based on their child's achievement in sport, and children who specialize appear to be more successful.
- They have heard stories of elite athletes who specialized early.
- They believe that the better coaches will work with the children who are serious and specialize in one sport.

Balyi *et al.* (2013) stated that the LTAD commitment to 10 000 hours of practice to achieve expertise may have inadvertently encouraged federations to pursue sport-specific specialization too early in the development of expertise particularly in late specialization sports. The authors subsequently clarified their support for 10 000 hours of practice to a commitment to 'sport-relevant' hours of practice, minimizing the expectation to specialize in one sport only during the Learn to Train stage. The DMSP recommended that specialization take place between the ages of 12 to 15, although a compromised version of specialization (early engagement) was acknowledged as appropriate for some sports (Côte & Fraser-Thomas, 2007).

There is consensus that specialization at some point is necessary in order to achieve expertise, but the debates surrounding when to begin specialization and how intensely to focus on a single sport continues. For example, a study by Baker *et al*. (2003) examined the role of sport-specific practice on decision making expertise in netball, basketball and field hockey among expert and non- expert athletes. Although the expert athletes reported more sport-specific training hours before the age of 12 than the non-expert athletes reported, it was also found that the experts' total number of sport-specific hours was nowhere near 10 000 hours. This introduced the possibility that their experiences with other sports prior to age 12, *i.e*. diversification, either had no negative impact or may have contributed to their achievement of expertise later in their development.

Diversification

Diversification refers to participation in a range of different sports. The DMSP makes provision for diversification during the sampling years (ages 6 to 12) and the LTAD model positions participation in a variety of sports during the Learn to Train stage (ages 8 to 12). A

number of advantages have been suggested to support diversification during these developmental periods. For example:

- Participation in a variety of sports allows for the development of other sport skills that would not have been developed if there were a focus on specializing in one sport (Baker *et al.*, 2003).
- There is less risk of athlete burnout because children do not feel as pressurized to excel in one sport and they do not experience the boredom of participation in just one activity (Gould, 2010).
- Transfer of fundamental cognitive (tactical) skills among similar sports can occur (Baker *et al*., 2009).

There is some support for the value of diversification on the development of sport-specific expertise. Cobley and Baker (2005) studied the diversification patterns of national elite female rugby players compared to varsity-level players. They found that the elite players accumulated almost twice the number of training hours in sports with high physiological demands (*e.g*. athletics) and in sports with similar perceptual demands to rugby (*e.g* hockey, soccer) than were recorded by the non-elite players. Broad involvement during the sampling year with sports that have similar attributes may be the key to creating a positive impact of diversification on future achievements in single sport (Baker *et al*., 2009).

Deliberate Practice and Deliberate Play

The initial theory on which the 10 000 hour principle for the development of expertise was based was called ‘deliberate practice’ theory (Ericsson *et al.*, 1993). To contrast the serious and adult-driven coaching methods characteristic of deliberate practice when applied to youth sport, Côté and Hay (2002) proposed the concept of ‘deliberate play’ that was

defined initially as ‘playing games with rules’, and regarded as an integral part of children’s pathway toward the development of sport expertise in the DMSP.

Deliberate Practice

In subsequent efforts to understand those training activities that correlated with the training histories of experts, Ericsson (2003) identified the following characteristics of what has been labelled as ‘deliberate practice’:

- Practice periods consisted of specific tasks with well-defined goals.
- The learner was provided with feedback intended to improve his/her performance.
- There were many opportunities for repetition.
- The tasks were designed (usually by a teacher) and engaged in with the primary goal of improving performance (with the implication that deliberate practice is not pursued for fun/enjoyment).
- Practice required effort on the part of the participant because of the focus on improvement.

Balyi *et al*. (2013) fully supported the role of deliberate practice in the development of expertise, but noted that for different sports, different criteria to total hours of practice were appropriate to mark milestones in the development pathway. For example, they suggested that for golf, transitions along the pathway will be indicated by total number of ball strikes rather than the number of hours of practice, with top senior golfers registering more than 1.5 million ball strikes in their career and participating in 300-600 competitions. Although criticisms of deliberate practice theory usually centre around a lack of research support for the 10 000 hours principle, it is a highly regarded theory for its insistence that the quantity of practice must be linked to quality of practice (Côté & Fraser-Thomas, 2008).

Deliberate Play

Côté and Fraser-Thomas (2008) favoured consideration of the full spectrum of types of play when planning sport practice sessions for children. They specifically identified 'deliberate play' as an alternative means to deliberate practice for developing expertise in sport. From their perspective, deliberate play was a critical counter-balance to the adult-driven deliberate practice sessions that dominate so many youth sport programmes, and they even suggested that for some late specialization sports, expertise could be achieved with 3000 to 4000 hours of deliberate practice *if* deliberate play dominated the sampling years in children's development (Côté & Fraser-Thomas, 2008).

Côté and Hay (2002) stated that engaging in deliberate play during the sampling years (ages 6 to 12) was crucial for the development of fundamental skills and a basic understanding of game play, thus setting the platform for achieving expertise in sport. (Baker *et al*., 2003) provided general support for intrinsic learning, deliberate play and play-like activities for children, stating that they contributed to the development of intrinsic motivation required during later stages of development when training becomes more structured and effortful.

Not all research supports a critical role for deliberate play in youth sport development. According to Ward *et al*. (2007), participation in deliberate play during the sampling years of elite and sub-elite soccer players (ages 9 to 18) was not found to be a contributing factor to their achievement of expertise. However, accumulated hours of team practice did distinguish between elite and sub-elite players suggesting that participation in deliberate practice activities is a key to achieving expertise in soccer.

Explicit and Implicit Learning

To form a clear idea of the difference between deliberate practice and deliberate play, the two concepts can be placed on a continuum of learning, ranging from explicit learning to implicit learning (Figure 5). Deliberate practice is associated with explicit learning and deliberate play with intrinsic learning (Côté & Fraser-Thomas, 2008). Relating these different types of play to different types of learning is very helpful when thinking about four pedagogical approaches.

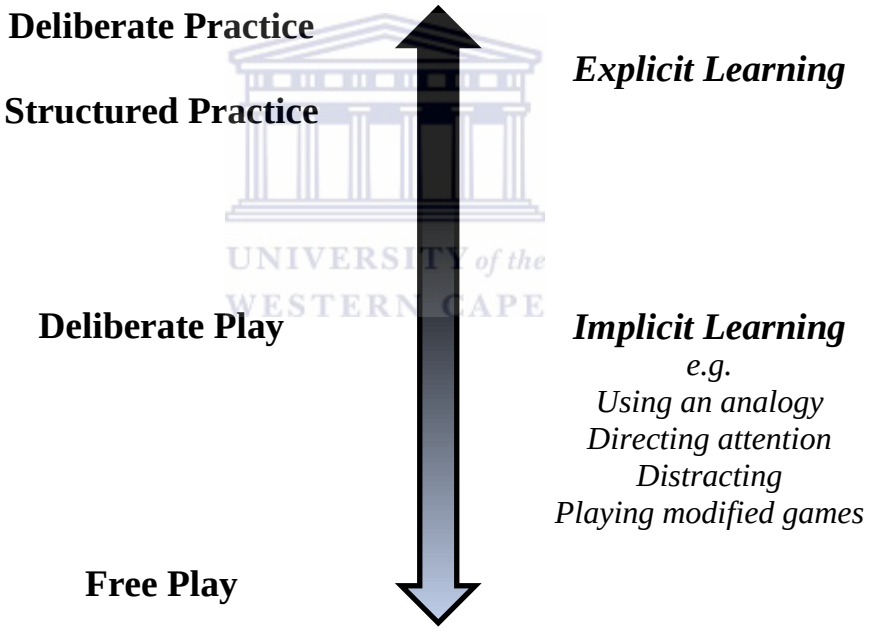

Figure 5: Different types of play associated with an explicit to implicit learning continuum

1. Deliberate practice which promotes explicit learning.
2. Structured practice (formally organized practice activities directed by a coach but lacking the sharp focus and intensity of deliberate practice) which promotes explicit learning.
3. Deliberate Play which promotes implicit learning.
4. Free Play (enjoyable, freely chosen and self-regulated) which promotes implicit learning.

Farrow (2014) related explicit learning to coaching methods where direct verbal instruction, demonstrations and coach feedback are used to structure practice experiences and make corrections in skill techniques. Explicit learning and deliberate practice require a technically proficient coach. He contrasted these traditional methods to less formal and indirect approaches that result in implicit learning, including:

- Using an analogy or metaphor to create a picture in the player's mind (*e.g.* when teaching a zone defence, ask players to imagine they are tied together with an elastic rope and must try to maintain its shape).
- Directing attention to a key feature in a task rather than telling players what to do (*e.g.* when receiving serve in tennis, tell the players to try to predict the speed of the ball and let them decide how to do that, rather than telling them where to look).
- Distracting players' attention from their own performance by introducing a secondary task (*e.g.* asking players to sing while practicing their passing skills).
- Playing modified games (*e.g.* design games with special rules and boundaries that highlight aspects of a sport, then letting the children play without coaching interference).

Raab (2003) discouraged arguments to support the superiority of one type of learning over the other, although she acknowledged that different tasks at different stages of development might be more suited for one type of learning over the other. For example, she found that in low complexity situations, implicit learning may be more effective while in high complexity situations explicit learning might be better. The implicit learning of motor skills was also found to be more resistant to the negative impact of anxiety on performance, when compared to explicit learning (Steenbergen, van der Kamp, Verneau, Jongbloed-Oereboom & Masters, 2010). This supported earlier research by Masters (2000) who documented children's implicit learning of motor skills as the foundation of automatic processing which has the advantage of resistance to skill performance failure under stress.

Comments about these Two Issues

The development of expertise in sport requires the optimal timing of specialized training, both in terms of its volume and its intensity (Baker *et al.,* 2009). In other words, the development of expertise requires specialization and deliberate practice. There is general acceptance that there are early specialization and late specialization sports, depending on the age range in which top level performance is achievable.

Baker *et al.* (2010) described deliberate play as child-centred with enjoyment as a primary goal. They noted that deliberate play activities often are modified versions of a sport rather than the adult version, and that they differ from free play in that they do have a sport development outcome. They also acknowledged that as important as deliberate play was during the sampling years, deliberate practice had an increasingly important role as youth progressed along the pathway toward expertise.

The LTAD model phases in specialization for children, and strongly promotes deliberate practice throughout the athlete development pathway. The DMSP recommends that children have the opportunity to engage in a variety of sport types and strongly promotes deliberate play during a developmental phase they labeled the sampling years. It could be argued that there is room for deliberate play in specialization, but the link must be made carefully. Balyi *et al. (*2013) noted that free play and deliberate play offer essential developmental opportunities for children, including those children who are specializing in one sport. However, they also emphasized the critical role of deliberate practice in specialization

There may be room to include some deliberate practice opportunities within the diversification of sport opportunities if the link between deliberate practice and explicit learning is made. In other words, if deliberate practice and deliberate play are conceived as coaching methods that can be placed on the explicit to implicit learning continuum, then coaches would select which methods to use regardless of whether they were involved in a sport specialization programme or a sport diversification programme. From this perspective, specialization and diversification speak to the content of a youth sport programme, and deliberate practice and deliberate play speak to teaching/coaching methods.

Côté and Fraser-Thomas (2008) supported this flexibility for thinking about content and methodology in their general recommendations for the distribution of types of play and specialization/diversification during the different stages of athlete development (Table 2).

Table 2: Côté and Fraser-Thomas' (2008) recommendations for the distribution of types of play and sport specialization/diversification during the different stages of development (p. 23)

	Deliberate Play	**Deliberate Practice**	**Number of Different Sports**
Sampling years (6-12)	80%	20%	3-4
Specialization years (13-15)	50%	50%	2-3
Investment years (16-22)	20%	80%	1-2

The dominance in deliberate play and diversification is evident during the sampling years. Even during the specialization, deliberate play and some diversity in sport participation is recommended. While substantially more scientific research is needed to clarify the risks and benefits of specialization versus diversification and the optimal relationships between deliberate play and practice, Burgess and Naughton (2010) cautioned that there are also ethical issues to be considered in discussion of youth sport content and coaching methodologies, particularly in terms of children's right to make their own choices in term of the long-term sport involvement.

From a social and psychological perspective, Côté *et al*. (2009) formalized the following seven postulates to support the emphasis on diversification and deliberate play during the sampling years, rather than specialization and deliberate practice. The following is paraphrased from their article:

> Postulate 1 – Early diversification does not have a negative impact on the ultimate achievement of elite sport participation in sports where peak performance is reached in early adulthood.
>
> Postulate 2 – Early diversification avoids burnout and may reduce over-use injuries, which will contribute to a longer sport career.

Postulate 3 –Early diversification allows participation in a range of sporting activities that provide a variety of different social and personal development opportunities.

Postulate 4 – An emphasis on deliberate play promotes intrinsic motivation by involving youth in activities that focus on their enjoyment and self-regulated participation.

Postulate 5 – An emphasis on deliberate play provides youth with opportunities to develop their perceptual and cognitive skills in a variety of movement situations, some of which will be transferable to their primary sport for specialization later on their development pathway.

Postulate 6 – During early adolescence (ages 13-15), youth should have the opportunity to choose for themselves whether to specialize in their favourite sport or to continue in sport at a recreational level.

Postulate 7 – During late adolescence (ages ±16), youth will have developed sufficient physical, motor, cognitive, social, emotional resources to sustain a commitment to highly specialized training in one sport.

Within the youth sport and physical education literature, various games-centred approaches have been developed that reflect this commitment to emphasize diversification and deliberate play for late specialization sports during the sampling years. Games-centred approaches are dominated by coaching methods that emphasize implicit learning, although as instruction becomes more technical, explicit learning is also promoted. The remainder of this chapter explores the thinking behind the games-centred approaches and finally arrives at the two versions that were compared in this study.

Games-Centred Approaches

The development of games-centred approaches to children's sport development has a long history with formal presentations of recommendations both for programme content and teaching/coaching methodology appearing from the 1970s. Common to all of these presentations has been the organization of programme content into different categories of games according to their tactical requirements and teaching/coaching methods that emphasize game play first and technical instruction second (Kirk & MacPhail, 2002). These approaches have also been labelled 'games for understanding' (GFU) approaches because they operate under the assumption that children will benefit from a positive transfer of tactical understandings within game categories because the teacher/coach has promoted their 'thinking' about what they do during their participation in modified, small-sided games.

Games for Understanding Approaches

Table 3 presents an adaptation of the Games Classification Approach by Thorpe, Bunker and Almond (in Werner & Almond, 1990) which is often cited as one of the clearest presentations of the four categories of games.

Table 3: Examples of Games from the Four Different Categories

Invasion Games	Net/Wall Games	Batting/Fielding Games	Target Games
Netball	Badminton	Cricket	Golf
Team Handball	Tennis	Baseball	Lawn Bowls
Hockey	Squash	Softball	Billiards
Rugby	Volleyball		Archery
Soccer			

1. Invasion Games: The purpose is to score by moving into other team's territory then putting object into goal – involves a mix of maintaining possession, gaining passion and scoring skills.
2. Net/wall Games: The purpose is to hit the object over a net or against a wall, into a space with sufficient accuracy and power that opponents cannot hit it back effectively.
3. Batting/fielding Games: The purpose is to strike an object with sufficient accuracy and power to avoid opponents who have attempted to position themselves strategically to make successful striking difficult.
4. Target Games: The purpose is to score by sending an object to hit a target. The competition can be either parallel where opponents do not actively interfere with each other (*e.g* golf), or confrontational where opponents try to block each other's efforts to hit the target (*e.g*. bowls, billiards).

Harvey and Jarrett (2013) highlighted four different variations of GFU approaches which have dominated youth sport pedagogy literature during the past 40 years.

- Teaching Games for Understanding (Bunker & Thorpe, 1982).

  The focus is on helping children realize why a skill is needed (by playing the game) before trying to teach the skill in a technical way. Coaches use a variety of child-centred methods within each of the four categories of games, including stopping play to ask questions and encouraging children to modify rules and to make up their own versions of games.

- Play Practice (Launder, 2001).

  The focus in this model is first on creating and maintaining a positive play environment to maximize children's enjoyment and develop intrinsic

motivation. Full and enthusiastic participation is identified as the key to children's learning. A variety of games from the different categories as well as other kinds of movement challenges are included in the programme content.

- The Tactical Games Model (Mitchell *et al.*, 2006).

  This instructional model is based on a framework of progressive tactical challenges common to the games in a single category. Children then are encouraged to participate in modified games at each level of difficulty, with the coach asking questions to develop the children's awareness of the decisions they can make in different tactical situations.

- Game Sense (Light, 2004).

  This approach is also based on the assumption that certain tactical principles are common across a range of games and teaching children about these principles will enable them to perform better at the games. Teaching includes both technical and tactical aspects, but begins with experiences in a generic game in each category (*e.g*. a generic invasion game) so that children first experience the tactical basics of the category before moving to sample a variety of specific games in that category (*e.g.* modified soccer, modified hockey, modified team handball).

Each of these approaches brings a special interpretation of teaching games to children that goes beyond the scope of this study. However, their relevance here is that they all include participation in a diversity of games and sports as the content of youth sport development programmes based on the assumption that there will be a transfer of understanding about tactics among games from the same category. They all also share a commitment to using

child-centred teaching methods and small-sided games that recognize deliberate play and implicit learning are the basis for establishing a positive learning environment for children.

Games for Understanding, Transfer and Diversification

Tactics were defined as adaptations to the configurations of game play as they occur during the game (Gréhaigne & Godbout, 1995). Transfer of tactical understanding among games would be based on the similarity of these the tactics (Magill, 2006). The small-sided games used during the intervention programmes in this study were all invasion games: soccer, hockey and team handball. Mitchell (1996) explained that invasion games share many tactical problems surrounding scoring, preventing the opponents from scoring and re-starting play after a stoppage Off-the-ball movements will be more similar than on-the-ball skills since the skills usually involve the manipulation of the sport-specific object (*e.g.* the soccer ball, the hockey ball). With this in mind, a small-sided invasion game for 3v3 or 4v4 might be designed in which allows children to experience the challenges of trying to get into position to score and into position to defend. Children practice for skill development after they have been exposed to the game.

The tactical similarities in invasion games suitable for children's programmes were identified by Wilson (2002) in terms of what attacking and defending teams are trying to achieve. For example:

- When members of the attacking team are on-the-ball, they are attempting to score, retain possession or pass. When they are off-the-ball, they are trying to advance, provide width or provide depth.
- When members of the defending team are on-the-ball, they are attempting to prevent scoring, contain an offensive player or channel the player. When they are

off-the-ball, they are trying to create positioning that either contracts or expands the space for the offensive players to move.

Research about Transfer of Tactical Understanding

Although the transfer of tactical understandings within similar game types might be logical and some support has been found, the research evidence generally has been equivocal. Research has typically compared the outcomes of a GFU approach to that of the traditional 'learn the skills separately then play the specific game' approach rather than look at transfer from one game/sport to another.

- Mitchell *et al*. (1995) implemented an eight lesson soccer unit and found that the only difference between the traditionally taught group and the GFU group was that the off-the-ball movements of the children in the GFU group were more effective during game play.
- Following a 15 lesson field hockey unit, Turner (1996) found that children from the GFU group were more effective making decision during game play than the children from the traditionally taught group.
- In another 15 lesson field hockey unit, Turner and Martinek (1992) not only found significantly higher scores for decision making during field hockey game play for children in the GFU group, but they also found significantly higher scores for ball control and passing execution.
- Memmert and Harvey (2010:303) examined a collection of invasion games for 6-7 year olds in order to determine whether they could confirm the validity of 'common' tactical understandings. They were able to identify six common tactics that were transferable: "Attacking the goal, taking the ball near the goal,

playing together, using gaps, feinting, and achieving advantage by supporting and cooperating with partners."

Comments about Transfer and Diversification

Transfer of learning implies that an individual who learns to successfully perform one task, can apply that learning to the successful performance of a different task (Causer & Ford, 2014). Although it is acknowledged that there is a lack of definitive research on the transfer of tactical understanding in GFU approaches (Harvey & Jarrett, 2013), the gap in the literature goes beyond a quantity issue. If transfer does occur, what is the basis for that transfer? Smeeton, Ward and Williams (2004) thought that pattern recognition skills might transfer from one invasion game to another, allowing players to more quickly read situation in similar games. They did find that skilled field hockey and soccer players were able to transfer perceptual strategies (where to look and when to look) from one sport to the other. However, their subjects were neither children nor beginning level players.

Another option is that the process of decision-making might transfer. Jordan, Lopez and Gimeno (2005) examined the impact of learning a generic invasion game on performance in the game of floorball. They worked with children between 10 and 11 years old, and found a positive transfer to decisions about when and where to dribble and pass during game play. Causer and Ford (2014) found a positive transfer between decision making in soccer to other invasion sports, but used video-based training rather than SSG participation.

It appears that the intuitive support for transfer of some perceptual or cognitive skills within invasion games has partial support. The use of a diverse sample of SSGs as a playful way for children to learn the tactical aspects of invasion game play remains a pillar of the GFU approaches. Deliberate play must next be considered as another pillar of GFU approaches.

Games for Understanding, Deliberate Play and Small-sided Games

The proposed relationship between the GFU approaches, SSGs and deliberate play have may be illustrated in an adaption of the Gréhaigne, Richard and Griffen's (2005) game analysis model, and is presented in Figure 6 as a framework for content and coaching methodology for invasion games. The area of the framework is divided into four quadrants based on the level of the challenge to players' decision making on the vertical axis and the focus on modified versions of the game to the adult version of the sport on the horizontal axis. The following associations appear:

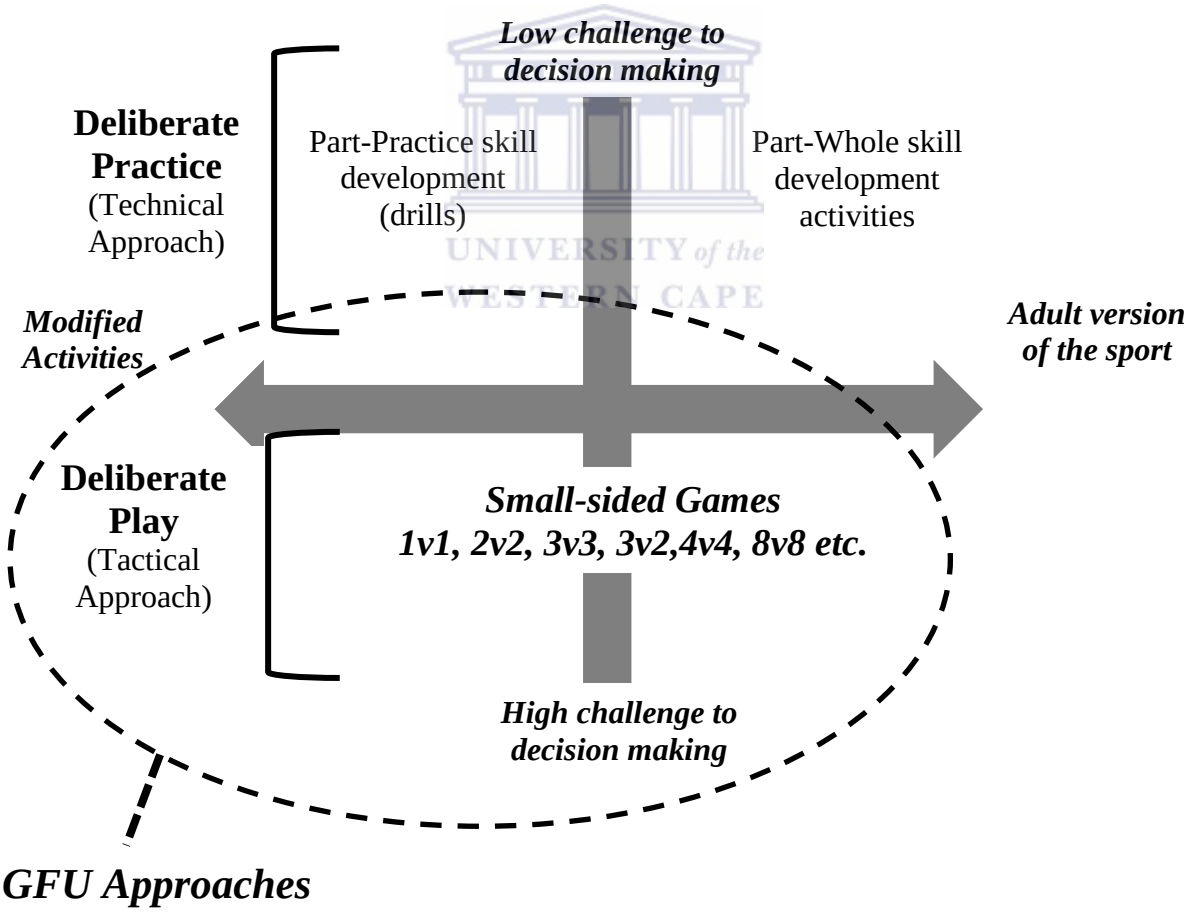

Figure 6: GFU Approaches within a Framework for Thinking about Content and Coaching Methodology for Invasion Games (adapted from Gréhaigne *et al.,* 2005, p.105)

- Deliberate practice is associated with the two top quadrants (lower levels of player involvement in decision making). This kind of practice has been labelled the 'technical approach' because it is focused on explicit learning through a variety of direct coaching methods, including demonstrations, drills, etc., where the coach provides consistent structure and feedback on performance.
- Deliberate play is associated with the two lower quadrants (higher levels of player involvement in decision making). Deliberate play practice has been labelled the 'tactical approach' because it is focused on children learning about how the game is played. Implicit learning is emphasized and coaches employ a variety of indirect coaching methods, including analogy and playing modified small-sided games.
- GFU approaches to invasion games are positioned in the lower left quadrant because they all emphasize deliberate play (the tactical approach). SSGs represent the bulk of the content of children's invasion-game lessons because they are modified versions of the adult game, but retain a challenge to children's decision making.

Games for Understanding and Small-sided Games

The minimal role in the GFU approaches for deliberate practice and the technical approach to coaching was founded on Bunker and Thorpe's (1982) argument that certain youth would never be able to play games if they had to wait to achieve a certain level of skill. The de-emphasis on the technical approach was later justified by Werner *et al*. (1996):

- Children do not feel successful if they cannot meet the technical demands of performance at the same rate as their peers.
- Children may develop sound skill techniques but are poor decision makers during game play.
- Children tend to become dependent on coaches/teachers to make decisions.

With a commitment to deliberate play, implicit learning and the development of a tactical understanding, SSGs became a critical feature of all of the GFU approaches, used to develop the principles of play related to basic offensive and defensive tactical knowledge (Pill, 2012).

Mitchell *et al.* (2006) advocated SSGs of 3vs3 minimum for teaching invasion sports because they felt the adult game would be evident, but the special accommodations could be made to slow down the tempo of game play, simplify tactical options and focus on selected options for success. These SSG accommodations included:

- Modifying the rules to permit the use of only some skills.
- Reducing the number of players.
- Reducing the playing area.
- Modifying the equipment to make it easier/safer to manage.
- Modifying the goals size or methods of scoring to increase odds for success.

Within the GFU approach to SSGs, the coach/teacher is seen as a facilitator of practice, and assumes a variety of responsibilities during deliberate play practice sessions Mitchell *et al.* (2006). For example:

- Organize the children into groups and teach them the rules for the SSG.
- Ensure that children play by the rules, but allow them to decide how to play within the rules.
- Adjust the SSG to simplify or make it more complicated to challenge students appropriately.
- Use questions to help children focus on the critical tactical features of the SSG.

Benefits of Small-sided Games

SSGs can provide players with many opportunities to improve their skills and decision-making by providing them with internal feedback from mistakes made during game play. In the game-sense framework for soccer Pill (2012) presented children with soccer SSG learning opportunities using 1v1, 2v1, 2v2 and 3v3 games to practice various aspects of attack and defence in a playful manner. Mitchell (1996) used SSGs for teaching tactical understanding in soccer where a 2v2 format is used at level 1 and a 3v3 format at level 2 to add complexity to tactical understanding. Greco, Memmert and Morales (2010) assessed the impact of deliberate play on tactical creativity and tactical intelligence in the invasion game of basketball for youth ages 10 to 12 years. A deliberate play group was taught only through SSGs and a placebo group participated in traditional basketball training sessions. The deliberate play/SSG group showed significant improvement in tactical understanding when compared to the placebo group. This also showed that the 18-lesson SSG intervention in game formats ranging from 1v1 to 4v4 were successful in developing tactical creativity.

Memmert and Harvey (2010) cited research with U/9 soccer players that found that reducing the number of players in SSGs could increase the number of technical actions required of players. Analysis revealed that 4v4 SSGs provided 585 more passes, 481 more scoring attempts, 301 more goals, 525 more 1v1 encounters and 436 more dribbling tricks when compared to 8v8 SSGs. Brandes, Heitmann and Müller (2012) concluded that SSGs have the potential to improve the technical and tactical abilities of players because they allow more time on the ball under game-like conditions.

Although SSGs were originally designed to develop tactical as well as technical skills, interest quickly developed in defining the physical conditioning contributions of SSG play (Fradua *et al*., 2013). In their study of the heart rates of pre-pubescent boys during soccer

match play, Capranica, Tessitore, Guidetti and Figura (2001) was able to use match analysis to determine that SSGs were played at significantly higher levels of aerobic challenge than regulation soccer games. Brandes *et al.* (2012) also found that 2vs2, 3v3 and 4v4 formats were suitable for youth aerobic fitness training. They explained that because soccer SSGs had a lower number of players, game play promoted a greater amount of engagement and higher heart rates than those with more players.

Comments about Deliberate Play and Small-sided Games

The Côté and Fraser-Thomas (2008) contention that deliberate play should constitute the bulk of the practice time of children between ages 6 to 12 is supported by research into children's participation in SSGs. The deliberate play that children experience when they participate in SSGs has been found to provide them with considerably more active engagement in sport-related movements than deliberate practice within a structured activity (Baker & Young, 2014).

Positive contributions to the development of both perceptual and physiological attributes have been found to occur specifically during participation in 4v4 soccer SSG play (Hill-Haas, Rowsell, Coutts & Dawson, 2008). Participation in a generic invasion game SSG was compared to a Soccer SSG in terms of technical and physical outcomes. The results indicated that the generic SSG provided more opportunities for successful skill performances and higher workloads (Harrison, Kilding, Gil & Kinugasa, 2014). However, despite universal support for the use of SSGs for achieving technical, tactical and physical outcomes, Halouani *et al* .(2014) cautioned that more research is necessary to determine the relative effectiveness of different SSGs with different numbers of players, pitch sizes and rule modifications.

Concluding Remarks

There has been very little formal research conducted surrounding children's sport development and the effects of early specialization versus diversification (sampling) and the subsequent benefits of deliberate play and/or deliberate practice (Baker & Young, 2014). Past research has relied on the recollections of experts in terms of how much time they spent as children/youth in either specialized or diversified sport experiences at the different stages of their development.

Fransen *et al.,* (2012) took a different approach and tested over 1000 boys between ages 6 to 12 who could be categorized as either specializing in only one sport and those who were sampling from three to four sports. While they found no differences between the groups of younger boys, for the boys in the 10-12 year old range, those with a diverse sport background scored significantly higher on tests of strength, speed, aerobic endurance and gross motor coordination than their peers who were specializing in only one sport. The authors acknowledged that it could be that the more versatile and generally more physically proficient boys were seeking out a diverse sport experience. This underscores how difficult it is to study the specialization versus diversification debate.

The GFU approaches are rooted in the value of deliberate play which is linked with a variety of types of implicit learning. GFU teaching/coaching methods for invasion games focus on the teacher/coach's role in observing children's SSG play and diagnosing performance to facilitate children's thinking processes. But what about situations where teachers/coaches do not have the technical and tactical knowledge to observe, diagnose and facilitate children's implicit learning? Can participation in SSGs produce positive learning outcomes without knowledgeable adult input? Implicit learning would suggest that it can and

this suggestion provides hope for school sport programmes where the adult leadership may be provided by teachers who have no special understanding of sport.

This study aims to be relevant in the context of South African primary schools in disadvantaged communities. While it may be unrealistic to presume that teachers in most of these schools have sufficient knowledge of sport to provide children with either technical or tactical feedback to improve sport performance, they should have the ability to organize SSGs and ensure that the children engage in deliberate play according to the rules of a modified game. Participation in the SSGs becomes the children's opportunity for implicit learning. Research has revealed that 4v4 SSGs often produce positive physical, motor, technical and tactical outcomes for 10 to 12 year olds, so teachers of these children would focus on implementing a 4v4 SSG programme.

Deliberate play is also linked to diversification in several sports as opposed to specialization in one sport during the sampling years (6 to 12). If teachers can organize a soccer SSG, they should be able to organize a team handball SSG and a hockey SSG as well. But is there any difference in the benefits for the children in a diversified approach compared to a specialized focus in only one sport? Deliberate play theory would say yes, that a diversified approach lays a stronger physical and tactical base for future expertise in the sport finally chosen for specialization later. The GFU approach would add that all of the games involved must be from the same category (*e.g.* invasion games) for this positive transfer to occur. These considerations led to the formulation of this study that compared the outcomes of children's participation in two versions of the GFU model.

1. The teaching/coaching methodology will promote deliberate play at the extreme end of the explicit – implicit learning continuum. The children will play modified versions of a sport without adult interference.

2. 4v4 invasion SSGs will be the programme content. One group will participate in a single-sport only programme and the other group will participate in a diverse (three sport) programme.

A comparison between two different GFU approaches (specialization versus diversification) would be made in terms of the outcomes for children's physical fitness and motor coordination, as well as their technical and tactical performance in soccer.

Chapter Three

METHODOLOGY

The purpose of this study was to determine the effects of participation in a single-sport (soccer) versus a multi-sport (soccer, hockey and team-handball) small-sided games (SSG) programme on the physical fitness, gross motor coordination, soccer skills and soccer tactics of grade four children from an historically disadvantaged community in the Western Cape. The following sections describe the design, procedures and data analysis phases of this research.

Design

This study is regarded as quasi-experimental research by Thomas, Nelson and Silverman (2005) because although it involved comparing the effects of two different intervention programmes, it was not possible to identify a control group. In order to compare the effects of specialization (the soccer SSG programme) to diversification (the multi-sport SSG programme), intervention was necessary with two different groups (*i.e.* both grade four classes). This made the assignment of groups (Group 1 for soccer, Group 2 for mulit-sport) a sample of convenience because the children came from two intact grade four classes at the same primary school. There was not another grade four class at this school, and trying to use children from another primary school as a control group would have introduced too many other kinds of social and cultural differences at the individual, the school and the community levels.

Procedures

Selection of Participants

The principal of the only primary school in a historically disadvantaged community was presented with an overview of the 20-week schedule for the study (Table 4).

Table 4: Weekly Schedule Followed in the Study

Week	Focus
Weeks 1 and 2	Familiarising the Children with the fitness and skills tests
Weeks 3 and 4	Pre-tests of fitness and skills
Weeks 5	Filming of SSGs to assess tactics
Weeks 6 - 11	6 weeks of participation in the SSG Programme (40 minute sessions, 2 sessions per week)
Weeks 12	Filming of SSGs to assess tactics
Weeks 13 - 14	Post-tests of fitness and skills
Weeks 15 - 18	No participation in running/invasion games
Weeks 19-20	Retention tests of fitness and skills

A meeting was then held between the researcher, the principal and the two grade four teachers where the study and proposed intervention programmes were explained. All testing periods, practice sessions and the games filmed for later games analysis, would be conducted at the primary school. The purpose of the research was discussed and the need for cooperation by the teachers was emphasized.

The research proposal was submitted and approved by the Senate Research Committee of the University of Western Cape. After consultation with the grade four

teachers, the principal provided a letter of support which was attached to the application to the Western Cape Education Department (WCED) for their approval of this research (Appendix A).

The researcher then visited each grade four class and described the project to the children. After this presentation, the children were asked if they had any questions. They all indicated that they wanted to volunteer to participate in the project, so they were all given an Information Letter to take home (Appendix B), an Informed Consent form (Appendix C) for their parent or guardian to sign, and an Assent Form (Appendix D) for their own signature. All of the children from both classes returned both the signed Informed Consent and Assent forms within four days. All of the children in both classes met the inclusion criteria (below).

- Group 1 (Class 4a) consisted of 39 children.
- Group 2 (Class 4b) consisted of 40 children.

Inclusion Criteria

The following inclusion criteria were applied when determining the participants in this study:

1. Boys and girls who were enrolled in Grade Four of the primary school were eligible to volunteer. Each participant must have achieved the age of nine years old by 1 January, 2010 but must not have had their 12th birthday before 31 October, 2010.

2. Both the child and his/her parents or guardians must have signed the Informed Consent and the Assent Form prior to pre-testing period.
3. The children all had to be injury-free and already actively participating in their daily recess periods.

Exclusion Criteria

The following exclusion criteria were applied to filter the results of this research so that data from any children who were not able to participate optimally in this research project were excluded:

1. It was hoped that all the children eligible would volunteer and that their parents/guardians would consent. However, it was made clear that children who did not choose to be involved or who chose to drop out of the research during the testing or the intervention programme, would not be penalised in any way. Although all of the children in both classes volunteered to participate and no one chose to drop out, had this occurred any data gathered that related to them would have been excluded from this research.
2. It was also hoped that all of the children who volunteered would want to participate fully during testing and during every SSG session. For the purpose of this study, an attendance register was kept and a rate of 80% was used to include children's data as part of the results of this research.
    - Children whose attendance rate was lower were still encouraged to play and enjoy the sessions, but their data were excluded from the results.
    - Children who missed participation due to illness, injury or for any other reason, also were encouraged to play and enjoy the sessions, but their data were excluded from the results.

Following application of the exclusion criteria as specified above, data were available for analysis from the following two groups of children:

- Group 1 (Class 4a) consisted of 35 children (17 boys and 18 girls).
- Group 2 (Class 4b) consisted of 37 children (17 boys and 20 girls).

Development of Test Protocols

This study required the administration of physical tests to assess fitness, gross motor coordination and soccer skills. In addition to being appropriate for children between the ages of 9 to 12, it was necessary to limit the number of tests in order to accommodate the school's timetable. Considerable effort has been made by physical educators in Europe in the past twenty years to develop field tests relevant to assessing children's physical abilities. These efforts have produced several test batteries that include selected physical fitness tests as well as tests of gross motor coordination and specific sport skills (Fransen *et al.*, 2012). After consultation with a primary school physical education teacher and the classroom teachers involved in this study, the selected variables were identified as suitable indicators of the effects of children's participation in a running/invasion SSG programme (Table 5). Keeping a record of changes in the children's height and weight was also considered important so that when the group results were compared, it could be seen whether there were physical differences between the groups which might have influenced the results.

Table 5: Dependent Variables for Fitness, Gross Motor Coordination and Soccer Skills

Selected Physical Fitness Variables	**Selected Gross Motor Coordination Variables**	**Selected Sport Skills from Soccer**
Muscle Endurance	Dynamic Balance	Dribbling
Power	Whole Body Coordination	Shooting at Goal
Speed		
Aerobic Endurance		

A total of nine tests were identified to measure the variables identified above were administered according to the protocols described in Appendix E, in addition to measurements of height and weight. The specific test items selected were consistent with current research conducted in Belgium which focused on the specialization versus diversification debate for children ages 6 to 12 (Fransen *et al.* 2012). The soccer-specific skill tests for dribbling and shooting as described in Appendix F, have been used previously in South African soccer talent identification research completed by Baatjes (2006).

Preparation for Testing

The researcher met for training sessions with four sport scientists who had volunteered to assist with the testing sessions. Each test protocol was reviewed and practiced in order to standardize the ways in which the tests were administered. The researcher then visited the school to determine the optimal location for conducting the tests, and to confirm the times for testing with each teacher.

A final schedule for testing was negotiated with the school principal and the teachers (Table 6). The first two weeks of the study were set aside to familiarize the children with the tests of each of the variables listed above. A total of four sessions (two each week) were spent showing the children each of the tests and allowing them to practice. The rules for a soccer SSG were also taught and the children learned not only how to play the game, but also how to take turns when playing so that everyone had equal amounts of playing time.

Table 6: Schedule for Pre-testing during Weeks Three and Four

Day	Sequence of Activities
Day One	Height Weight ***Light warm-up*** Power: Standing long jump test Dynamic Balance (walking on the balance beam)
Day Two	***Light warm-up*** Whole body coordination: Side Jump Muscle endurance: Push-ups Speed: 20m Sprint
Day Three	***Light warm-up*** Muscle endurance: Sit-ups Soccer skill test - Dribbling
Day Four	***Light warm-up*** Soccer skill test – Shooting at Goal Aerobic endurance: 6 minute Run

Pre-tests

During weeks three and four, the physical fitness tests, coordination tests and soccer skills tests were administered for both classes during their pre-scheduled sessions. The physical fitness tests were conducted indoors, with the exception of the endurance run, which was conducted on the outdoor field. Both soccer tests were conducted on the outdoor field. The time of testing for Group One (soccer SSG) was from 10:15 to 11:00 on Mondays and Wednesdays, and from 10:15 to 11:00 for Group Two (multi-sport SSG) on Tuesdays and Thursdays. The children from both groups had their morning break at 11:00.

At the beginning of the first test session, each child was given a number that corresponded to the number on his/her scorecard. The testing was organized into various testing stations with the children rotating from station to station in the order indicated above. Two trained sport scientists managed each station and conducted one test. When that test was completed, they then administered the next test as assigned to them. When the children had completed all the tests for the day, they gave their scorecards to the researcher and then were allowed to go to the playground for a recess period.

During week five, the two scheduled sessions for both Group One and Group Two consisted of 4-on-4 game play in the soccer version of the SSG. A digital video recording and separate file was made of every soccer SSG. The children were pre-assigned to a team. Their classroom teacher randomly assigned them to their team by drawing their name out of a hat.

Each of the children wore a pre-assigned numbered bib for the intervention portion of this study, which became their 'jersey.' The numbers helped the researcher take attendance at each session and also to keep track of each child's playing time so that all of the children received a similar amount of SSG participation during every session.

The children played a 5-minute 4v4 soccer game then rotated out while another team of children took their turn. After the second group had their turn, a third rotation of players in the games was made, and so on until the end of the session. Because the children each had a different number on their bibs, the researcher was able to review the video recordings and then identify and assess each child's use of simple tactics during the pre-intervention as well as post-intervention SSG soccer games.

The researcher filmed all of the games using a JVC Everio HDD digital video camera set on a tripod at an elevated vantage point on the side of the field. The following steps were involved for each of the SSGs filmed:

1. Set up video camera and tripod in a suitable position for optimal filming of the soccer SSGs.
2. Test video camera and correct camera positioning errors (if any).
3. Begin to film the game with the focus of the camera on the movement of the ball in relation to the on-field movement of players.
4. Pause filming between SSG to prolong battery life.
5. Stop filming at the end of the session.
6. Download, label and store the file on the laptop computer.

The Small-sided Games Intervention Programmes

The intervention programmes followed a set pattern with two SSG sessions per week per group (Table 7).

Table 7: Outline of Weekly Training Maintained for Weeks 6 - 11

Grade Four Class	Monday	Tuesday	Wednesday	Thursday
Group 1 Soccer small-sided game n = 35	Single sport (soccer SSG) play		Single sport (soccer SSG) play	
Group 2 Multi-sport small-sided games n = 37		Multi-sport (soccer, hockey & team handball SSGs) play		Multi-sport (soccer, hockey & team handball SSGs) play

The playing schedule and rules of the games are presented in Appendix G. The researcher was the teacher/coach for every session in order to make sure that the children played according to the rules of their SSG as well as to check the children's attendance and

participation. There were no progressions in SSG difficulty. Only one type of 4v4 soccer, hockey and team handball SSG were played throughout the programme.

Group 1 participated in a single-sport version of the GFU approach, a 4v4 soccer SSG. In this game, the basic rules of soccer applied, but the number of players was reduced to four players per side, the size of the pitch was reduced to 30m long and 20m wide, and the size of the goal was reduced to 2m. A goalie was included as a 5th player, but he/she could only play the ball with the feet. This is the same game that was used in the pre-test and post-test sessions, so it was anticipated that the children in Group One would benefit substantially from specialization. In order to facilitate class organization and taking turns, the boys' group was divided into Team A (8 boys) and Team B (9 boys). The girls were divided into Team C (9 girls) and Team D (9 girls).

Group 2 participated in the multi-sport version of the GFU approach, with an SSG for soccer, team handball and field hockey included as the content. For each of the SSGs, the basic rules of the sport were maintained, but the games were all 4v4 and the size of the field was 30m long and 20m wide. A goalie was included as a 5th player, and the size of the goal was reduced to 2m. The same soccer SSG that was used for Group 1 was used with Group 2. In order to facilitate class organization and taking turns, the boys' group was divided into Team A (8 boys) and Team B (9 boys). The girls were divided into Team C (10 girls) and Team D (10 girls).

Post-tests and Retention Tests

During week 12, the SSGs were all recorded on digital video for later analysis of the children's use of tactics and the comparison to pre-test use of tactics during game play. In the 13th and 14th week, the post-tests of physical fitness, gross motor coordination and soccer

skills were administered following the exact same schedule that was followed for the pre-tests. The same sport scientists were involved.

The children were asked to play no soccer, hockey, team handball or any other invasion game for weeks 15 to 18. The retention tests for physical fitness and soccer skills were administered in weeks 19 and 20, again using the identical protocols followed on the pre-tests.

Data Processing and Analysis

A pre-test, post-test, retention test design for gathering data was followed in order to record children's height, weight, scores on selected physical fitness, gross motor coordination, soccer skills tests and ratings of their application of tactics during soccer SSG play.

Physical Fitness, Gross Motor Coordination and Soccer Skills

For the purpose of statistical analysis, group membership (SSG or Multi-sport) and gender (boys or girls) were the independent variables and the dependent variables were the selected components of fitness, gross motor coordination and selected soccer skills. The results of the pre-, post- and retention tests were recorded on an Excel spreadsheet and sent to the Stellenbosch University Statistical Support Unit for guidance on processing and subsequent analysis.

The Statistics Consultant Centre at Stellenbosch University was consulted for the processing and analysis of the data. Two separate one way repeated measures ANOVA analyses were applied to identify any significant changes within either the boys' or the girls' groups as a result of their participation in their respective SSG intervention programmes. A

mixed 2 x 3 repeated measures ANOVA was applied to determine if there were any interaction effects among the independent and dependent variables. In all cases, $p \leq .05$ was set as the level for determining significant effects. A description of these processes is explained in more detail in the next chapter.

Application of Tactics during Game Play

Video-based games analysis was used to assess the children's application of offensive and defensive tactics during game play. The first step in games analysis is the development of an observational plan to organize the analysis of player performances. This observational plan is called a category set. A category set is also used to structure the way in which the investigator reported game performance. The category set used in this study was adapted from the Mitchell *et al.*, 2006 Games Performance Assessment Instrument (GPAI) for defining game performance in running/invasion games such as soccer (Table 8).

Validity of the Category Set

Face/logical validity is accepted when an assessment method or instrument is considered by experts to be accurate (Thomas *et al*., 2005). Through adopting the Game category set from the Game Performance Assessment Instrument (GPAI) described by Mitchell *et al. (*2006) face/logical validity is accepted. Harvey *et al*. (2010) used the GPAI to assess game play in soccer among high school pupils.

Table 8: Category Set to Guide the Games Analysis of Invasion Games (adapted from Mitchell *et al*., 2006)

Category	Purpose	Observable Action
Scoring	Maintaining possession of the ball	Move the ball into space to avoid opponents
		Move the ball forward to using controlled actions
		Support the ball carrier
	Attacking the goal - Shooting	Receive the ball and take a quick shot on target
		Follow the shot for the rebound
	Attacking the goal	Turning with the ball
	Creating space in the attack	Creating space in the attack
	Using space in the attack	Using space in the attack
Preventing Scoring	Defending space	Marking (guarding)
		Pressuring the ball
	Defending the goal	Goalkeeping – positioning to narrow the angle
		Defender – positioning to narrow the angle
	Winning the ball	Tackle without fouling
Re-starting Play	Throw-in	Throw to open teammate
		Throw to open space
	Corner kick	Kick to goal area

Games Analysis Sessions

The recorded version of each game from both the pre-test and the post-test sessions were downloaded as separate video-clips to a computer. The analysis process took place over

a period of three days (one session each day). The analysis session for each day was approximately three hours long. The investigator was concerned that longer sessions would produce fatigue which in turn might reduce the validity of the process.

Three three-hour sessions were considered to be manageable. An expert who has published the results of similar video analysis for game play in per-reviewed research journals, agreed to work with the researcher to analyze the tapes. Together, they become the evaluators of the children's game play. The following steps were taken:

1. Orientation to games analysis process (session one only).

   The evaluators reviewed the use of the Focus X2 software for games analysis in terms of how they would apply it to digitize the video files for each of the SSGs. They discussed the GPAI category set to guide the games analysis process.

2. Trial practice using games analysis.

   After acquaintance with the software and category set, the evaluators took the recordings of three SSGs at random on which to practice in order to confirm clarity on their interpretation of what was happening on the field. Because the children played at a very simple level of tactical awareness, it was not necessary to use the full GPAI. A reduced complexity version was then determined and it was agreed that it would serve as the category set for the analysis of the children's game play (Table 9). The evaluators also agreed to rate each child holistically on a scale from 1 to 5 in terms of their proficiency in offensive play and in terms of their proficiency in defensive play, rather than attempt to arrive at a rating for each separate category (Table 10).

Table 9: The Simplified Category Set Used to Guide the Games Analysis

Category	Purpose	Observable Action
Offensive Play	Maintaining possession of the ball	Move the ball into space to avoid opponents
	Attacking the goal - Shooting	Receive the ball and take a quick shot on target
		Follow the shot for the rebound
Defensive Play	Defending space	Marking (guarding)
	Winning the ball	Tackle without fouling

Table 10: Rating Scale used by Evaluators to Assess Children's Game Play

Rating	Description of Player Behaviour
1 pt	Child never employs the tactic
2 pts	Child seldom employs the tactic
3 pts	The child employs the tactic, but misses some opportunities to do so
4 pts	The child employs the tactic frequently, although some opportunities are missed
5 pts	The child employs the tactic effectively and seldom misses an appropriate opportunity to do so

3. Process of consensual validation.

   The evaluators used a process known as consensual validation in order to arrive at scores for each of the children (Scanlan, Stein & Ravizza, 1991). They sat together in silence and viewed the game tapes for each child. They then viewed the tapes again and shared their thoughts about a fair rating on offensive as well as defensive play. Agreement had to be achieved in the rating of each child's application of tactics in their SSG play.

4. Determining reliability.

   Reliability or repeatability in the rating process is critical. If a measurement instrument cannot yield the same results upon successive trials then the test cannot be trusted (Thomas *et al.*, 2005).

For the purpose of this study, reliability was defined as at least 80% agreement in the game play ratings determined by the evaluators during one viewing session, with the ratings determined for the same game situation for the same players, during a session scheduled six days later. This repeated viewing and rating process was followed for four game sessions and the agreement between sessions was calculated at 90%. This was taken as sufficient support for accepting the reliability of the evaluation process.

Presentation of the Results

The results of the data analysis were reported in tables and graphs. All games analysis results were reported in frequency tables. The information needed to answer all research questions were taken from these tables and graphs, and are presented in the following chapter.

Chapter Four

RESULTS

This study compared the effects of children's participation in a soccer small-sided games (SSG) programme to participation in a multi-sport SSG programme on selected physical fitness, gross motor coordination and soccer skills as well as their ability to apply selected tactics during soccer SSG play. Data related to the four hypotheses that guided this study were gathered from two intact Grade four classes from a primary school in a disadvantaged community.

Descriptive Data

A total of 72 children participated in this study: 35 participated in the soccer SSG programme (17 boys and 18 girls) and 37 in the multi-sport SSG programme (17 boys and 20 girls) (Table 11).

Table 11: Demographics of the Participants

Gender	Group	Mean Age	SD
Boys	Gr 1 Soccer (n=17)	10 years 7 months	9.0 months
	Gr 2 Multi-sport (n=17)	10 years 6 months	7.6 months
Girls	Gr 1 Soccer (n=18)	10 years 8 months	8.6 months
	Gr 2 Multi-sport (n=20)	10 years 7 months	7.5 months

The height and weight of all participants were measured as part of their physical fitness pre-test, post-test and retention test in order to document their physical growth. A steady increase can be seen in the boys' height (Figure 7) and weight (Figure 8) from the pre-

test to the post-test to the retention test for both the boys in Gr 1 Soccer and Gr 2 Multi-sport programmes.

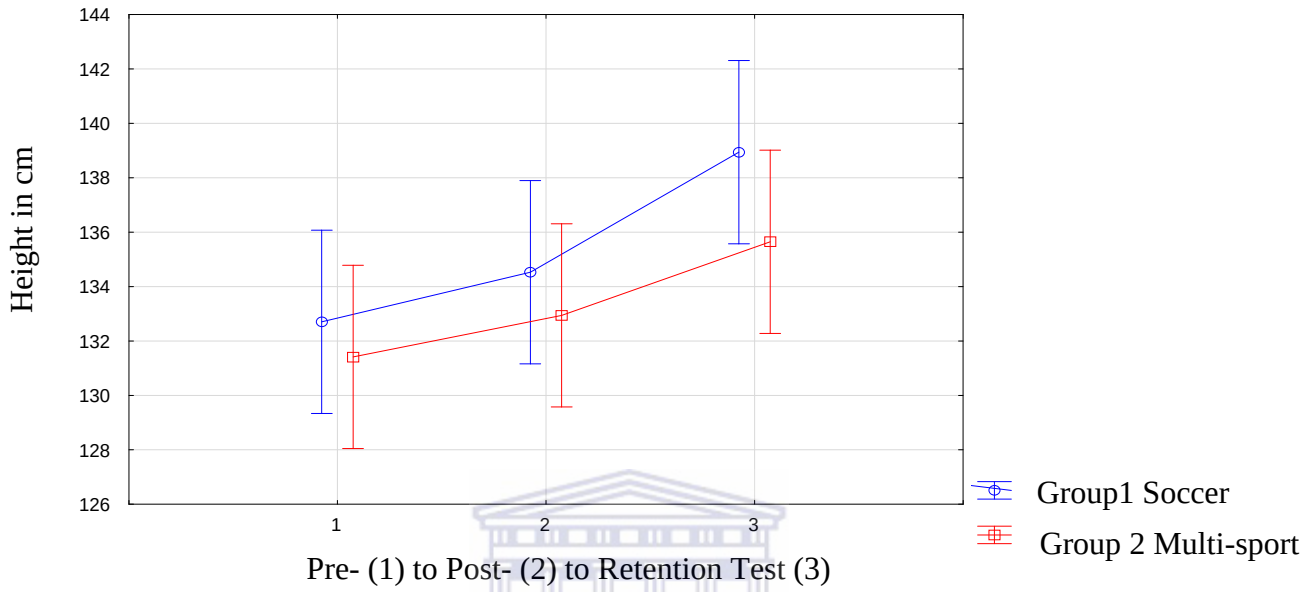

Figure 7: Boys' Height (cm)

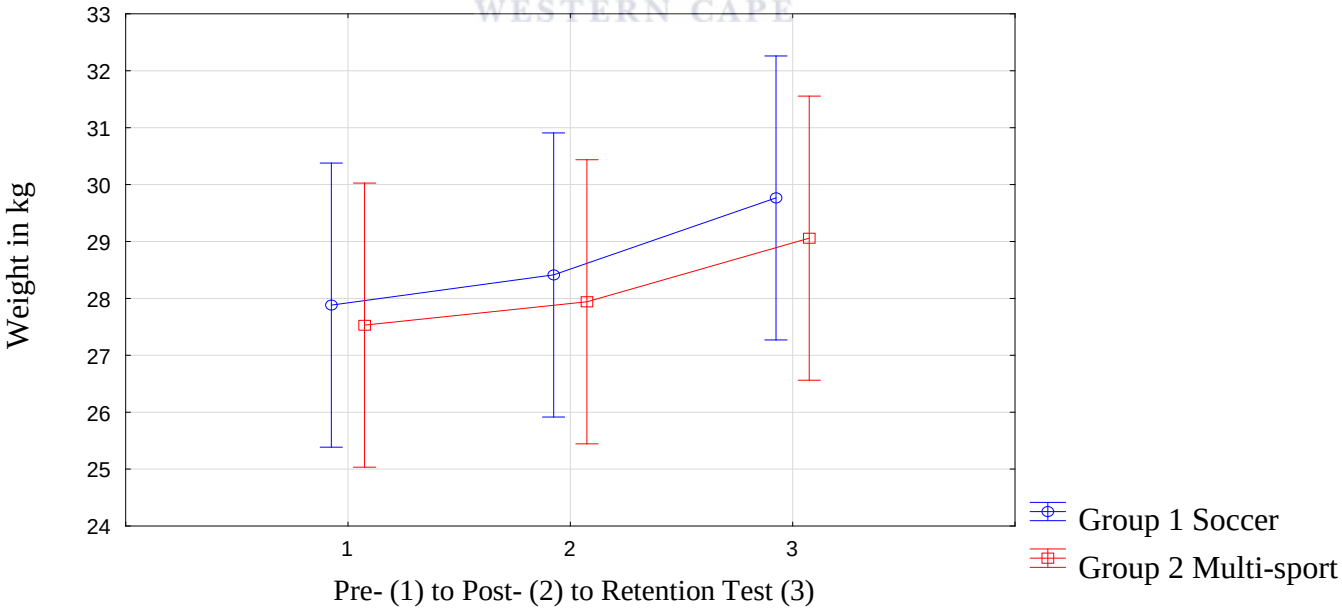

Figure 8: Boys' Weight (kg)

A similar pattern of steady increase can be noticed for the height (Figure 9) and weight (Figure 10) of both groups of girls from their pre-test to post-test to retention test.

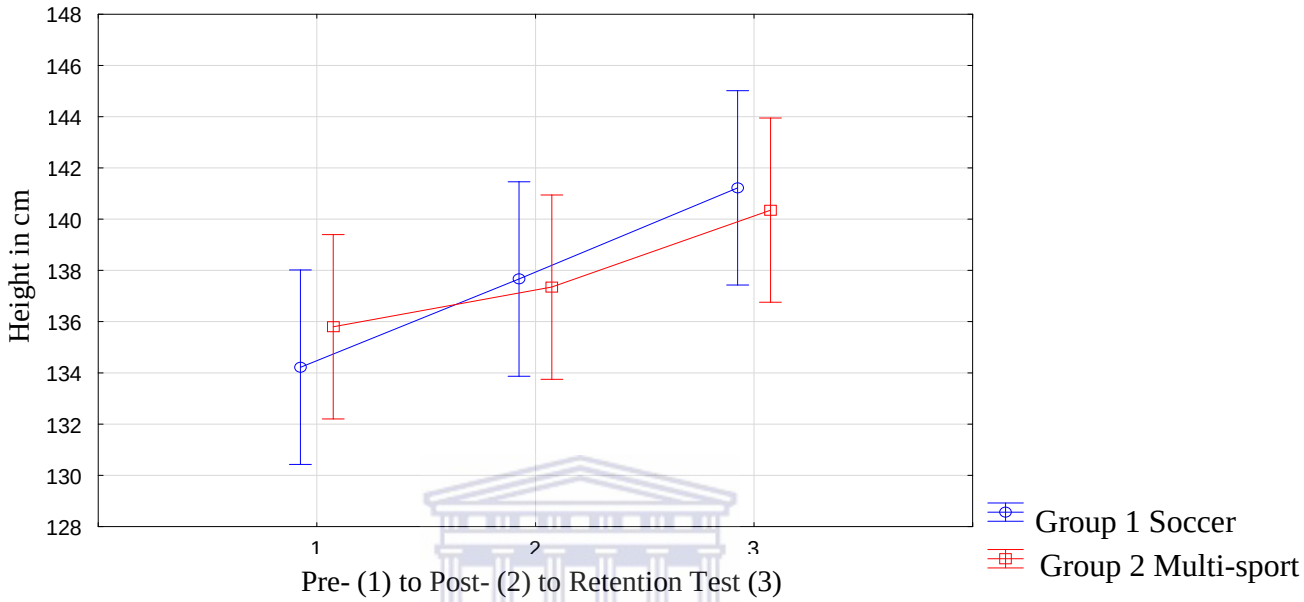

Figure 9: Girls' Height (cm)

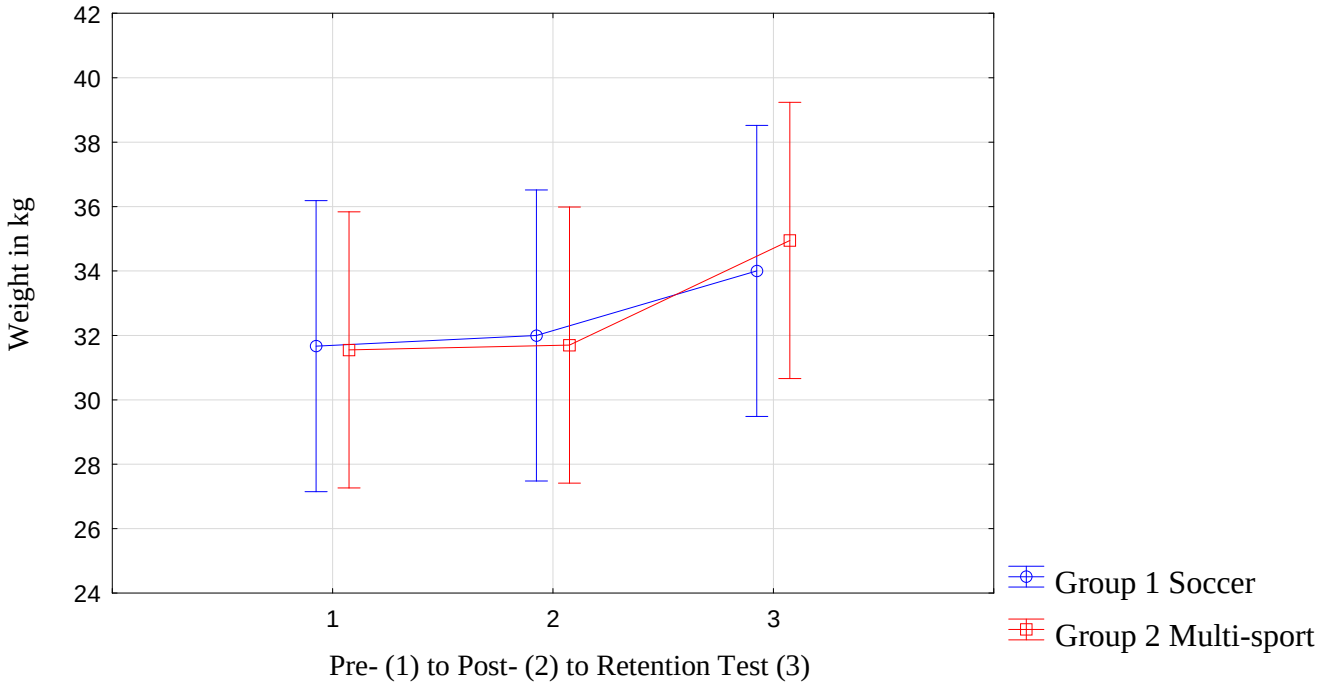

Figure 10: Girls' Weight (kg)

Analysis of Data

The physical fitness, gross motor coordination and skill performance data were recorded on an Excel spread sheet, and submitted to the Statistics Consultant Centre at Stellenbosch University. They processed and analysed the data using two different types of repeated measures analysis of variance (ANOVA) as recommended by Bell and Rowley (2011).

1. A one-way repeated measures ANOVA was applied separately to the pre-, post- and retention test data for Gr 1 Soccer and for Gr 2 Multi-sport in order to determine if there were significant changes in any of the dependent variables as a result of participation in their respective SSG programmes. This is referred to as a "within group" comparison because the results describe what happened to the members of the same group only and do not compare results to what has happened in any other group.
2. A mixed 2 x 3 repeated measures ANOVA (2 groups x 3 repetitions of the same test for each variable) was applied to determine if there were any interaction effects between Gr1 Soccer and Gr 2 Multi-sport for each variable. Interaction effects refer to the effects on the dependent variables associated with the combination of the independent variables that are not detectable when the effects of each independent variable on the dependent variables are analysed by themselves (as in the one way repeated measures ANOVA described above). In this study, the independent variables were group membership (soccer or multi-sport) and time of testing (pre-, post- and retention test) and the dependent variables were each of the components of physical fitness gross motor coordination as well as the soccer skills that were tested.

The 2 x 3 repeated measures ANOVA applied in this study yielded the "between group" analysis of the changes experienced by the Gr1 Soccer participants compared to those experienced by the Gr 2 Multi-sport participants for each of the dependent variables. If an interaction effect is determined to be statistically significant for a particular variable, it means that no conclusions can be drawn about the impact of the type of intervention programme on that variable. This is the case whether a graph that illustrates the interactions show an ordinal relationship (the lines follow a similar or parallel path) or disordinal (the lines intersect or cross).

The rating scores for the application of offensive and defensive tactics were presented in descriptive format only. This approach was taken because of the limited number of observations of the game play of each child, and the limited number of children whose performances were analysed (Vincent & Weir, 2012). Additional decisions were made that influenced the analysis of the results:

- When looking at physical fitness, gross motor coordination and soccer skills, only the pre-test to retention test changes received attention in the following sections. These comparisons determine if either programme had a lasting effect on the children, which is an approach favoured in applied motor learning and pedagogy (Magill, 2006). The following chapter discusses any significant changes that were revealed on the pre- to post-test comparisons, but lost on the retention test.
- Interaction effects were presented in this chapter only if determined to be significant.

- The boys and girls were regarded as separate, and no data were reported or analysed that either combined or compared boys (Gr 1 Soccer and Gr 2 Multi-sport) with/to girls (Gr 1 Soccer and Gr 2 Multi-sport).

Hypothesis One

There will be no differences in selected physical fitness outcomes for children who participated in the soccer SSG programme and children in the multi-sport SSG programme.

Within Group Changes for Boys' Physical Fitness

The changes within each group of boys on the selected physical fitness variables are presented in Table 12.

Boys' Gr 1 Soccer

Significant changes were discovered for three of the five physical fitness variables for the boys who participated in the soccer SSG programme. There were significant improvements in muscle endurance-push-ups (0.000); aerobic endurance (0.000) and power (0.000). No significant changes were discovered either for speed (0.853) or for muscle endurance sit-ups (0.115). Although speed did improve significantly from pre- to post-test (0.000), speed scores returned close to pre-test values on the retention test.

Table 12: Changes in Boys' Physical Fitness within each Group

	Pre –Test		Post - Test		Retention Test		Pre-Post	Pre- to Retention
	Mean	SD	Mean	SD	Mean	SD	p value	p value
Boys – Speed (sprint 20m in sec)								
Soccer	4.30	0.36	3.65	0.50	4.32	0.36	0.000*	0.853
Multi-sport	4.46	0.55	3.99	0.43	4.37	0.65	0.000*	0.417
Boys – Muscle Endurance (bent-knee push-ups in 30 sec)								
Soccer	14.2	3.3	17.6	3.0	16.5	3.4	0.000*	0.000*
Multi-sport	17.7	3.7	23.1	5.9	22.1	5.0	0.000*	0.000*
Boys – Muscle Endurance (bent-leg sit-ups in 30 sec)								
Soccer	21.4	6.1	22.5	5.5	22.5	6.1	0.115	0.115
Multi-sport	19.8	5.8	21.9	6.2	22.3	6.0	0.004*	0.000*
Boys – Power (standing long jump in cm)								
Soccer	132.7	17.8	137.9	17.7	138.2	18.3	0.000*	0.000*
Multi-sport	135.2	16.2	140.7	13.5	139.8	15.5	0.000*	0.001*
Boys – Aerobic endurance (6-minute run in m)								
Soccer	678.0	128.2	1026.6	119.1	863.1	112.5	0.000*	0.000*
Multi-sport	785.9	152.5	1057.2	115.1	988.5	127.5	0.000*	0.000*

*Significant change $p < 0.05$

Boys' Gr 2 Multi-sport

For the boys who participated in the multi-sport SSG programme, significant changes were achieved for four of the five physical fitness variables. Significant improvements in pre-test to retention test scores were achieved for muscle endurance-push-ups (0.000); muscle endurance-sit-ups (0.000), power (0.000) and aerobic endurance (0.000). No significant changes were noted for speed (0.417), however, the same pattern was evident as for the boys in the soccer group: A significant improvement (0.000) from pre- to post-test speed over 20m was achieved, then a return to scores similar to the pre-test on the retention test.

Interaction Effects for Boys' Physical Fitness

The data were processed to determine if there were any interactions between the soccer SSG programme, the multi-sport SSG programme and each of the physical fitness variables (Table 13). The only significant interaction was determined for muscle endurance-push-ups (0.031). This means that no interpretation can be made for the boys in terms of changes in this variable. A visual presentation of this interaction is provided in Figure 11.

Table 13: Interaction Effects for Boys' Physical Fitness Variables

Dependent Variable	Interaction
Speed	0.146
Muscle Endurance: Push-ups	0.031*
Muscle Endurance: Sit-ups	0.371
Power	0.835
Aerobic Endurance	0.066

*Significant interaction $p < 0.05$

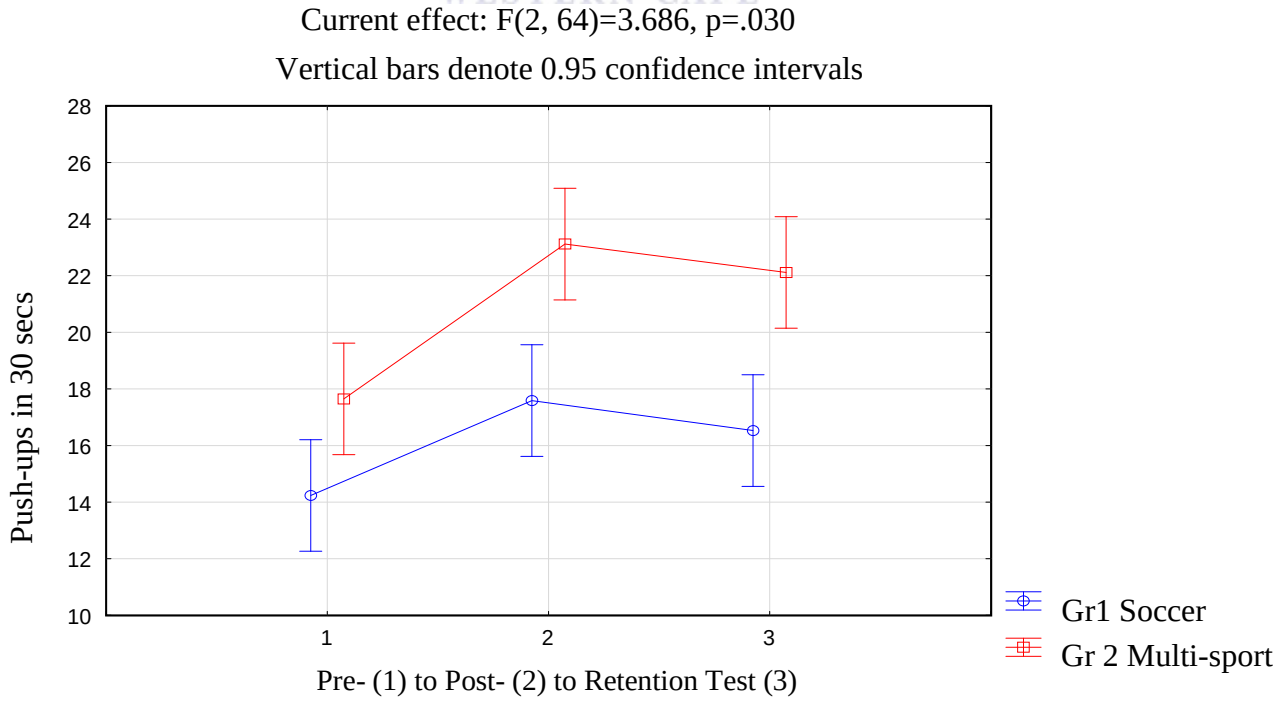

Figure 11: Interaction Effects for Boys' Muscle Endurance (push-ups in 30 secs)

Between Group Differences for Boys' Physical Fitness

The results of the between group comparisons are presented in Table 14.

Table 14: Between Group Differences for Boys' Physical Fitness

Dependent Variable	Pre-test	Post-test	Retention Test
Speed	0.357	0.045*	0.765
Muscle Endurance: Sit-ups	0.456	0.796	0.931
Power	0.657	0.653	0.780
Aerobic Endurance	0.015*	0.482	0.005*

*Significant difference $p < 0.05$

There was a significant difference between groups on the post-test of speed, where the boys in the soccer group reduced their mean 20m sprint time by .65s from their pre-test while the boys in the multi-sport group reduced their meant time by only .47s (refer to values reported on Table 12). However, there was no significant difference between groups on the retention test.

There were also significant differences between boys' groups on both the pre-test and the retention test for aerobic endurance. The boys in the multi-sport groups ran 785.9m on the pre-test while the boys in the soccer group completed a mean distance of only 678.0m (refer to values reported on Table 12). Although this distance gap was reduced on the post-test, it was reaffirmed on the retention test when the boys in the multi-sport group completed a mean distance of 988.5m, significantly greater than the 963.1m recorded as the mean distance of the boys in the soccer group.

Within Group Changes for Girls' Physical Fitness

The changes from pre-test to post-test and pre-test to retention test for each group of girls on the selected physical fitness variables are presented in Table 15.

Table 15: Changes in Girls' Physical Fitness within each Group

	Pre –Test		Post - Test		Retention Test		Pre- to Post	Pre- to Retention
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**p value**	**p value**
Girls – Speed(sprint 20m in sec)								
Soccer	4.64	0.49	4.13	0.37	4.42	0.35	0.000*	0.014*
Multi-sport	4.56	0.51	4.04	0.22	4.44	0.35	0.000*	0.150
Girls – Muscle Endurance (bent-knee push-ups in 30 sec)								
Soccer	15.2	4.6	17.7	5.3	16.9	5.3	0.001*	0.023*
Multi-sport	12.6	3.6	18.3	3.4	15.2	3.1	0.000*	0.000*
Girls – Muscle Endurance (bent-leg sit-ups in 30 sec)								
Soccer	14.6	5.5	17.9	4.9	16.4	5.2	0.000*	0.006*
Multi-sport	12.8	4.7	16.6	5.6	15.9	5.7	0.000*	0.000*
Girls – Power (standing long jump in cm)								
Soccer	112.8	23.3	125.9	23.4	126.7	23.0	0.000*	0.000*
Multi-sport	120.1	13.4	125.6	13.4	124.7	14.5	0.003*	0.012*
Girls – Aerobic endurance (6-minute run in m)								
Soccer	685.7	117.4	895.7	124.5	829.2	130.3	0.000*	0.000*
Multi-sport	723.8	127.8	919.9	129.1	866.5	147.6	0.000*	0.000*

*Significant change $p < 0.05$

Girls' Gr 1 Soccer

There were significant changes for all five of the physical fitness variables for the girls who participated in the soccer SSG programme. There were significant improvements in speed (0.014); muscle endurance-push-ups (0.023); muscle endurance-sit-ups (0.006); power (0.000) and aerobic endurance (0.000).

Girls' Gr 2 Multi-sport

Significant improvements were recorded for the girls who participated in the multi-sport SSG programme for four of the five physical fitness variables: Muscle endurance-push-ups (0.000); sit-ups (0.000); power (0.012); and aerobic endurance (0.000). No significant change was documented for speed (0.150).

Interaction Effects for Girls' Physical Fitness

The data were processed to determine if there were any interactions between the soccer SSG programme, the multi-sport SSG programme and each of the physical fitness variables (Table 16).

Table 16: Interaction Effects for Girls' Physical Fitness Variables

Dependent Variable	Interaction
Speed	0.572
Muscle Endurance: Push-ups	0.006*
Muscle Endurance: Sit-ups	0.444
Power	0.001*
Aerobic Endurance	0.846

*Significant interaction p <0 .05

Significant interactions were determined for muscle endurance-push-ups (0.006) and power (0.001). This means that no interpretation can be made for the girls in terms of changes in either of these variables. A visual presentation of these interactions is provided in Figure 12 and Figure 13.

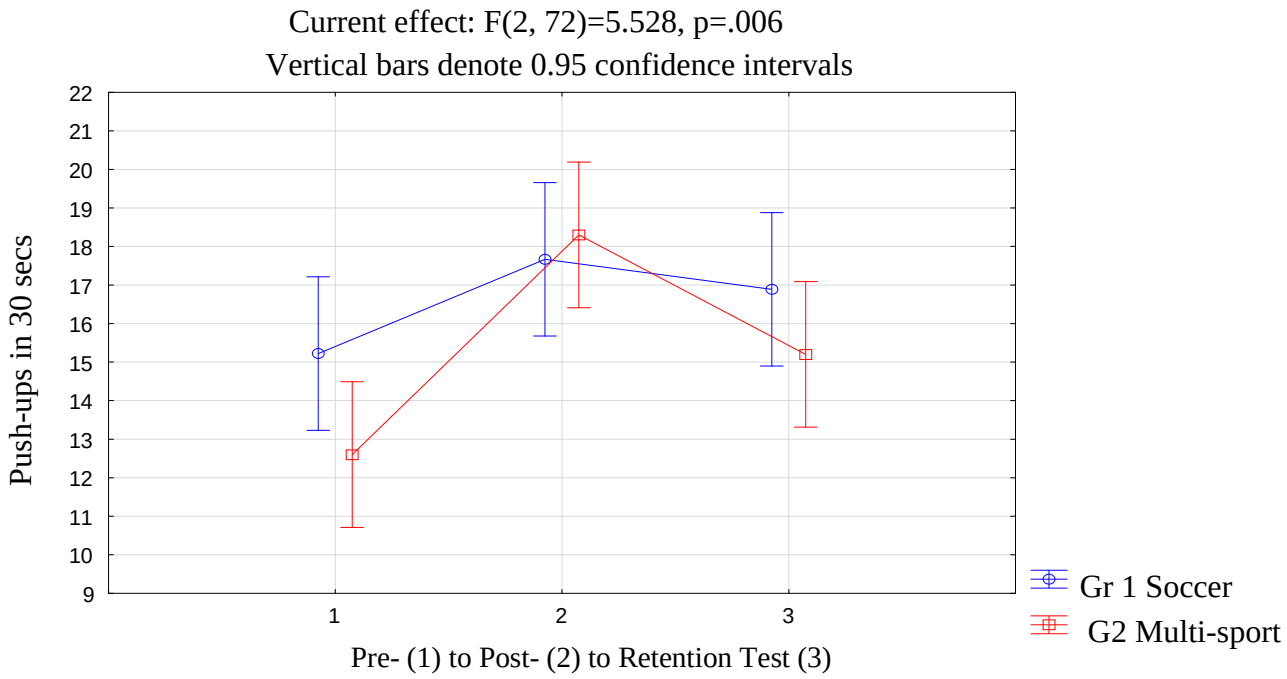

Figure 12: Interaction Effects for Girls' Muscle Endurance (push-ups in 30 secs)

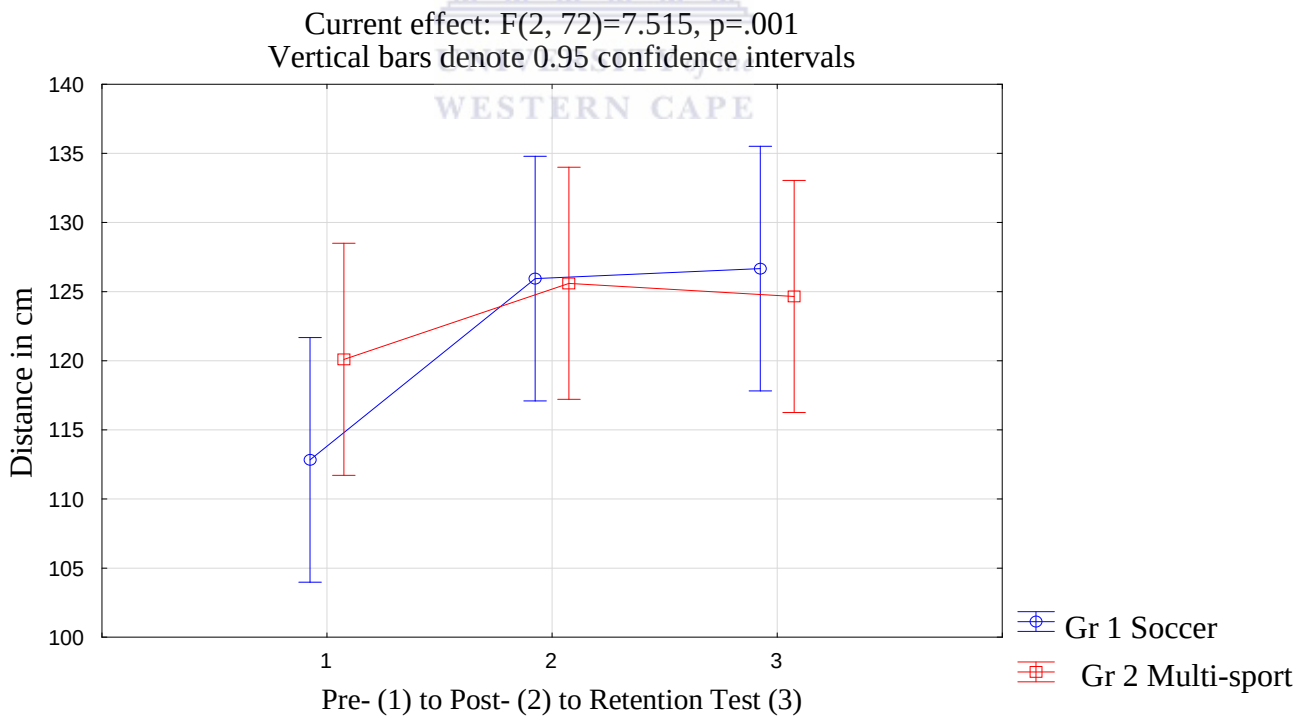

Figure 13: Interaction Effects for Girls' Power (standing long jump cm)

Between Group Differences for Girls' Physical Fitness

There were no significant differences between girls' groups on any of the tests of physical fitness variables (Table 17) as measured during any of the test periods.

Table 17: Between Group Differences for Girls' Physical Fitness

Dependent Variable	Pre-test	Post-test	Retention Test
Speed	0.562	0.455	0.845
Muscle Endurance: Sit-ups	0.309	0.435	0.729
Aerobic Endurance	0.369	0.567	0.381

*Significant difference $p < 0.05$

Response to Hypothesis One (Physical Fitness)

The hypothesis is partially supported (Table 18).

Table 18: Summary of Significant Changes in Children's Physical Fitness

	Speed	Muscle Endurance (push-ups)	Muscle Endurance (sit-ups)	Power	Aerobic Endurance
Boys					
Soccer	No	-	No	Yes	Yes
Multi-Sport	No	-	Yes	Yes	Yes
Girls					
Soccer	Yes	-	Yes	-	Yes
Multi-sport	No	-	Yes	-	Yes

- In both groups of boys and both groups of girls, significant improvements in aerobic endurance were achieved whether they participated in the soccer SSG programme or the multi-sport SSG programme. The boys' Gr 2 multi-sport actually scored significantly higher than Gr 2 soccer, which means their aerobic endurance

was significantly better prior to the intervention programme. Gr 2 multi-sport boys also scored significantly better than Gr 1 soccer on the retention test of their aerobic endurance. In other words, the groups were significantly different from each other in terms of aerobic endurance both prior to and after the intervention programme. Both groups, however, did improve their aerobic significantly.

- Both the soccer and the multi-sport groups of boys' demonstrated significant improvements in their power.
- No significant changes for speed were achieved by either group of boys.
- Girls achieved significant improvements for their muscle endurance-sit ups, regardless of the kind of SSG programme on girls' muscle endurance (sit-ups)
- Differences were noted, however, for muscle endurance (sit-ups) between the boys' group. Boys in the multi-sport SSG improved while those in the soccer group did not.
- Differences were also noted for speed between the girls' groups. Girls the soccer SSG improved and those in the multi-sport group did not.

Hypothesis Two

There will be no differences in selected gross motor coordination outcomes for children who participated in the soccer SSG programme and children in the multi-sport SSG programme.

Within Group Changes for Boys' Gross Motor Coordination

The changes from pre-test to post-test and pre-test to retention test for each group of boys on the selected motor coordination variables are presented in Table 19:

Table 19: Changes in Boys' Gross Motor Coordination within each Group

	Pre –Test		Post - Test		Retention Test		Pre- to Post	Pre- to Retention
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**p value**	**p value**
Boys – Balance Beam Walk (number of steps before stepping off beam)								
Soccer	16.7	4.0	21.1	2.4	20.9	2.9	0.000*	0.000*
Multi-sport	20.1	3.3	22.1	2.0	22.3	2.0	0.000*	0.000*
Boys – Side Jump (number of jumps in 15 secs)								
Soccer	37.4	6.4	39.4	6.5	39.1	6.2	0.001*	0.003*
Multi-sport	38.2	6.2	40.8	5.6	40.2	6.5	0.000*	0.001*

*Significant interaction $p < 0.05$

Boys' Gr 1 Soccer

Significant differences were registered for both tests of gross motor coordination for the boys who participated in the soccer SSG programme. Significant improvements were achieved both for walking on a beam (0.000) and for jumping sideways (0.000).

Boys' Gr 2 Multi-sport

Significant differences were discovered for both tests of gross motor coordination for the boys who participated in the multi-sport SSG programme. Significant improvements were recorded both for walking on a beam (0.000) and for jumping sideways (0.000)

Interaction Effects for Boys' Gross Motor Coordination

The data were processed to determine if there were any interactions between the soccer SSG programme, the multi-sport SSG programme and each of the gross motor coordination variables (Table 20).

Table 20: Interaction Effects for Boys' Gross Motor Coordination Variables

Dependent Variable	Interaction
Balance Beam Walk	0.000*
Side Jump	0.801

*Significant interaction $p < 0.05$

A significant interaction was noted for the balance beam walk, which means that no interpretation of these results can be made. A visual presentation of this interaction is provided in Figure 14.

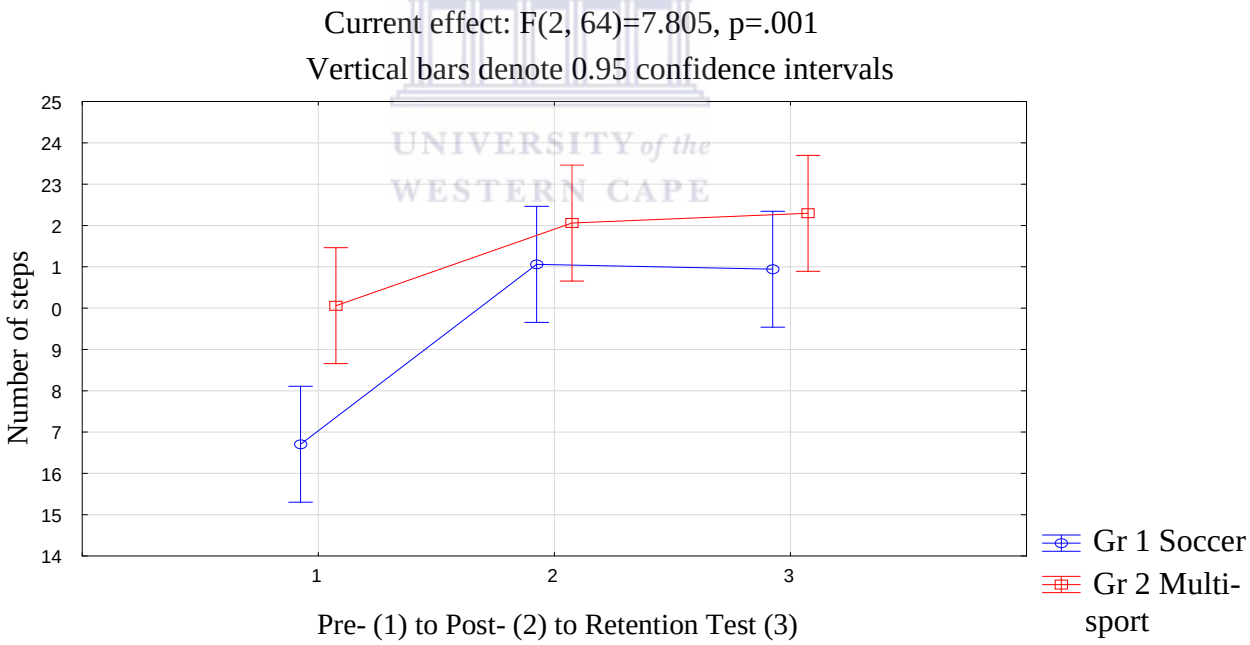

Figure 14: Interaction Effects for Boys' Balance Beam Walk

Between Group Differences for Boys' Gross Motor Coordination

There was no significant difference between boys' groups in terms of their gross motor coordination (Table 21) as measured during any of the test periods.

Table 21: Between Group Differences for Boys' Gross Motor Coordination

Dependent Variable	Pre-test	Post-test	Retention Test
Side Jump	0.701	0.529	0.603

*Significant difference $p < 0.05$

Within Group Changes for Girls Gross Motor Coordination

The changes from pre-test to post-test and pre-test to retention test for each group of girls on the selected motor coordination variables are presented in Table 22.

Table 22: Changes in Girls' Gross Motor Coordination within each Group

	Pre –Test		Post - Test		Retention Test		Pre- to Post	Pre- to Retention
	Mean	SD	Mean	SD	Mean	SD	p value	p value
Girls – Balance Beam Walk (number of steps before stepping off beam)								
Soccer	18.78	3.72	21.56	2.68	22.17	2.18	0.000*	0.000*
Multi-sport	19.55	3.12	21.20	2.71	21.80	2.40	0.002*	0.000*
Girls – Side Jump (number of jumps in 15 secs)								
Soccer	38.22	4.67	40.94	6.41	39.89	6.13	0.001*	0.032*
Multi-sport	39.05	4.78	43.10	4.59	42.05	5.00	0.000*	0.000*

*Significant change $p < 0.05$

Girls' Gr 1 Soccer

Significant differences were noted for both tests of gross motor coordination for the girls who participated in the soccer SSG programme. Significant improvements were recorded for walking on a beam (0.000) and for jumping sideways (0.032)

Girls' Gr 2 Multi-sport

The girls in the Multi-sport SSG programme also achieved significant improvements for walking on a beam (0.000) and for jumping sideways (0.000).

Interaction Effects for Girls' Gross Motor Coordination

The data was processed to determine if there was any interaction between the soccer SSG programme, the multi-sport SSG programme and each of the gross motor coordination variables (Table 23). No interaction effects were evident.

Table 23: Interaction Effects for Girls' Gross Motor Coordination Variables

Dependent Variable	Interaction
Balance Beam Walk	0.215
Side Jump	0.350

*Significant interaction p <0 .05

Between Group Differences for Girls' Gross Motor Coordination

There were no significant differences between girls' groups in terms of their gross motor coordination (Table 24) as measured during any of the test periods.

Table 24: Between Group Differences for Girls' Gross Motor Coordination

Dependent Variable	Pre-test	Post-test	Retention Test
Balance Beam Walk	0.405	0.701	0.692
Side Jump	0.631	0.213	0.212

*Significant difference $p < 0.05$

Response to Hypothesis Two (Gross Motor Coordination)

The hypothesis is supported (Table 25). There were no differences between the effects of participation in either kind of SSG programme on children's gross motor coordination. In both groups, significant improvement was achieved for the side jump and for the girls' significant improvement also was achieved for the balance beam walk (interaction effect precluded interpretation of the balance beam walk for the boys).

Table 25: Summary of Significant Changes in Children's Gross Motor Coordination

	Balance Beam Walk	Side Jump
Boys		
Soccer	-	Yes
Multi-Sport	-	Yes
Girls		
Soccer	Yes	Yes
Multi-sport	Yes	Yes

Hypothesis Three

There will be no differences in selected soccer skill outcomes for children who participated in the soccer SSG programme and children in the multi-sport SSG programme.

Within Group Changes for Boys' Soccer Skills

The changes from pre-test to post-test and pre-test to retention test for each group of boys on the skill variables of shooting and dribbling are presented in Table 26.

Table 26: Changes in Boys' Soccer Skills within each Group

	Pre –Test		Post - Test		Retention Test		Pre- to Post	Pre- to Retention
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**p value**	**p value**
Boys – Shooting at goal (points scored from 5 attempts)								
Soccer	8.8	2.6	13.3	2.3	11.1	2.7	0.000*	0.000*
Multi-sport	8.7	2.4	12.7	1.6	11.2	2.1	0.000*	0.000*
Boys – Dribbling (completion of course in sec)								
Soccer	30.50	8.18	18.59	2.57	20.70	2.81	0.000*	0.000*
Multi-sport	30.55	4.24	21.56	3.63	22.68	3.83	0.000*	0.000*

*Significant change $p < 0.05$

Boys' Gr 1 Soccer

Significant improvements were achieved both for shooting at goal (0.000) and for dribbling (0.000) by the boys who participated in the soccer SSG programme.

Boys' Gr 2 Multi-sport

The boys who participated in the Multi-sport SSG programme also achieved significant improvements both for shooting at goal (0.000) and for dribbling (0.000).

Interaction Effects for Boys' Soccer Skills

The data were processed to determine if there were any interactions between the soccer SSG programme, the multi-sport SSG programme and each of the soccer skill variables (Table 27). No interaction effects were determined.

Table 27: Interaction Effects for Boys' Soccer Skill Variables

Dependent Variable	Interaction
Shooting at Goal	0.527
Dribbling	0.338

*Significant interaction $p < 0.05$

Between Group Differences for Boys' Soccer Skills

There were no significant differences between boys' groups in terms of their soccer skills (Table 28) as measured during any of the test periods.

Table 28: Between Group Differences for Boys' Soccer Skills

Dependent Variable	Pre-test	Post-test	Retention Test
Shooting at Goal	0.766	0.414	0.881
Dribbling	0.806	0.064	0.213

*Significant difference $p < 0.05$

Within Group Changes for Girls' Soccer Skills

The changes from pre-test to post-test and pre-test to retention test for each group of girls on the skill variables of soccer shooting and soccer dribbling are presented in Table 29.

Table 29: Changes in Girls' Soccer Skills within each Group

	Pre –Test		Post - Test		Retention Test		Pre- to Post	Pre- to Retention
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**p value**	**p value**
Girls – Shooting at goal (points scored from 5 attempts)								
Soccer	9.0	2.4	11.6	2.2	10.5	2.6	0.000*	0.017*
Multi-sport	8.3	2.4	11.7	2.8	10.9	2.5	0.000*	0.000*
Girls – Dribbling(completion of course in sec)								
Soccer	48.21	9.45	29.18	4.69	31.38	5.63	0.000*	0.000*
Multi-sport	48.08	9.50	29.43	4.79	33.08	6.36	0.000*	0.000*

*Significant change $p < 0.05$

Girls' Gr 1 Soccer

Significant improvements were recorded for both tests of soccer skill development for the girls who participated in the soccer SSG programme: Shooting at goal (0.000) and dribbling (0.000).

Girls' Gr 2 Multi-sport

The soccer skills tests for the girls who participated in the multi-sport SSG programme also revealed significant improvements both for shooting at goal (0.000) and dribbling (0.000).

Interaction Effects for Girls' Soccer Skills

The data were processed to determine if there were any interactions between the soccer SSG programme, the multi-sport SSG programme and each of the soccer skill variables (Table 30). No interaction effects were determined.

Table 30: Interaction Effects for Girls' Soccer Skill Variables

Dependent Variable	Interaction
Shooting at Goal	0.437
Dribbling	0.708

*Significant interaction $p < .05$

Between Group Differences for Girls' Soccer Skills

There were no significant differences between girls' groups in terms of their soccer skills (Table 31) as measured during any of the test periods.

Table 31: Between Group Differences for Girls' Soccer Skills

Dependent Variable	Pre-test	Post-test	Retention Test
Shooting at Goal	0.391	0.907	0.667
Dribbling	0.954	0.912	0.460

*Significant difference $p < 0.05$

Response to Hypothesis Three (Soccer Skills)

The hypothesis is supported (Table 32). There were no differences between the effects of participation in either kind of SSG programme on children's soccer skill

development. In both groups and for both boys and girls, significant improvements were achieved for shooting at goal and for dribbling a soccer ball.

Table 32: Summary of Significant Changes in Children's Soccer Skills

	Shooting at Goal	Dribbling
Boys		
Soccer	Yes	Yes
Multi-Sport	Yes	Yes
Girls		
Soccer	Yes	Yes
Multi-sport	Yes	Yes

Hypothesis Four

There will be no differences demonstrated in the application of selected tactics in soccer SSG for children who participated in the soccer SSG programme and children in the multi-sport SSG programme.

Games Analysis for Boys

The results of the analysis of the pre- to post-test application of tactics of both groups of boys' game play during the soccer SSG pre- and post-test video recordings are presented in Table 33 and illustrated in Figure 15.

Table 33: Results of the Games Analysis for the Boys

Boys	***Offence***			***Defence***		
Gr 1 Soccer	Pre	Post	Difference	Pre	Post	Difference
Mean Score	2.7	2.9	0.2	2.3	2.6	0.3
Highest Boy	4.0	3.0	-1.0	3.0	3.0	0.0
Lowest Boy	2.0	2.0	0.0	2.0	2.0	0.0
SD	0.7	0.4		0.5	0.5	
Gr 2 Multi-sport						
Mean Score	2.4	2.4	0.0	2.0	2.9	0.9
Highest Boy	3.0	4.0	1.0	2.0	4.0	2.0
Lowest Boy	2.0	2.0	0.0	2.0	2.0	0.0
SD	0.5	0.7		0.0	0.6	.

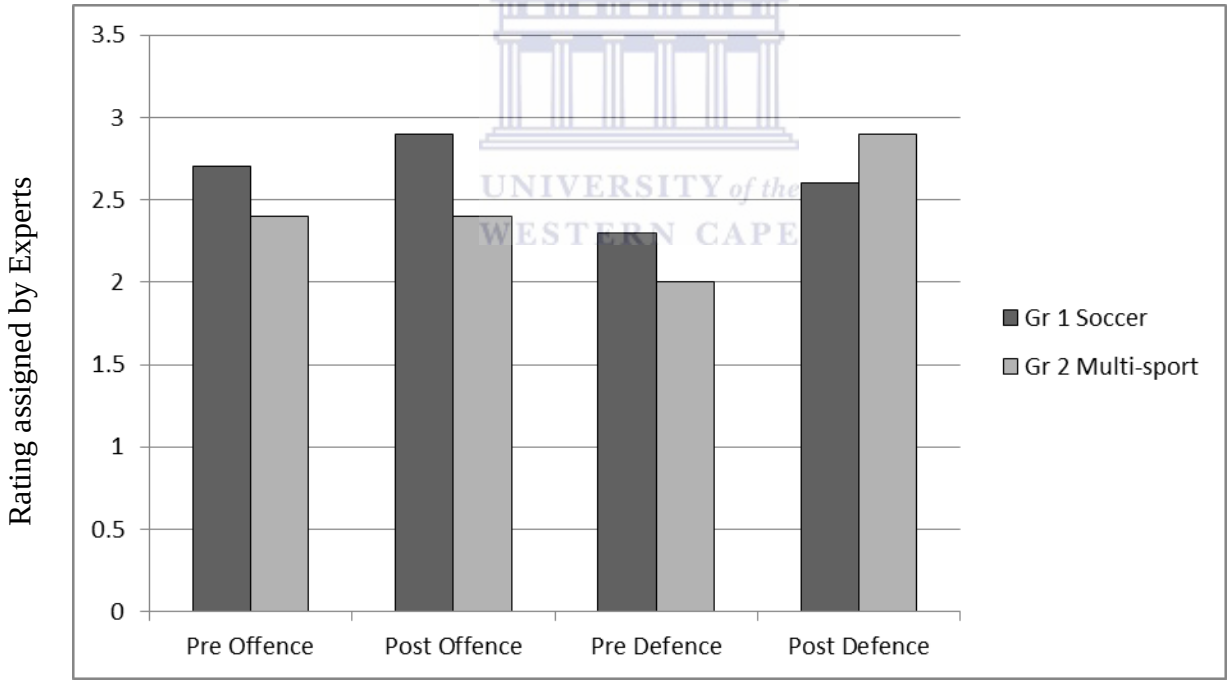

Figure 15: Pre- to Post-test Comparisons for Boys' Application of Offensive and Defensive Tactics

Boys' Gr 1 Soccer

Minimal positive changes were evident in the application of tactics for both offensive and defensive play for the boys who participated in the soccer SSG programme.

- Offensive play improved slightly from a pre-test rating of 2.7 to a post-test rating of 2.9. It can be noted that there was more variability on boys' ratings on the pre-test (SD 0.7) than the post-test (SD 0.4).

- Defensive play improved slightly from a pre-test rating of 2.3 to a post-test rating of 2.6. The variability was the same on the pre-test (0.5) and post-test (0.5).

Boys' Group 2 Multi-sport

Although no differences were noted in the application of offensive tactics between pre- and post-tests for the boys in the multi-sport SSG programme, there was an improvement in their application of defensive tactics.

- The rating of offensive play was 2.4 on both the pre- and the post-tests. Variability increased slightly from SD 0.5 to SD 0.7 on the pre- and post-tests respectively.

- A positive change was evident in the application of defensive tactics from the pre-test (2.0) to the post-test (2.9). This positive changes and the increase in variability from SD 0.0 to SD 0.6 is attributed to the improvement of a few players (note the highest rated player on the pre-test received a score of 2 and on the post-test a score of 4).

Games Analysis for Girls

The results of the analysis of the pre- to post-test application of tactics of both groups of Girls' game play during the soccer SSG pre- and post-test video recordings are presented in Table 34 and illustrated in Figure 16.

Table 34: Results of the Games Analysis for the Girls

Girls	***Offence***			***Defence***		
Gr 1 Soccer	Pre	Post	Difference	Pre	Post	Difference
Mean Score	2.5	2.1	-0.4	1.9	2.3	0.4
Highest Girl	3.0	3.0	0.0	3.0	3.0	0.0
Lowest Girl	2.0	2.0	0.0	1.0	2.0	1.0
SD	0.5	0.4		0.6	0.5	
Gr 2 Multi-sport						
Mean Score	2.3	2.4	0.1	1.9	2.1	0.2
Highest Girl	3.0	4.0	1.0	3.0	3.0	0.0
Lowest Girl	2.0	2.0	0.0	1.0	2.0	1.0
SD	0.5	0.7		0.6	0.4	

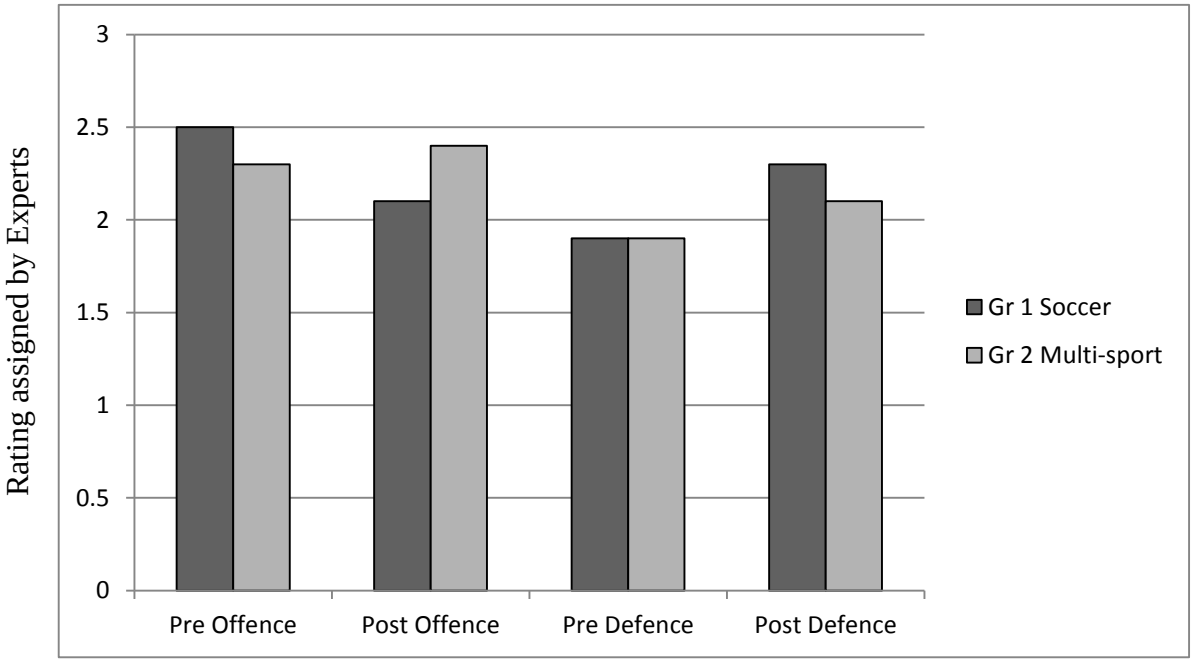

Figure 16: Pre- to Post-test Comparisons for Girls' Application of Offensive and Defensive Tactics

Girls' Gr 1 Soccer

Minimal differences were demonstrated in the application of offensive and defensive tactics for the girls who participated in the soccer SSG programme.

- Offensive play deteriorated from a pre-test rating of 2.5 to a post-test rating of 2.1. It can be noted that there was similar variability on the pre-test (SD 0.5) and the post- test (SD 0.4).
- Defensive play improved from a pre-test rating of 1.9 to a mean post-test rating of 2.3. It can be noted that there was similar variability on the pre-test (SD 0.6) and post-test (SD 0.5).

Girls' Gr 2 Multi-sport

Differences were noted in the application of both offensive and defensive tactics for the girls who participated in the multi-sport SSG programme.

- The application of offensive tactics improved from a pre-test rating of 2.3 to a post-test rating of 2.9. Variability increased slightly from pre-test (SD 0.5) to post-test (SD 0.7).
- The application of defensive tactics improved from a pre-test rating of 1.9 to a post-test rating of 2.1. There was slightly more variability on the pre-test (SD 0.6) than on the post-test (SD 0.4).

Response to Hypothesis Four (Application of Tactics)

The hypothesis is partially supported (Table 35).

Table 35: Summary of Significant Changes in Children's Application of Tactics

	Offensive Tactics	Defensive Tactics
Boys		
Soccer	Slight improvement	Slight improvement
Multi-sport	No change	Improvement
Girls		
Soccer	Slight deterioration	Slight improvement
Multi-sport	Slight improvement	Slight improvement

- A mixed pattern of changes were evident for the application of offensive tactics. For those children who participated in the soccer SSG programme, the boys improved slightly but the girls deteriorated slightly. For those children who participate in the multi-sport SSG programme, the boys showed no change and the girls improved slightly.
- All of the children improved in their application of defensive tactics which supports the hypothesis that there will be no difference in the effects of the type of SSG programme in which children participate, on their application of tactics in a soccer SSG.

Summary

This study was focused on determining if there would be differences in the physical fitness, gross motor coordination, soccer skills and application of tactics in a soccer SSG, between children who participated in a soccer SSG programme and those who participated in a multi-sport SSG programme. The results are intended to contribute to the debate about the relative benefits of sport specialization versus sport diversification for children in the early phases of their sport development. There do not appear to be substantial differences in the effects of the two different games-centred approaches on any of the variables selected for assessment in this study.

In Terms of Physical Fitness

1. All groups of boys and girls improved significantly in terms of their aerobic endurance, although the boys in Gr 2 multi-sport had significantly higher scores on both the pre- and retention tests than the boys in Gr 2 soccer.

2. There were no differences for the boys for power (both groups improved) or speed (both groups stayed the same).
3. There were no differences for the girls for muscle endurance (sit-ups) (both groups stayed the same).
4. Differences were noted for boys' muscle endurance (sit-ups). The soccer SSG group did not improve significantly, but the mulit-sport SSG group did.
5. In terms of boys' speed, no significant difference was found when pre-test to retention test scores were compared. However, both groups ran significantly faster on their post-test, returning to near pre-test values on the retention test. In fact, Gr 1 soccer SSG boys improved significantly more that the Gr 2 multi-sport boys on the post-test.
6. Differences were noted for girls' speed. The soccer SSG group improved significantly, but the multi-sport SSG group did not.

Results for boys' and girls' muscle endurance and girls' power could not be interpreted because an interaction effect was determined.

In Terms of Gross Motor Coordination

1. All groups of boys and girls improved significantly on their side jump.
2. Both groups of girls improved significantly on their balance.

Results for the boys' balance beam walk could not be interpreted because an interaction effect was determined.

In Terms of Soccer Skills

1. All of the boys' and girls' groups improved significantly on their shooting at goal soccer skills test.
2. All of the boys' and girls' groups also improved significantly on their soccer dribbling skills.

In Terms of the Application of Tactics

1. All groups of boys and girls improved. No differences were evident between groups on their application of defensive tactics
2. A small difference was noted for boys on their application of offensive tactics. Boys in the soccer SSG programme improved slightly while boys in the multi-sport SSG remained the same.
3. A difference was also noted for girls on their application of offensive tactics. Girls in the soccer SSG programme actually deteriorated slightly while girls in the multi-sport SSG improved slightly.

Chapter Five

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

This chapter is divided into three sections. The first section presents a discussion of the results that were reported in the previous chapter. The second section presents the researcher's conclusions about how the findings from this research can make a contribution to an understanding of the specialization versus diversification debate within the South African context. The third section makes some specific recommendations both for professional applications and for future research.

Discussion

This study compared the effects of grade four children's participation in a soccer small-sided games (SSG) programme (representing sport specialization) versus a multi-sport SSG programme (representing sport diversification) on selected physical fitness and gross motor coordination variables, as well as on their performance of selected soccer skills and the application of tactics in a soccer SSG.

Physical Fitness

- Hypothesis One stated: There will be no differences in selected physical fitness outcomes between children who participated in the soccer SSG programme and children in the multi-sport SSG programme. The boys' Gr 2 multi-sport actually scored significantly higher than Gr 2 soccer on the pre-test, which means their aerobic endurance was significantly better prior to the intervention programme. Gr 2 multi-sport boys also scored significantly better than Gr 1 soccer on the

retention test of their aerobic endurance which was expected because they were significantly better to start with.

No substantial differences were found between groups in terms of physical fitness outcomes, regardless of gender or type of intervention programme. Both groups achieved improvements for most of the selected variables. This is consistent with past research that has documented the positive effects of participation in SSGs on physical fitness (Krustrup, Dvorak, Junge & Bangsbo, 2010).

Both the boys and girls who participated in the soccer SSG and the multi-sport SSG programme showed significant improvements in their aerobic endurance. These results are consistent with previous research. Brandes *et al.* (2012) found that 3v3 and 4v4 SSGs formats were both effective specifically for developing soccer-specific aerobic endurance. Earlier research by Hill-Haas *et al.* (2008) also showed that SSG formats of 2v2 and 4v4 provide effective aerobic training. Harrison *et al.* (2014) compared a generic invasion SSG with a soccer SSG and showed a significant improvement in aerobic endurance for both groups, however, their study included only male participants aged 13 – 19 years.

In their summary of games-centered approaches, Harvey and Jarrett (2013) noted that most physical-fitness related research on SSGs had looked at the effects of participation on aerobic endurance rather than variables such as speed, muscle endurance and power. For example, within this study, both groups of boys and both groups of girls showed a significant pre- to post-test improvement in their 20m sprint speed. However, they all recorded much slower times on their retention test only two weeks later. Only the girls from the soccer SSG programme managed to retain their significant improvement from pre- to retention test.

The all-out effort required from this speed test may be the key to interpreting these results. The children who participated in this study have no background in formal sport coaching, physical education or fitness testing. The pre-test may have been just an interesting new "thing for them to do" despite the efforts by the researcher to motivate them to run their fastest. The post-test followed six weeks of participation in a structured programme which the children seemed to enjoy both their game play and the presence of the researcher, a possible role model for them. They may have been highly motivated on the post-test and applied themselves to running their fastest. In fact, the boys in Gr 1 soccer performed significantly faster than the boys in Gr 2 multi-sport on the post-test. However, both groups returned to near pre-test values on the retention test. The two week gap to the retention test was one of non-participation in games and the absence of the researcher from the school. It is possible that they may have lost some of their interest and performed less than their best on the retention test. There is no hard evidence to support this speculation, but it is accepted that the physical performance testing of children is very challenging because of the variability in motivation, effort and enjoyment children may bring to the testing situation (Wiersma & Sherman, 2014)

Muscle endurance (sit-ups) improved significantly in the boys in the multi-sport SSG programme, yet muscle endurance did not improve significantly in the boys in the soccer SSG programme. Fransen *et al.* (2012) found that boys who participated in multiple sports outperformed the boys who participated in a single sport. No research could be found on girls and SSG participation.

Both groups of boys' in this study achieved significant improvements in their power as reflected by their scores on the standing long jump test. This is in contrast to the Fransen *et al.* (2012) research where the boys who participated in multiple sports

performed better on the standing long jump test than the boys who participated in a single sport.

It does appear that there were overall gains in physical fitness for most of the children who participated in this study, although the gains for aerobic fitness are the most commonly supported in the literature as outcomes for games programmes (Wiersma & Sherman, 2014).

Gross Motor Coordination

Hypothesis Two stated that there will be no differences in selected gross motor coordination outcomes between children who participated in the soccer SSG programme and children in the multi-sport SSG programme.

The only research found that looked at participating in multiple sports versus a single sport in terms of gross motor coordination was that of Fransen *et al.* (2012). They found that boys 8-10 who participated in the multi-sport programme scored significantly higher on gross coordination tests than boys in a soccer-specific programme. The outcomes of this study were somewhat different in that the boys from both SSG programmes improved significantly on the two tests of gross motor coordination. It must be noted that the Fransen *et al.* (2012) study did not focus on SSG participation only, but rather involved boys participating in a variety of sport types compared to boys participating specifically in soccer. Krustrup *et al.* (2010) did mention that soccer SSGs had the potential to enhance gross motor coordination, but provided no specific evidence to support this statement.

Soccer Skills

Hypothesis Three stated that there will be no differences in selected soccer skill outcomes between children who participated in the soccer SSG programme and children in the multi-sport SSG programme.

Both the boys and girls in the soccer specific and multi-sport SSG programmes experienced significant improvements in their soccer shooting at goal and their soccer dribbling. These results challenged the deliberate practice theory (Ericsson *et al.,* 1993) which states that sport-specific practice is needed to develop technical skills, even from a young age. The current study showed that participation in either a single sport or multiple sports led to improvements in soccer specific skills, providing support for the Côté and Fraser-Thomas (2007) deliberate play approach that supports the possibility of transfer of fundamental skills when diverse sport experiences from the same category are provided.

No formal soccer training had taken place before at the school that was the site of this study, which may have also played a role in the significant soccer skill improvements experienced by both groups. The children were "true beginners" in terms of structured play in any kind of invasion game. Games for Understanding approaches support participation in child-centred SSGs because of the premise that the learning of motor skills will be accelerated if children understand the game context in which the skills are needed, and that there will be initial transfer of both skill and tactical proficiency when multiple-games from the same category are the focus (Hopper, 2002).

Application of Tactics in the Soccer Small-sided Game

Hypothesis Four stated that there will be no differences demonstrated in the application of selected tactics in soccer SSG between children who participated in the soccer SSG programme and children in the multi-sport SSG programme.

Both groups of boys and girls improved in their application of defensive tactics, regardless of their participation in either the soccer or the multi-sport SSG programme. This supports the theory of deliberate play (Côté & Fraser-Thomas, 2007) as well as the GFU position that there will be transfer of tactical application among games from the same category (Hopper, 2002).

Results for improvement in offensive play were not as clear. The boys in the soccer SSG programme improved while the girls in the soccer SSG programme actually deteriorated. The boys in the multi-sport programme did not improve in their offensive play, while the girls in the multi-sport programme improved slightly. It might be that offensive play requires that children make more decisions rather than simply reacting to what is happening, which is a more defensive play concept. This would make improvements in offensive play more unpredictable and difficult to learn, thus the erratic results for the children who participated in the current study.

Conclusions

The conclusions drawn from this study that compared the effects of two versions of the GFU approach, *i.e.* specialization in a single sport SSG programme versus diversification in a multi-sport SSG programme must be put in the context of its limitations. Comments then may be made regarding the potential of SSGs as a format for

deliberate play and implicit learning, and the specialization versus diversification debate as it impacts youth sport for children in the early stages of development.

Limitations

Any research project with children, especially those conducted in real-world settings, can be affected by many variables that cannot be controlled. In the context of this study, for example, a child's participation may have been affected by a variety of environmental factors. This is not an unlikely possibility because of the high HIV infection rate in the disadvantaged community where the school was located, as well as the presence of gangsterism and the enduring problems of drug and alcohol abuse. Any of these factors may have created stressors that could have affected the involvement of some of the children. Other limitations included:

- The lack of a control group is problematic, although it was believed by the researcher to be justified in this particular applied research. It is a constraint, however, on the generalizability of the results that must be acknowledged.

- In terms of the children's motivation to improve during game play, not only did their teachers' presence seem to encourage them, but the researcher assuming responsibilities as coach for all sessions also seemed to be positively perceived. The researcher had a three-year history of involvement in sporting activities in the school, which hopefully made this programme a credible one in the eyes of the children.

- There were children participating in the programme who typically avoided competitive games and sports. They may have volunteered to participate in the programme just to be part of what was happening.

- The tests of physical fitness, gross motor coordination and soccer skills assessed only selected variables.

- Because the conclusions were drawn from comparisons of scores between two intact groups, care must be taken to set the interpretation of findings in the context of the particular primary school and community in which the study took place, rather than to generalise the findings to a broader population.

Recognition must also be given to the environmental challenges of studying the effects of participation of any kind of sport intervention programme implemented in a disadvantaged community. In this study, the following challenges may have influenced the results of this study that found no substantial differences in the effects of participation in either a specialized or a diversified SSG programme:

- The children do not have access to proper sport facilities. Within this study, the playing areas had to be cut out of the field with a lawn mower every week.
- The children have to participate in their school clothes and school shoes or bare feet. For some of the children, they may have "held back" while playing in order to save their school uniform from being soiled or damaged during game play.
- The school had no access to sporting equipment such as balls, cones, bibs, etc. which meant the intervention programmes provided a very special sport experience.
- The teachers at the school do not have any special training to teach games or sport, although they do release the children each day for a recess period. Although the research only presented one simple 4v4 game from each sport type, the children were not accustomed to structure of any kind for their play

period. It was noted that some of the children had trouble staying focused for any period of time on any specific task or activity. Some of the boys struggled with playing within the rules, while some of the girls had difficulty sustaining their involvement in the games. This may have been a result of their lack of background in structured play as well as other self-management issues.

- None of the children had any previous experience with formal sport coaching or participation in a formal soccer programme, although all of the boys had previously played soccer-like games with their friends.
- The fact that the children knew they were going to get to play twice a week during school hours with various pieces of sporting equipment made it exciting and motivating for them. They responded with great enthusiasm and all of the children reported enjoyment of their programme. Enjoyment is a powerful aspect of children's sport development and their improvement on most of the variables measured in this study could be attributed to this positive emotional response more than the content of the programmes.

A review of available literature prior to implementation of this study revealed a lack of research on children aged 8-12 years in relation to the effects of their participation in SSG programmes. A comprehensive search of the library database of research and professional publications was completed using key word searches such as sport specialization, sampling, sport diversification, deliberate practice, deliberate play, implicit learning, explicit learning and games for understanding. Some searches yielded resources that either described the development of expertise at the higher levels or described expert and novice differences. Very few studies were found that addressed the effects of programme participation on pre-pubescent children. Those few studies that were found dealt only with boys' participation.

From a theoretical perspective, current review articles written by Côté and Vierimaa (2014), Gulbin *et al*. (2013a) and Balyi *et al.* (2013) that related directly to the specialization versus diversification debate were examined to identify additional references.

Small-sided Games, Deliberate Play and Implicit Learning

Games for Understanding approaches rely on SSG formats to offer children the opportunity to become involved in sport in a progressive manner. SSGs give them a chance to be involved in a fun way. The skills and tactics needed for these games are simpler than for the adult version of the sport and the children take turns frequently, playing or rotating out for a substitution. There is an assumption with the GFU approaches that both skills and tactics will transfer among sports from the same category, *e.g.* invasion games/sports. In the 4v4 SSGs in this study, there are no set offensive or defensive positions. This format is specifically designed so that children will frequently change roles rather than gravitate toward either an offensive or defensive preference (Mitchell *et al*., 2006).

In this study, children from the multi-sport SSG programme improved their soccer skills and their defensive play in soccer. It is also encouraging that SSG participation had a positive impact on all the children's aerobic endurance.

Both the soccer and multi-sport SSG programmes implemented in this study relied only on deliberate play and implicit learning as methodology. The SSGs were modified games with simple rules that teachers without special training could manage to implement in the future. The researcher did not introduce any technical instruction (deliberate practice and explicit learning) into any of the intervention sessions. The purpose of this was to determine what effect a total absence of technical instruction might have on skill

development and the application of tactics. The reason for this decision was to simulate the type of SSG programmes that a classroom teacher with no special training in sport could deliver. The results of this study show that children can indeed engage in deliberate play, learning implicitly, and if they do so in the structure of a 4v4 modified game, can experience improvement in sport skills and the application of defensive tactics.

Specialization versus Diversification

This research attempted to implement two SSG programmes that differed only in content: one was a soccer only programme and the other was a multi-sport programme that included soccer, hockey and team handball. The results of this study were equivocal in terms of outcomes for physical fitness, gross motor coordination, soccer skills and application of tactics in a soccer SSG. This leads to the conclusion that youth in the early stages of sport development will benefit 'similarly' from participation in a structure but deliberate play based SSG programme. This conclusion would disappoint both the supporters of deliberate practice, who advocate specialization, and the advocates of deliberate play, who contend that multi-sport diversification is a more effective approach. It appears that specialization in an invasion game/sport such as soccer is not critical at this point in their development, provided they are exposed to similar experiences in other invasion games. The important thing for children, or at least children such as those from the previously disadvantaged community in this study, is that they have the opportunity for structured SSG play opportunities.

Concluding Thoughts about Specialization, Diversification and Deliberate Play

A recent article by Côté and Vierimaa (2014) provided a review of evidence in support of diversification as the preferred approach to children's development in sports

where peak performance is achieved after maturation. This would include all invasion games such as the four that were included in this study. They noted that research now indicates that diversification in children's sport not only promotes performance improvement at a rate similar to that of specialization, but that it also has a more positive impact on children's interest in continued participation and their personal development. Although this study did not include measurements of children's continued participation or personal development, the results did demonstrate that the diversification approach was similarly beneficial when compared to the specialization approach on selected physical, gross-motor coordination and application of tactics during 4v4 soccer.

Diversification also brings important sport policy considerations. By exposing children to a variety of sports, they will have choices when it is time to decide to specialize (if indeed they want to specialize), whereas if they specialize too early, one sport may be all they know and if they do not want to pursue it, they may drop out of sport entirely (Côté & Vierimaa, 2014)

Both versions of the GFU approach followed in this study employed deliberate play rather than deliberate practice. Deliberate play is increasingly regarded as a more over-all desirable approach to children's sport development because it encourages children's enjoyment and inclusion in the ways in which their play is structured (Côté & Vierimaa, 2014).

Recommendations

Two types of recommendations are made based on the insights gained from completing this study: Recommendations for professionals involved in youth sport development programmes and recommendations for future research on this topic.

For Professionals

The following recommendations are made in relation to youth sport development:

- Provide deliberate play experiences that support implicit learning in SSGs for children in order to develop their aerobic fitness as well as skills and tactics for sport.
- Recognise that structured deliberate practice that supports explicit learning in all probability is not necessary in order for children in their early stages of sport development to develop skills and tactics.
- Understand that early sport specialization in invasion games/sport may be overrated. A multi-sport diverse background appears to be equally effective as a platform for developing skills and tactics in the chosen sport.
- Train teachers without specialist backgrounds in sport how to organize and implement an SSG deliberate play programme and thus make a substantial contribution to youth sport development despite a lack of technical knowledge about sport.

For Future Research

The following recommendations are made in relation to future research in sport development for pre-pubescent youth:

- Research is needed that includes girls. No studies relevant to this research were found that addressed the development of sports for girls. There were a few that addressed early specialization sports such as gymnastics, but none for invasion sports.

- Research is needed on all of the different games categories because the physical, motor, technical and tactical dimensions of each category differ substantially, which may impact youth development paths within that category.
- Research on the effects of specialization and diversification on intrinsic motivation could help determine the impact of youth programmes on long-term engagement in competitive sport and/or participation in an active lifestyle.
- Research on SSG's in order to better understand their potential to contribute to children's technical and tactical development, as well as achieve physical and motor coordination outcomes.
- Research that explores the full continuum of children's learning, ranging from deliberate play for implicit learning to deliberate practice with explicit learning.

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Appendix A

Application and Institutional Approval

Application to the Western Cape Education Department

Navrae Enquiries Imibuzo	**Dr R.S. Cornelissen**	**Wes-Kaap Onderwysdepartement**	
Telefoon Telephone Ifoni	**021 - 467 2286**	**Western Cape Education Department**	
Faks Fax Ifeksi	**021 - 425-7445**	**ISebe leMfundo leNtshona Koloni**	
APPLICATION TO CONDUCT RESEARCH IN PUBLIC SCHOOLS WITHIN THE WESTERN CAPE			
Applicant Detail			
Title:	**Mr**	**Surname:**	**Adams**
First Name(s):	**Warren**	**Gender:**	**Male**
Name of Organization: Dept. of Sports, Recreation & Exercise Science, UWC			
Contact Person: Warren Adams			
Address: Kleinvallei Str 4, Stellenbosch 7600			
Telephone number:	**021-887-4376**	**Cell number:**	**716026685**
Fax number:	**021-808-3527**	**E-mail address:**	**warrena@sarugby.co.za**
Name of Institution:	**University of the Western Cape**		
Student Number:	**3078401**	**Degree/ Diploma:**	**PhD**
Supervisor's Name:	**Dr Susan Bassett**	**Tel no. of Supervisor:**	**072-148-7147**
Year of Registration:	**2010**	**Year when Completing:**	**2014**
Specialization:	**Sport Science**	**Faculty:**	**Community & Health Sciences**
Title of Research:	The Effects of Two Versions of the Games-for-Understanding Approach on the Application of Tactics, Motor Skills and Physical Fitness of Grade Four Children		
Research Questions/Hypotheses:	1. No significant differences will be found in the application of selected tactics in soccer between children who participate in the single-sport version of the Games-for-Understanding approach and the children who participate in the multi-sport version. 2. No significant differences will be found in the development of selected soccer skills between subjects who participate in the single-sport version of the Games-for-Understanding approach and the subjects who participate in the multi-sport version. 3. No significant differences will be found in physical fitness and gross motor coordination variables between subjects who participate in the single-sport version of the Games-for-Understanding approach and the subjects who participate in the multi-sport version.		
Respondents:	Children between the ages of 9 and 12 years old		
Name(s) of Education Institution(s):	Weber Gedenk Primary School, Jamestown		
Research Period in Education Institutions:			
Start Date:	15 March or as soon thereafter as possible pending WCED permission	**End Date:**	Pre-test for 3 weeks, then after 10 weeks of game play and post-test, a retention test 3 weeks later.

Approval from the University of the Western Cape

OFFICE OF THE DEAN
DEPARTMENT OF RESEARCH DEVELOPMENT

Private Bag X17, Bellville 7535
South Africa
Telegraph: UNIBELL
Telephone: +27 21 959-2948/2949
Fax: +27 21 959-3170
Website: www.uwc.ac.za

1 June 2010

To Whom It May Concern

I hereby certify that the Senate Research Committee of the University of the Western Cape has approved the methodology and the ethics of the following research project by: Mr. W Adams (Sport, Recreation and Exercise Science)

Research Project: The effects of two versions of the games-for-understanding approach on the application of tactics, motor skills and physical fitness of grade four children

Registration no: 10/3/11

Peter Syster
Manager: Research Development Office
University of the Western Cape

Appendix B

Information Letter to Parents/Guardians

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa

Contact: Dr. S Bassett, 021 959 2273; fax: 021 959 3688;
email: sbassett@uwc.ac.za

The participation of your child is requested in a PhD Research Project entitled;

The effects of two versions of the games-for-understanding approach on the application of tactics, motor skills and physical fitness of grade four children

1. Your child has been invited to participate in the above-mentioned project to be conducted by Warren Adams from the Department of Sport and Exercise Science at the University of the Western Cape. The results of this study will form part of a PhD dissertation, which may be published.

1.1. The aim of the project is to determine whether a multi-sport training programme will have a different effect on my child's development as a soccer player compared to a soccer-only programme.

1.2. Early sport Specialization is not recommended by experts in team sports, and children in Grade Four (the 9-12 age group) are believed to benefit just as much from a multi-sport programme as from a specific sport programme.

1.3. Your child will have the opportunity to participate as part of his/her class group in two sport-skill development periods per week that will also be attended by his/her classroom teacher.

1.4. This programme is offered at your child's primary school and involves no costs to you.

2. Procedures

2.1. Your child will complete two kinds of tests plus have some of his/her game play video-taped during participation in soccer, hockey and/or team handball games.

The basic physical fitness test consists of running, push-ups, and sit-and-reach tests.

The basic soccer skills test consists of dribbling the ball, passing the ball and shooting the ball at a goal.

2.2. The intervention programme will follow the first test period and be for 10 consecutive weeks. The programme will be adjusted to meet your child's developmental needs so that he/she enjoys participation and does not feel undue pressure to succeed.

2.3. The tests will be re-administered after 10 weeks of training and competitive soccer games, and again two weeks after the programme stops.

2.4. All testing and training will take place at your child's primary school.

3. Potential risks and discomforts

3.1. No invasive procedures or administration of any substances form part of this project.

3.2. There are no known risks involved with this study. Your child will be able to perform both the fitness test and the soccer skill test individually. Both tests consist of simple movements and your child's performance will be supervised for safety. The video-taping of games will not interfere with the games and no public use will ever be made of the images.

3.3. The intervention programme consists of practice sessions that will be controlled by qualified coaches for safety. Some of the activities will be competitive and there is always a small risk of injury when children compete in sports. However, the coaches will emphasise enjoyment and safe play, and there are appropriate medical staff available during practice sessions and competitive games should any injuries occur.

3.4. If your child experiences any discomfort at any time during the testing, the intervention programme or the competitive games, he/she may stop participation. I will explain this to my child.

4. Potential benefits

4.1. The training programme can potentially improve your child's soccer skills and his/her performance in soccer matches, as well as his/her skills in other sports.

4.2. The results will assist in designing sport training programmes for other children and help information for sport talent development programmes for children ages 9 to 12.

5. Payment for participation

5.1. There will be no payment for your child's participation in this study.

6. Confidentiality

6.1. Any information that is obtained in connection with this study and that can be identified with your child will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of each child receiving a code and from then on being identified by this

code. The data will be stored on the researcher's password controlled computer and in a locked cabinet, to which only the researcher and his promoter have access.

6.2. The results will also be shared with the Supervisor, Dr. Susan Bassett, and the Co-supervisor, Prof. Elizabeth Bressan.

6.3. The results from the study will be published in a PhD dissertation and a research journal, but each child will be identified only by the code that he/she has been assigned and therefore remain anonymous.

Appendix C

Informed Consent

(English Version for Parents)

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa

Contact: Dr. S Bassett, 021 959 2273; fax: 021 959 3688;
email: sbassett@uwc.ac.za

Title of Research Project: The effects of two versions of the games-for-understanding approach on the application of tactics, motor skills and physical fitness of grade four children

The study has been described to me in language that I understand and I freely and voluntarily agree to allow my child to participate. My questions about the study have been answered. I understand that my child's identity will not be disclosed and that he/she may withdraw from the study without giving a reason at any time and this will not negatively affect him/her in any way. I give permission for the publication of photographs of my child's involvement in this study.

Parent/guardian's name…….

Parent/guardian's signature…….

Witness…….

Date……

Should you have any questions regarding this study or wish to report any problems you have experienced related to the study, please contact either me or my study supervisor:

Warren Adams
Cell: 071 602 6685
warrena@sarugby.co.za

Or my supervisor:
Dr Susan Bassett
University of the Western Cape
Private Bag X17, Belville 7535
Telephone: (021) 959-2273
Cell: 072 148 7137
Email: sbassett@uwc.ac.za

Appendix D

Assent Form

(English Version for Children)

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa

Contact: Dr. S Bassett, 021 959 2273; fax: 021 959 3688;
email: sbassett@uwc.ac.za

Title of Research Project: The effects of two versions of the games-for-understanding approach on the application of tactics, motor skills and physical fitness of grade four children

Mr. Warren Adams has explained the sport programme and the testing that he would like to do with our class. I understand what is expected of me if I decide that I want to participate.

I have decided that I want to participate. I understand that I may withdraw from the study without giving a reason at any time and that it will be OK with everyone if I do stop.

Child's name……..

Child's signature…….

Witness…….

Date……

If you have any questions or wish to report any problems during this program, please tell your teacher to contact me. You can also contact me or my supervisor.

Warren Adams
Cell: 071 602 6685
warrena@sarugby.co.za

Or my supervisor:
Dr Susan Bassett
University of the Western Cape
Private Bag X17, Belville 7535
Telephone: (021) 959-2273 Email:
sbassett@uwc.ac.za

Appendix E

Test Protocols for Physical Fitness and Gross Motor Coordination

Physical Fitness Test Protocols

(from MacKenzie, 2005)

Standing Height

- **Purpose:** To measure the maximum distance from the floor to the highest point of the child's head.
- **Equipment required:** Stadiometer or steel ruler placed against a wall.
- **Procedures:** Ask the children to remove bulky clothing, hair ornaments and to unbraid any hair that might interfere with the measurement. Shoes should be off as the child takes a position directly under the stadiometer, with heels, buttocks and upper back in contact with the wall. Feet must be together, arms by the sides and shoulders level. The child must be looking straight ahead with a line of sight that is parallel to the floor. The stadiometer is then pulled down until it rests gently the crown of child's head.
- **Scoring:** Accurately record the height to the nearest 0.1 cm.

Weight

- **Purpose:** To determine the child's body mass.
- **Equipment:** A digital scale, placed on firm flooring (such as tile or wood) rather than carpet.
- **Procedures:** Have the child remove shoes and heavy clothing, then step up on the scale and stand with both feet in the center of the scale.
- **Scoring:** Record the weight to the nearest decimal fraction (for example 25.1 kilograms).

Bent-knee Push-up (30 secs).

- **Purpose:** To measure upper body strength/muscle endurance.
- **Equipment:** Stopwatch and mat.
- **Procedures:** Child takes the "up" position with hands about shoulder-width apart, flat on the floor and aligned with the upper chest, not significantly behind or in front of the shoulders. The body should be a straight line from the neck to the knees that are resting on the mat (do not allow hips to sag or rise out of alignment). At the signal "Go", the child lowers the torso toward the floor by bending the elbows, allowing them to flare out to the sides. Pause when the chest is a few centimeters

above the floor, then re-extend the arms and return to the starting position. Repeat this down-up sequence as many times as possible before hearing the "Stop" signal.

- **Scoring:** Each time the child returns to the starting position counts 1. The object is to complete as many push-ups as possible in 30 seconds.

20 Meter Sprint

- **Purpose:** To determine acceleration, and also provide a reliable indicator of speed.
- **Equipment required:** Measuring tape or marked track, stopwatch, cone markers, flat and clear surface of at least 40 meters.
- **Procedure:** The test involves running a single maximum sprint over 20 meters, with the time recorded. A thorough warm up should be given, including some practice starts and accelerations. Start from a stationary position, with one foot in front of the other. The front foot must be on or behind the starting line. This starting position should be held for 2 seconds prior to starting, and no rocking movements are allowed. The tester should provide hints to maximizing speed (such as keeping low, driving hard with the arms and legs) and encouraged to continue running hard past the finish line.
- **Scoring:** The child has two trials with a 5 minute rest between trials. Record the fastest time to 0.1 sec.

Standing Long Jump Test (Broad Jump)

- **Purpose:** To measure the explosive power of the legs
- **Equipment required:** Tape measure to measure distance jumped, non-slip floor for take-off, and soft landing area preferred. The take-off line should be clearly marked.
- **Procedure:** The athlete stands behind a line marked on the ground with feet slightly apart. A two foot take-off and landing is used, with swinging of the arms and bending of the knees to provide forward drive. The subject attempts to jump as far as possible, landing on both feet without falling backwards.
- **Scoring:** Two attempts are allowed. Record longest jump to 0.1 cm. The distance is the pendicular distance from the inside of the take-off line to the back of the heel nearest the take-off line.

Sit-ups (30 secs)

- **Purpose:** To measures the endurance of the abdominal and hip-flexor muscles.
- **Equipment required:** floor mat or flat ground, stopwatch, partner to hold feet
- **Procedure:** The aim of this test is to perform as many sit-ups as you can in 30 seconds. Lie on the mat with the knees bent at right angles, with the feet flat on the floor and held down by a partner. The fingers are to be interlocked behind the head. On the command 'Go', raise the chest so that the upper body is vertical, then return to the starting position so that the shoulder blades return to the floor. Continue for

30 seconds. For each sit up the back must return with the shoulder blades touching the floor.

- **Scoring:** The maximum number of correctly performed sit-ups in 30 seconds is recorded. The sit up will not be counted if the subject fails to reach the vertical position, fail to keep your fingers interlocked behind your head, arch or bow your back and raise your buttocks off the ground to raise your upper body, or let your knees exceed a 90-degree angle.

6-Minute Run Test

The six minute run test has been developed as a shorter alternative to the 12-minute Cooper run test.

- **Purpose:** To test aerobic endurance fitness (the ability of the body to use oxygen as an energy source).
- **Equipment:** flat oval or running track, marking cones, recording sheets, stop watch. The shape should be at least 30m per shorter two sides.
- **Procedure:** Place markers at set intervals around the track to aid in measuring the completed distance.
- **Scoring:** Participants run for 6 minutes and the total distance covered is recorded to the nearest meter. Walking is allowed, although the participants must be encouraged to run.

Gross Motor Coordination Test Protocols

(from Kliphard & Shilling, 1974)

Side Jump Test (15 secs)

- **Purpose:** To test the ability to maintain body control/coordination while jumping sideways, back and forth over a line on the ground.
- **Equipment:** A smooth surface suitable for jumping side to side; a line 20cm long and 4 cm wide drawn or pasted on the surface; a stopwatch or timer to measure 15 sec and 1 minute intervals.
- **Procedure:** The participant stands comfortably with feet slightly apart and weight evenly distributed between both legs. Feet should be parallel to the line on the ground. The test administrator then explains that when the "go" signal is given, the child should begin jumping as fast as possible back and forth over the line. Both the take-off and the landing should be made on both feet simultaneously (a two foot take-off and two foot landing). After the administrator demonstrates the technique, the participant then tries to jump back and forth 6 times to master the technique.

  The particpant then takes a position next to the line and indicates when ready. The administrator then gives the "go" signal and 15 secs later, the "stop" signal.
- **Scoring:** The participant has two trials at this side jumping task. The score is the highest total for one trial. Each time the participant lands legally, one point is scored. The administrator calls out the correct jump landing as it occurs (1, 2, 3, 4 and so on). A landing is not counted if the landing was on one foot or one foot first, the take-off was from one foot, or the line was touched in any way during the task.

Dynamic Balance Test

- **Purpose:** To test the ability to maintain the centre of gravity over a dynamic base of support (maintain balance while walking backward).
- **Equipment:** Three balance beams, each 1.5m in length: 6 cm beam, 4.5 cm beam and a 3 cm beam.
- **Procedure:** The child steps up and balances on the end of the 6cm beam, ready to walk backwards. When ready, he/she attempts to take 8 steps backwards without touching the ground. This backward walking task is repeated for the 4.5 cm beam and for the 3cm beam.
- **Scoring:** Participants have two trials at this three beam task. The score is the highest total for one trial. Scores from different trials cannot be combined to get a higher 3-beam total.

Appendix F

Test Protocols for Selected Soccer Skills

1. Shooting-at-goal test (Baatjes, 2006)

Purpose of test/measurement: To assess the goal-shooting accuracy of the participants using a goal-scoring drill.

Procedure used: For this test, each participant is required to shoot at goal (ball was in a stationary position), with the goal being divided into 3 areas, each representing a specific number of points. Each participant has one trial of 5 shots at goal from a distance of 20m to try and accumulate as many points as possible. There is no time limit to complete the test.

Number of trials: 1 (each trial had 5 shots at goal).

Scoring: The total number of points scored from the 5 shots taken by each player was added up and served as their score for the test (3 points for shots in the middle of the goal and 1 point for shots within 1m of the side goal post), with a maximum of 15 point possible for a perfect test.

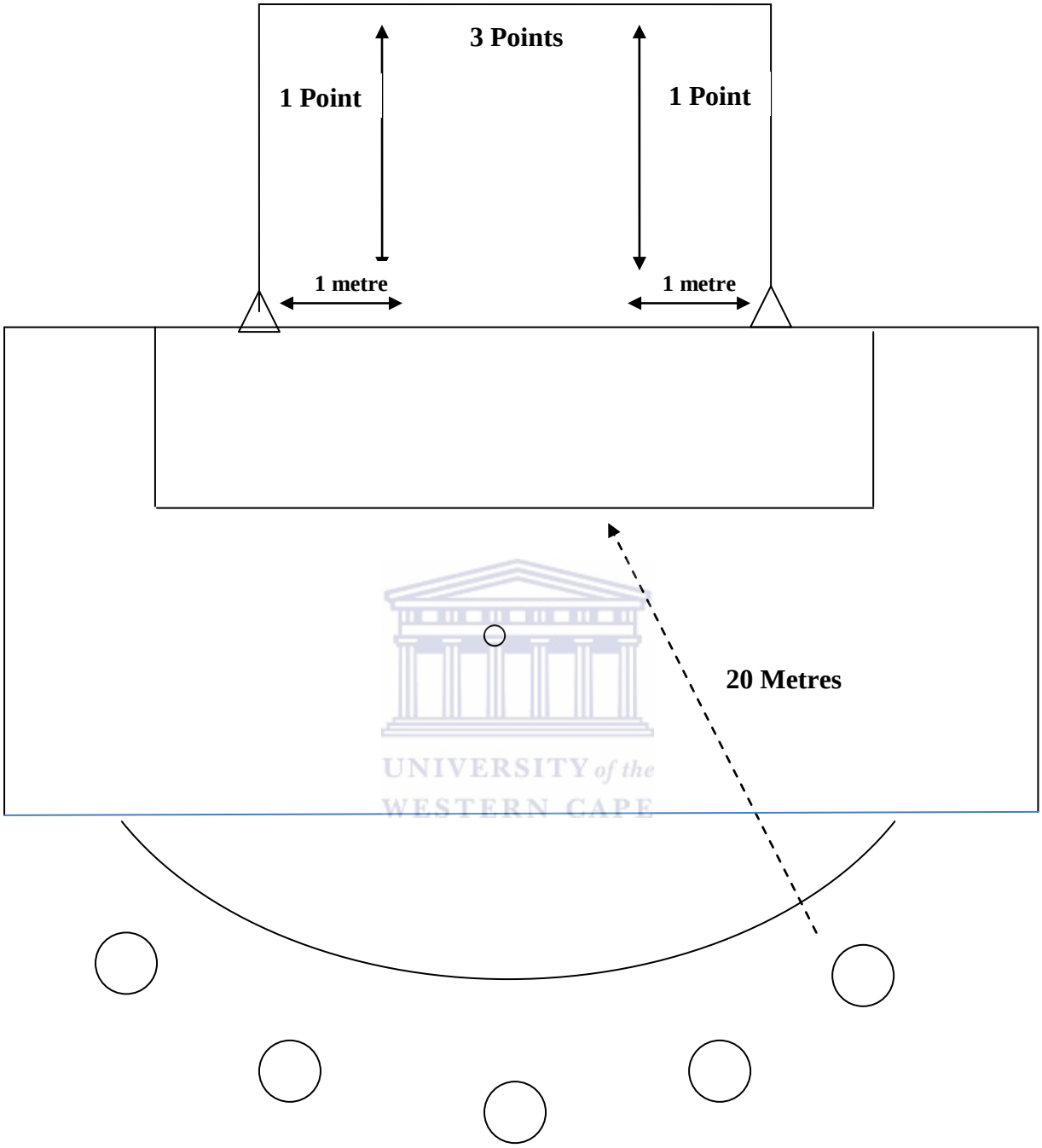
2. Dribbling test (Baatjes, 2006)

Purpose of test/measurement: To assess the dribbling speed of the participants using a modified Illinois agility grid.

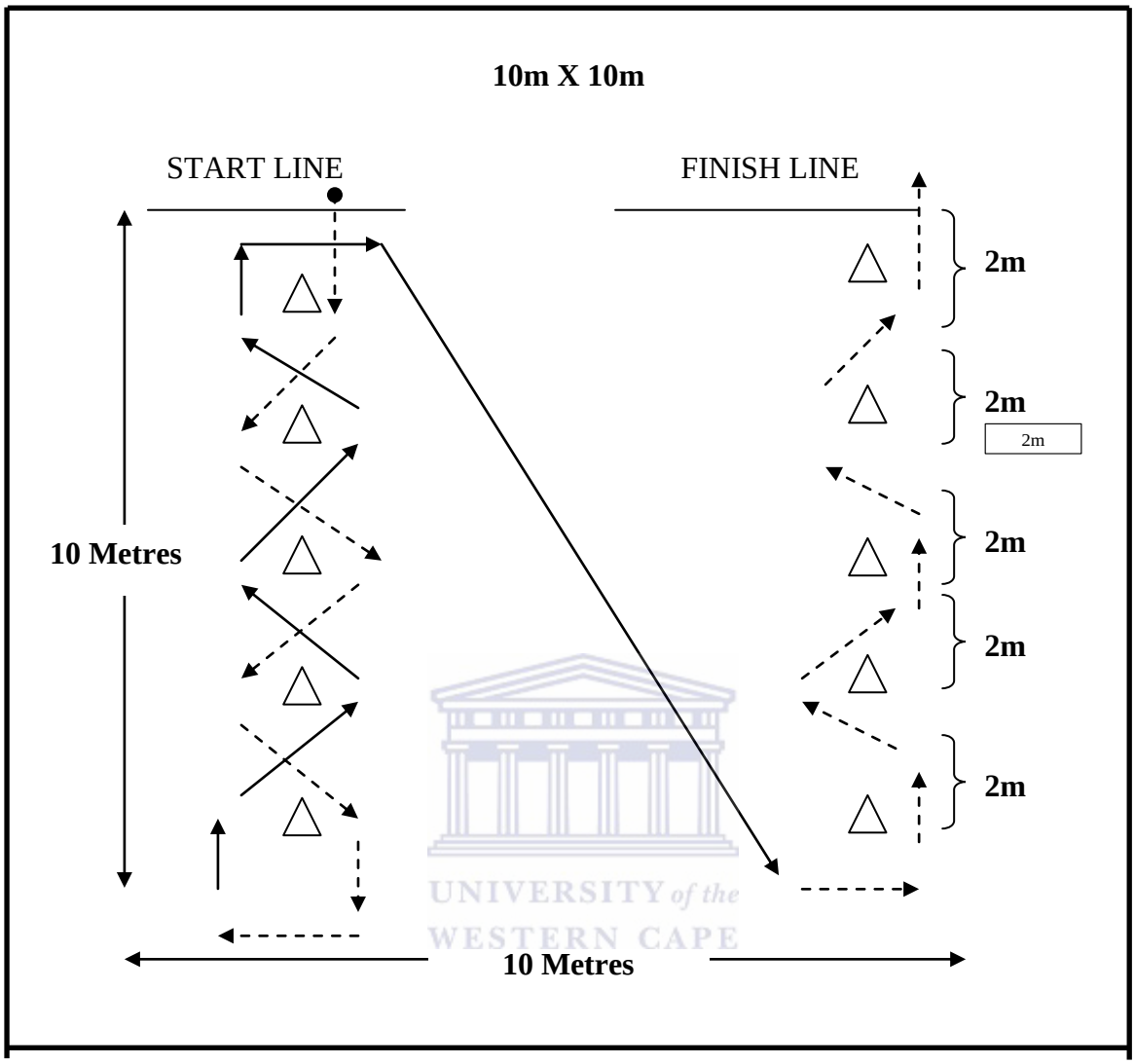
Procedure used: For this test, the participants were asked to dribble a ball through a grid (similar to the Illinois agility run), between a series of markers (beacons) in the shortest time possible. The grid comprised a 10 x 10m square with cones laid out within the square 2 metres apart. Upon the "go" signal (whistle) participants dribbled the ball from the start line (first beacon) to the finish line (last beacon), with the time being recorded from the moment that their right/left foot with the ball crossed the start line (first beacon) until the right/left foot with ball had passed the finish line (last beacon) within the grid.

Number of trials: 2

Scoring: The fastest time of two trials was recorded.



Shooting-at-goal test (Baatjes, 2006)



Dribbling test (Baatjes, 2006)

Appendix G

Playing Schedule and Rules of the Small-sided Games

The following schedule reflects the different versions of the 4v4 small-sided games that the children in this study played 2x per week for 6 weeks.

Week of the Intervention Programme						
	1	2	3	4	5	6
Gr 1 Soccer	Soccer Soccer	Soccer Soccer	Soccer Soccer	Soccer Soccer	Soccer Soccer	Soccer Soccer
Gr 2 Multi-sport	Soccer Soccer	Hockey Hockey	Team Handball Team Handball	Soccer Soccer	Hockey Hockey	Team Handball Team Handball

The same 4v4 soccer game was played by the children in the Gr 1 Soccer programme during each of the practice sessions (*i.e.* they played the same game for all 12 practice sessions).

The same 4v4 soccer game was played by the children in the Gr 1 Soccer only programme and those in the Gr 2 Multi-sport (soccer, hockey and team handball) programme.

The same 4v4 hockey game and the same 4v4 team handball game were played by the children in the Gr 2 Multi-sport programme (*i.e.* they played the same soccer game for 4 practice sessions, the same hockey game for 4 sessions and the same team handball game for 4 sessions).

The 4v4 soccer game that was played during the pre-test and the post-testing sessions for both groups was the same 4v4 game that later was played during the intervention programme.

The descriptions of the rules of the three different 4v4 games are on the following pages.

Soccer SSG Modified Rules

Law 1 – The Field of Play
Dimensions: The field of play is rectangular.
Length: 30m
Width: 20m
Field Markings: The outline and goal line of the field were marked with beacons every 2m.
The Goals: Goals were marked at the centre of each goal line at each end of the field with two cones.
Law 2 – The Ball: Size four (4).
Law 3 – The Number of Players: A match is played by two teams, each consisting of 4 players, one of whom is the goalkeeper.
Law 4 – The Players' Equipment: Teams wore different colour bibs with each player wearing a his/her own unique number on the bib.
Law 5 – The Ball In and Out of Play: The game starts with a throw-in from the side line at the centre of the field. Play is restarted with a throw- in regardless of whether it went out over the side line or behind the goal line, from the spot where it crossed the line. Play is restarted after a goal from the side line at the centre of the field by the team who just allowed the goal.
Law 6 – The Method of Scoring: a goal is scored and one point awarded when a team kicks the ball through the opposition teams goals and below the waist of the goalkeeper.
Law 7 – Offside: None.

Hockey SSG Modified Rules

Law 1 – The Field of Play
Dimensions: The field of play is rectangular.
Length: 30m
Width: 20m
Field Markings: The outline and goal line of the field were marked with beacons every 2m.
The Goals: Goals were marked at the centre of each goal line at each end of the field with two cones.
Law 2 – The stick and ball: Mini plastic hockey sticks and a sponge ball the size of a softball.
Law 3 – The Number of Players: A match is played by two teams, each consisting of 4 players, one of whom is the goalkeeper.
Law 4 – The Players' Equipment: Teams wore different colour bibs with each player wearing a his/her own unique number on the bib.
Law 5 – The Ball In and Out of Play: The game starts with a free hit from the side line at the centre of the field. Play is restarted with a free hit regardless of whether it went out over the side line or behind the goal line, from the spot where it crossed the line. Play is restarted after a goal from the side line at the centre of the field by the team who just allowed the goal.
Law 6 – The Method of Scoring: a goal is scored and one point awarded when a team hits the ball through the opposition teams goals and below the knees of the goalkeeper.
Law 7 – Offside: None.

NB: Safety – Players were required to <u>not</u> lift the sticks above their shoulders. If they did raise their sticks, they were sent off the field for 5 minutes and their team was allowed to make a substitution.

Team Handball SSG Modified Rules

Law 1 – The Field of Play
Dimensions: The field of play is rectangular.
Length: 30m
Width: 20m
Field Markings: The outline and goal line of the field were marked with beacons every 2m.
The Goals: Goals were marked at the centre of each goal line at each end of the field with two cones.
Law 2 – The Ball: Size four (4).
Law 3 – The Number of Players: A match is played by two teams, each consisting of 4 players, one of whom is the goalkeeper.
Law 4 – The Players' Equipment: Teams wore different colour bibs with each player wearing a his/her own unique number on the bib.
Law 5 – The Ball In and Out of Play: The game starts with a throw-in from the side line at the centre of the field. Play is restarted with a throw- in regardless of whether it went out over the side line or behind the goal line, from the spot where it crossed the line. Play is restarted after a goal from the side line at the centre of the field by the team who just allowed the goal.
Law 6 – The Method of Scoring: a goal is scored and one point awarded when a team throws the ball through the opposition teams goals and below the shoulders of the goalkeeper.
Law 7 – Offside: None.

Appendix H

Pictures from the SSG Intervention Programmes

Boys and Girls in Group 1 Soccer SSG Programme

Boys and Girls in Group 2 Multi-sport SSG Programme

The playing areas (above and below) presented challenges. They were cut out from the surrounding fields so the children could play soccer, team handball and hockey SSGs.

Challenges from the children's backgrounds included "no shoes" for playing (below left) and difficulty staying "on task" during structured game play (below right).

Each intervention session began with the children joining their pre-assigned teams and putting on their bibs, while the researcher took attendance and set up the rotation for taking turns playing the 4v4 games.

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The children all wore the same colour and number bib each day to ensure they played for their correct team and had a sufficient amount of playing time during each practice session

While waiting for their turn to play, the children from the different teams would sit under the tree waiting for the whistle to sound that signalled their turn had come.

Action Photos of the Children Playing the Soccer SSG