DESIGNING A PROTOCOL AND COMPARATIVE NORMS FOR THE IDENTIFICATION AND SELECTION OF TALENT AMONG ELITE AGE-GROUP RUGBY PLAYERS IN SOUTH AFRICA

by

CONRAD BOOYSEN

submitted in partial fulfilment of the requirements for the degree

DOCTOR PHILOSOPHIAE

in the

Faculty of Humanities

Department of Biokinetics, Sport and Leisure Sciences

University of Pretoria

December 2007
Pretoria

Supervisor: Prof. P.E. Krüger



DEDICATION

This work is dedicated to my Lord and Saviour and my two girls; Chantél my wife and Zoey my daughter.

Without you in my life, I am nothing and I amount to nothing.

Thank you!



ACKNOWLEDGEMENTS

I would like to take the opportunity to thank the following individuals and groups for standing by me and assisting me in the successful completion of this study.

To My Lord and Saviour Jesus Christ: You came into my life at a young age and have been there ever since. I have made mistakes and you have picked me up. I have needed help and you've been there. But, above all else I would like to thank you for dying for me on the cross and for choosing me to be your servant. It is my aim in life to glorify you and to let you shine. You are my Alpha and Omega, my beginning and my end.

To Chantél and Zoey: My two girls. You have brought unending joy and happiness into my life and I thank the Lord every day for blessing me with you both. Chantél, you're everything I could ever have asked for and more. Thank you for standing by me in this study and for always believing in me. Zoey, you entered into our lives during the course of this study and we thank the Lord for you daily. You are such a blessing to us and have made us so happy. May we successfully raise you in the ways of the Lord so that you honour and glorify Him with your life and your all. I love you both so much!

To my Parents: Mom and Dad, your example has been of immeasurable value to me in my life. Your humility, your years of humble service in the ministry to the King, and your endless sacrifices for me and Anton have meant so much to us. This example and experience is engraved upon our hearts forever. Thank you for always believing in me; you made me believe in myself! I love you.

To Anton, Carla, Ian and Clayton: Anton, as my older brother you always stood up for me and protected me, sometimes to your own detriment. You're a role model and an example to me. Carla, Ian and Clayton, you're all much loved and we look forward to many years of happiness and productivity together as a family.



To Mom Denise: Thank you for accepting and treating me as your son. You are so loving and kind and supportive. Thank you for raising such beautiful and loving children and for setting the example to Chantel and Sunet that you did. You are our mother and "mother to many." May God richly bless you.

To Professor P.E. Krüger: As my Supervisor I cannot say thank you enough. Sir, you have always been available and accessible and willing to help. I truly appreciate your patient endurance with me and your guidance. I have immeasurable respect for you and this deepens the more I work with you. Thank you Sir.

To Elim Full Gospel Church and the @ELIM Student Ministry: As my congregation you have interceded for me and stood by me. You have also allowed me the time to complete this study. I truly appreciate each and every one of you and I thank you earnestly. My time will always be dedicated to the service of the Master and to you. You overwhelm me with your love and support. You are too many to mention, but thank you to everyone.

To all my Friends and Colleagues: Thank you so much for your constant enquiries and support in prayer and other means. It is so humbling to be surrounded by individuals who care so much. I can only hope I can be of similar support and comfort in your time of need.

To the Following in no Particular Order: Elsa Coertze (my information specialist); Irene Bower (transcriber); Carmen Jacobs (my "other" sister and interview transcriber); Cosmos Shatto (proofreading); Christine Smit (my statistician); Denise Swanepoel (proofreading). You have all been of such immeasurable assistance and I have you to thank for the completion of this study.

Philippians 1:6: "And I am convinced and sure of this very thing, that He Who began a good work in you will continue until the day of Jesus Christ [right up to the time of His return], developing [that good work] and perfecting and bringing it to full completion in you." (AMP)



SUMMARY

TITLE Designing a protocol and comparative norms for the

identification and selection of talent among elite age-group

rugby players in South Africa

CANDIDATE Conrad Booysen

SUPERVISOR Prof. P.E. Krüger

DEPARTMENT Biokinetics, Sport and Leisure Sciences

DEGREE D.Phil

Talent identification and the subsequent development of those individuals with the most potential to succeed is currently of great concern for sporting bodies in a number of countries and South Africa is no exception. Sport in South Africa holds a position of great prominence and has been used in many instances to facilitate national unity and pride.

Rugby Union is one of the most prominent sports in South Africa and it is in this sport that South Africa has achieved a great measure of success, both historically and currently. It is a sport in which the future sustainability of this success is high on the agenda. There have been a number of studies on talent identification in rugby and this study aims to contribute to that body of knowledge. To achieve this contribution, this study has two primary goals and aims.

This study has as its primary goals and aims: 1) to have a sound theoretical base provided by in-depth and up to date research that will form the foundation for, 2) reviewed and alternative sport and position-specific testing protocols as well as comparative results consisting of norms and scores that will adequately identify and select those capable of participating in elite age-group rugby union.



Contained in the theoretical base of this study is a review of the physical parameters required to succeed in sport, a discussion of the nature vs. nurture debate and a review of the developmental approaches to talent and ability. Other factors such as psychological skills, abilities and attributes and a historical review of talent identification models and approaches world-wide as well as in South Africa have also been provided. In all, the first primary aim and goal of this study has therefore successfully been achieved.

Thereafter, the reviewed and alternative test protocol has been presented, discussed and executed, followed by an analysis of the results obtained. Specific achievements of this study are that new and modified tests (3x5x22m Anaerobic capacity test, S-Test and the Kick-for-distance and accuracy test) for talent have been developed and that specific scores and norms for these new tests, as well as other pre-existing tests, have been established for future reference. In noting the success of the alternative, broad-position specific protocol and the establishment of scores and norms, the second primary goal and aim of this study can be said to be achieved. This study then ends with conclusions and further proposed recommendations.

It can therefore be concluded with a great amount of certainty that this study has been successful not only in presenting as up to date research as possible in the fields of excellence and elite sport, but that furthermore, this study has provided a robust test protocol with comparative norms that can be used as an alternative identification and selection tool.

Key words:

rugby sustainability

talent physical parameters

identification psychological skills, abilities and attributes

selection historical approaches

protocol comparative norms



OPSOMMING

TITEL Die ontwerp van 'n protokol en vergelykende norms vir die

identifisering en seleksie van talent in elite ouderdoms-groep

rugby spelers in Suid Afrika.

KANDIDAAT Conrad Booysen

PROMOTOR Prof. P.E. Krüger

DEPARTEMENT Biokinetika, Sport and Vryetydwetenskappe.

GRAAD D.Phil

Talent identifisering en die daaropvolgende ontwikkeling van daardie individue met die meeste potensiaal is huidiglik van groot belang vir sportliggame in talle lande. Suid Afrika is geen uitsondering nie. Sport in Suid Afrika is in 'n posisie van groot prominensie en was al gebruik in baie gevalle om nasionale eenheid en trots te bewerkstellig.

Rugby is een van die mees prominente sportsoorte in Suid Afrika, en dit is in hierdie sport dat Suid Afrika groot suksesse behaal het, beide histories gesproke en huidiglik. Dit is 'n sport waarin die toekomstige handhawing van hierdie sukses hoog op die agenda is. Daar was al 'n aantal studies met betrekking tot talent identifisering in rugby en hierdie studie beoog om 'n bydrae maak tot daardie kennis. Om hierdie bydrae to maak het hierdie studie twee doelwitte en oogmerke.

Die twee primêre doelwitte is: 1) om 'n grondige teoretiese basis te skep deur deurtastende en kontemporêre navorsing wat grondliggend sal wees vir, 2) oorsigtelike en alternatiewe sport en posisie-spesifieke toetsprotokolle wat daardie individue genoegsaam sal identifiseer wat die nodige vaardighede en karaktertrekke het vir elite ouderdomsgroeprugby.



Bevat in die teoretiese basis van hierdie studie is 'n oorsig van die fisiese paradigmas nodig vir sukses in sport, 'n bespreking van die "aard vs. opvoeding" debat en 'n oorsig van die ontwikkelings benaderings tot talent en vaardighede. Bykomende faktore soos sielkundige vaardighede, vermoëns en karaktertrekke en 'n historiese oorsig van talent identifisering's modelle en benaderings oor die wêreld sowel as in Suid Afrika word bespreek. Dus is die eerste primêre doelwit van hierdie studie suksesvol behaal.

Daarna word die alternatiewe toets protokol aangebied, bespreek en uitgevoer, gevolg deur 'n analise van die resultate wat behaal is. Spesifieke prestasies van hierdie studie is dat nuwe en gemodifiseerde toetse (3x5x22m Anaerobiese kapasiteitstoets, S-Toets en die Skop-vir-afstand en akkuraatheidstoets) vir talent ontwikkel is en dat spesifieke tellings en norms vir die nuwe toetse en ander voorafgaande toetse vir toekomstige gebruik opgestel is. As gevolg van die sukses van die alternatiewe, breë posisie-spesifieke protokol sowel as die opstelling van tellings en norms, is die tweede primêre doelwit vir hierdie studie ook suksesvol behaal. Daarna volg die gevolgtrekkinge en verdere aanbevelinge vanuit hierdie studie.

Daar kan met groot sekerheid gesê word dat hierdie studie geslaagd is in die aanbieding van navorsing so op datum as moontlik in die gebiede van uitnemendheid en elite sport, maar dat hierdie studie 'n robuuste toets protokol aanbied met vergelykende norms wat gebruik kan word as 'n alternatiewelike identifiserings en seleksie werktuig.

Sleutel woorde:

rugby volgehoudendheid talent fisiese parameters

identifisering sielkundige vaardighede, vermoëns, karaktertrekke

keuring historiese benaderings protokol vergelykende norms



TABLE OF CONTENTS

| TITLE F | PAGE | į | |
|----------|--|------|--|
| DEDICA | ATION | ii | |
| ACKNO | ACKNOWLEDGEMENTS | | |
| SUMMA | ARY | V | |
| OPSON | IMING | vii | |
| TABLE | OF CONTENTS | ix | |
| LIST O | F FIGURES | XX | |
| LIST O | F TABLES | xxii | |
| LIST O | FAPPENDICES | xxvi | |
| CHAPT | ER ONE: RESEARCH PROBLEM AND GOAL OF STUDY | | |
| 1.1 | INTRODUCTION | 1 | |
| 1.2 | STATEMENT OF PROBLEM | 7 | |
| 1.3 | GOAL OF STUDY | 12 | |
| 1.3.1 | Primary goals and aims | 12 | |
| 1.3.2 | Secondary goals and aims | 13 | |
| 1.4 | HYPOTHESIS | 13 | |
| 1.5 | METHODS | 13 | |
| 1.5.1 | Literature review | 13 | |
| 1.5.2 | Empirical investigation | 14 | |
| 1.5.2.1 | Design | 14 | |
| 1.5.2.2 | Measuring instruments | 16 | |
| 1.5.2.2. | 1 Final test protocol | 17 | |
| 1.5.2.3 | Data analysis and assimilation | 18 | |

CHAPTER TWO: TALENT IDENTIFICATION: ORIENTATION OF TERMS AND CONCEPTS



| 2.1 | INTRODUCTION | 21 |
|----------|--|----|
| 2.2 | TERMS AND CONCEPTS | 22 |
| 2.2.1 | Talent | 22 |
| 2.2.1.1 | Talent vs. giftedness | 22 |
| 2.2.1.2 | Centrist and interactionist views of the nature and origin | |
| | of talent | 23 |
| 2.2.1.3 | Nurture-based views of talent | 26 |
| 2.2.1.4 | Further definitions of talent in literature | 27 |
| 2.2.1.5 | Conceptual definition of talent | 28 |
| 2.2.2 | Skill | 29 |
| 2.2.3 | Identification | 30 |
| 2.2.3.1 | Conceptual definition of talent identification | 30 |
| 2.2.3.1. | Talent identification vs. talent detection, selection and | |
| | development | 36 |
| 2.2.4 | Expert | 39 |
| 2.2.5 | Performance | 40 |
| 2.2.5.1 | Conceptual definition of expert performance in sport | 41 |
| 2.2.5.1. | Orientation of the terms "expert performance in sport" | |
| | and "elite sport" | 42 |
| 2.2.6 | Expertise | 42 |
| CHAPT | ER THREE: SPORT AND RUGBY | |
| 3.1 | INTRODUCTION | 44 |
| 3.1.1 | Chapter outline | 45 |
| 3.2 | CHARACTERISTICS OF SPORT | 46 |
| 3.3 | SOCIOLOGICAL AND SOCIETAL TRENDS IN SPORT | 48 |
| 3.4 | HISTORICAL DEVELOPMENT AND CURRENT DAY | |
| | PERSPECTIVES OF RUGBY UNION | 54 |
| 3.4.1 | The beginning | 54 |
| 3.4.2 | Rugby in South Africa | 58 |



3.4.3 Modern perspectives

60

CHAPTER FOUR: TALENT IDENTIFICATION: PHYSICAL PERSPECTIVES,

NATURE VERSUS NURTURE AND DEVELOPMENTAL

CONSIDERATIONS

| 4.1 | INTRODUCTION | 63 |
|----------|--|-----|
| 4.1.1 | Chapter outline | 64 |
| 4.2 | PHYSICAL PARAMETERS AND FACTORS IN SPORT AND | |
| | RUGBY | 66 |
| 4.2.1 | Anthropometric and physiological variables | 69 |
| 4.2.2 | Sport-specific skill variables | 74 |
| 4.3 | MATURATION, GROWTH AND DEVELOPMENT | 75 |
| 4.3.1 | Periods of life-span development | 76 |
| 4.3.2 | Phases of motor-behaviour development | 78 |
| 4.3.3 | Early maturation and sport | 81 |
| 4.3.4 | Relative-age effect | 86 |
| 4.4 | NATURE AND GENETICS VERSUS NURTURE AND | |
| | DEVELOPMENT | 87 |
| 4.4.1 | Specific genetic explanations for elite performance in sport | |
| | and physical proficiency with associated rebuttals | 90 |
| 4.4.1.1 | Genetic explanations of elite performance in sport and | |
| | physical proficiency | 90 |
| 4.4.1.2 | Rebuttals, environmental and developmental considerations | |
| | of talent and ability | 99 |
| 4.4.1.2. | 1 Rebuttals to genetic constraints on Performance | 100 |
| 4.4.1.2. | 1a Genetic constraints on VO ₂ max | 101 |
| 4.4.1.2. | 1b Genetic constraints on muscle fibre types | 105 |
| 4.4.1.2. | 1c ACE I/D gene findings | 106 |
| 4.4.2 | Role of significant others in the development of talent and | |
| | excellence in sport | 107 |



| 4.4.2.1 | Support and role of parents | 109 |
|----------------------|--|-----|
| 4.4.2.2 | Peer interaction and support | 111 |
| 4.4.2.3 | Interactions between athletes and coaches | 112 |
| 4.4.3 | Specific talent and expertise developmental models for sport | 113 |
| 4.4.3.1 | Characteristics of talented performers (Bloom, 1985) | 114 |
| 4.4.3.2 | Theory of deliberate practice (Ericsson et al., 1993) | 115 |
| 4.4.3.3 | Stages of development in sport (Côté, 1999) | 119 |
| 4.4.3.4 | Developmental model of sport participation (Côté et al., 2007) | 121 |
| 4.4.3.5 | Stages of development (Button & Abbott, 2007) | 123 |
| 4.5 | SUMMARY AND APPLICATION TO TALENT IDENTIFICATION | |
| | AND DEVELOPMENT | 126 |
| 4.5.1 | Physical perspectives and talent identification | 126 |
| 4.5.2 | Nature versus nurture | 128 |
| 4.5.3 | Talent development and identification | 131 |
| СНАРТ | ER FIVE: PSYCHOLOGICAL PERSPECTIVES | |
| | | |
| 5.1 INT | RODUCTION | 134 |
| 5.1.1 B | ackground of sport psychology | 136 |
| 5.1.2 C | hapter outline | 137 |
| 5.2 MO | TIVATION, COMMITMENT AND PRACTICE | 140 |
| 5.2.1 A | chievement goal theory | 142 |
| 5.2.1.1 | Profile of goal orientation questionnaire (PGOQ) | |
| | (Wilson <i>et al.,</i> 2006:298) | 145 |
| 5.2.2 S | elf-determination theory | 146 |
| 5.2.2.1 | Hierarchical model of intrinsic and extrinsic motivation | |
| | (Vallerand, 2007:60) | 148 |
| 5.2.3 S | port commitment model | 149 |
| 5.2.4 D | eliberate practice | 152 |
| 5.3 PEF | RCEPTUAL-COGNITIVE AND PERCEPTUAL-MOTOR SKILLS | 154 |
| 5.3.1 P | erceptual-cognitive abilities and skills | 154 |

| 5.3.1.1 Backg | round | 154 |
|-----------------|--|-----|
| 5.3.1.1.1 | Cognitive revolution | 155 |
| 5.3.1.1.2 | Information-processing approach | 158 |
| 5.3.1.2 Leadir | ng research findings | 160 |
| 5.3.1.2.1 | Information recall, retention and recognition | |
| | (Helsen & Starkes, 1999) | 160 |
| 5.3.1.2.2 | Sport specific knowledge | |
| | (Bock-Jonathan <i>et al.,</i> 2007) | 163 |
| 5.3.1.2.3 | Faster and more efficient processing of Information | |
| | (Starkes <i>et al.,</i> 2001) | 164 |
| 5.3.1.2.3a | Situational probabilities | |
| | (Williams e <i>t al.,</i> 2004:332) | 164 |
| 5.3.1.2.3b | Visual search behaviour | |
| | (Williams e <i>t al.,</i> 2004:330) | 164 |
| 5.3.1.2.3c | Advanced cue utilisation | |
| | (Williams & Ward, 2007:205) | 165 |
| 5.3.1.2.4 | Trainability and transferability of perceptual-cognitive | |
| | abilities | 165 |
| 5.3.2 Percept | ual-motor abilities and skills | 169 |
| 5.3.2.1 Ecolog | gical psychology | 171 |
| 5.3.2.2 Dynan | nical systems theory | 173 |
| 5.4 MENTAL | FOUGHNESS | 175 |
| 5.4.1 Recent | studies on mental toughness | 179 |
| 5.4.1.1 Menta | l toughness framework (Jones e <i>t al.,</i> 2007) | 179 |
| 5.4.1.2 Elite a | thlete development model (Cooper & Goodenough, 2007) | 182 |
| 5.5 SUMMAR | Y AND APPLICATION TO TALENT IDENTIFICATION | 187 |
| 5.5.1 Interrela | tion of psychological skills, attributes and abilities | 187 |
| 5.5.1.1 Motiva | ntion, commitment, practice and enjoyment | 188 |
| 5.5.1.1.1 | Commonalities | 190 |
| 5.5.1.2 Role o | f practice in perceptual-cognitive and perceptual- | |
| motor | skills | 191 |



| 5.5.1.2.1 Prac | tice an | nd perceptual-cognitive skills | 191 |
|----------------|------------|--|-----------|
| 5.5.1.2.2 Prac | tice an | d perceptual-motor skills | 192 |
| 5.5.1.2.3 Prac | tice an | nd skill transfer | 193 |
| 5.5.1.3 Impac | t of int | errelatedness on talent identification and | |
| develo | pment | | 193 |
| 5.5.2 Incorpo | ration | of mental toughness measures in talent | |
| identific | ation p | protocols | 194 |
| 5.5.3 Recomr | nendat | ions regarding the inclusion of perceptual- | |
| cognitiv | e and | perceptual-motor tests within talent | |
| identific | ation p | protocols | 196 |
| 5.5.3.1 Film a | nd vide | eo-based simulations, virtual-reality and field- | |
| based | and m | ethods | 196 |
| 5.5.3.1.1 | Eye n | novement recordings and visual occlusion | |
| | techn | iques (Williams & Ward, 2007) | 197 |
| 5.5.3.1.2 | Proto | col analysis (Hodges e <i>t al.,</i> 2007) | 198 |
| 5.5.3.2 Recon | nmend | ations for the inclusion of these methods | |
| in tale | nt iden | tification protocols | 199 |
| CHAPTER SI | X : | TALENT IDENTIFICATION: HISTORICAL AN PRACTICES | D CURRENT |
| 6.1 INTRODU | CTION | | 201 |
| 6.1.1 Chapter | outlin | e | 203 |
| 6.2 HISTORIC | AL DE | VELOPMENT OF TALENT IDENTIFICATION | 204 |
| 6.2.1 Gimbel | (1976) | | 207 |
| 6.2.2 Harre (1 | 982) | | 209 |
| 6.2.3 Havlicel | k et al. | (1982) | 211 |
| 6.2.4 Bompa | (1985) | | 212 |
| 6.2.5 Concep | tual mo | odel for talent identification | 218 |
| 6.2.5.1 Régni | er (198 | 7) | 218 |
| 6.2.5.1.1 Iden | tification | on of sport-specific requirements | 218 |

| 6.2.5.1.2 Identification of determinants of performance | 220 |
|---|-----|
| 6.2.6 Talent identification in South Africa | 222 |
| 6.3 ORIENTATION OF THIS STUDY | 228 |
| 6.4 CURRENT DAY PERSPECTIVES ON TALENT IDENTIFICATION | 229 |
| 6.4.1 Modern day perspectives on talent identification | 230 |
| 6.4.1.1 Problems | 232 |
| 6.4.1.2 Solutions and recommendations | 237 |
| 6.4.2 Genetic doping and testing | 244 |
| 6.5 SANZAR APPROACHES TO TALENT IDENTIFICATION AND | |
| DEVELOPMENT | 247 |
| 6.5.1 Talent identification and development at the South African Rugb | y |
| Union | 248 |
| 6.5.1.1 Talent identification | 248 |
| 6.5.1.1.1 Testing protocol SARU | 251 |
| 6.5.1.2 Talent development | 253 |
| 6.5.2 Talent identification and development at the New Zealand Rugby | , |
| Union | 255 |
| 6.5.2.1 Talent identification | 255 |
| 6.5.2.1.1 Testing protocol NZRU | 256 |
| 6.5.2.2 Talent development | 257 |
| 6.5.3 Talent identification and development at the Australian Rugby | |
| Union | 259 |
| 6.5.3.1 Talent identification | 259 |
| 6.5.3.1.1 Testing protocol ARU | 261 |
| 6.5.3.2 Talent development | 264 |
| 6.6 SUMMARY | 264 |
| CHAPTER SEVEN: EMPIRICAL INVESTIGATION | |
| 7.1 INTRODUCTION | 267 |
| 7.1.2 Chapter outline | 268 |



| 7.2 REP | ORTING | OF | INTERVIEWS | WITH | NATIONAL | AND |
|---------|--------|----|-------------------|------|----------|-----|
|---------|--------|----|-------------------|------|----------|-----|

| INTERNA [*] | TIONAL LEVEL COACHES | 268 |
|----------------------|--|-----|
| 7.2.1 Internat | ional and national level coaches and conditioners | 269 |
| 7.2.1.1 Eugen | e Eloff | 269 |
| 7.2.1.2 Jake V | Vhite | 269 |
| 7.2.1.3 Peter | de Villiers | 270 |
| 7.2.1.4 Ashle | y Evert and Pieter Terblanche | 270 |
| 7.2.1.5 Nick N | lallett | 270 |
| 7.2.1.6 Robbi | e Deans | 271 |
| 7.2.2 Results | of interview | 271 |
| 7.2.2.1 Tight 1 | forwards | 272 |
| 7.2.2.1.1 | General | 272 |
| 7.2.2.1.2 | Physical-motor | 273 |
| 7.2.2.1.3 | Position and game-specific skills | 273 |
| 7.2.2.1.4 | Psychological, vision, anticipation and reading of the | |
| | game | 274 |
| 7.2.2.2 Loose | forwards | 274 |
| 7.2.2.2.1 | General | 274 |
| 7.2.2.2.2 | Physical-motor | 275 |
| 7.2.2.2.3 | Position and game-specific skills | 275 |
| 7.2.2.2.4 | Psychological, vision, anticipation and reading of the | |
| | game | 276 |
| 7.2.2.3 Backli | ne players | 276 |
| 7.2.2.3.1 | General | 277 |
| 7.2.2.3.2 | Physical-motor | 277 |
| 7.2.2.3.3 | Position and game-specific skills | 277 |
| 7.2.2.3.4 | Psychological, vision, anticipation and reading of the | |
| | game | 278 |
| 7.2.2.4 Discus | ssion of findings | 279 |
| 7.3 FINAL TE | STING PROTOCOL | 281 |
| 7.3.1 Backgro | ound | 281 |

| 7.3.1.1 Anthro | opometry and physical-motor | 281 |
|---------------------|--|-----|
| 7.3.1.2 Sport- | specific skills | 282 |
| 7.3.1.3 Sport | vision testing | 283 |
| 7.3.2 Sample | group | 283 |
| 7.3.3 Final tes | st protocol | 284 |
| 7.3.3.1 Anthro | opometrical measurements | 284 |
| 7.3.3.2 Physic | cal-motor measurements | 284 |
| 7.3.3.3 Rugby | y-specific self-devised skills tests | 285 |
| 7.3.3.4 Sport | vision tests | 285 |
| 7.3.4 In-depth | discussion of final test protocol | 285 |
| 7.3.4.1 Anthro | opometric measurements | 286 |
| 7.3.4.1.1 | Body mass | 287 |
| 7.3.4.1.2 | Body stature (height) | 287 |
| 7.3.4.1.3 | Skinfold measurements | 287 |
| 7.3.4.2 Physic | cal-motor measurements | 291 |
| 7.3.4.2.1 | Vertical jump | 291 |
| 7.3.4.2.2 | 10m/40m dash | 291 |
| 7.3.4.2.3 | T-Test | 292 |
| 7.3.4.2.4 | 3x5x22m Anaerobic capacity test | 294 |
| 7.3.4.2.5 | Description of the discarded physical-motor tests | 296 |
| 7.3.4.3 Rugby | y-specific self devised skills tests | 296 |
| 7.3.4.3.1 | S-Test (core skills) | 297 |
| 7.3.4.3.2 | Kick for distance and accuracy (core skills) | 300 |
| 7.3.4.3.3 | Description of the discarded sport-specific skills tests | 300 |
| 7.3.4.3.4 | Description of the modified sport-specific skills test | 304 |
| 7.3.4.4 Sport | vision testing | 305 |
| 7.3.4.4.1 | Accuvision 1000 "30 accurate lights in total time" test | 305 |
| 7.3.4.4.2 | Description of the discarded sport vision test | 306 |
| 7.4 STATISTIC | CAL METHODS | 307 |
| 7.4.1 The follo | owing statistical data analysis procedures were used | 307 |
| 7.4.1.1 Descri | iptive statistics | 307 |



| 7.4.1.2 Infer | ential statistics | 307 |
|---------------|---|-----|
| 7.4.1.2.1 | Kruskal-Wallis One-Way Analysis of Variance | 308 |
| 7.4.1.3 Norm | ns | 308 |
| | | |
| CHAPTER E | EIGHT: RESULTS AND DISCUSSION | |
| 8.1 INTROD | UCTION | 309 |
| 8.1.1 Statist | ical data analysis procedures | 310 |
| 8.1.2 Chapte | er outline | 310 |
| 8.2 DESCRI | PTION OF THE DATA BY MEANS OF FREQUENCIES | 311 |
| 8.2.1 Data s | ampling | 311 |
| 8.3 DESCRI | PTIVE STATISTICS OF VARIABLES THAT DID NOT | |
| REMAIN | THE SAME ACROSS MEASUREMENTS OR | |
| VARIABI | LES WITH SMALL BASE SIZES | 315 |
| 8.3.1 Protoc | ol 1/Test 1: Blue Bulls U/21 | 315 |
| 8.3.2 Protoc | ol 2/Test 2: South Africa U/21 | 319 |
| 8.3.3 Protoc | ol 3/Test 3: TUKS Rugby Academy | 321 |
| 8.4 NON-PA | RAMETRIC ONE-WAY ANALYSIS OF VARIANCE | |
| AMONG | ST DIFFERENT GROUPED POSITIONS | 323 |
| 8.4.1 Anthro | ppometric components | 328 |
| 8.4.2 Physic | al-motor components | 333 |
| 8.4.3 Sport v | vision testing | 339 |
| 8.5 NORM T | ABLES OF COMPARABLE VARIABLES | 340 |
| 8.5.1 Norm t | tables of S-test as determined for the second and third | |
| measu | rement combined | 356 |
| 8.5.1.1 Impli | cations of the scoring system for the S-Test | 360 |
| 8.5.1.1.1 | Zero score | 360 |
| 8.5.1.1.2 | Five score | 360 |
| 8.5.1.1.3 | Ten score | 360 |
| 8.5.1.1.4 | Twenty score | 361 |
| 8 6 SLIMMAI | RY OF RESULTS | 362 |

| 8.6.1 Summary of inconsistent tests | | |
|-------------------------------------|---|-----|
| 8.6.2 Summary of o | consistent tests | 364 |
| CHAPTER NINE: | CONCLUSIONS AND RECOMMENDATIONS | |
| 9.1 INTRODUCTION | N | 367 |
| 9.1.1 Chapter outli | ne | 367 |
| 9.2 CONCLUSIONS | S AND RECOMMENDATIONS FROM LITERATURE | 368 |
| 9.2.1 Terms and co | oncepts | 368 |
| 9.2.2 Sport and rug | gby | 369 |
| 9.2.3 Physical pers | pectives | 369 |
| 9.2.3.1 Nature vers | us nurture | 371 |
| 9.2.4 Psychologica | ıl perspectives | 373 |
| 9.2.5 Talent identif | ication | 374 |
| 9.2.5.1 Talent ident | tification in SANZAR | 375 |
| 9.3 CONCLUSIONS | S AND RECOMMENDATIONS FROM THE EMPIRICA | ٩L |
| INVESTIGATIO | N | 376 |
| 9.3.1 Interviews wi | th coaches and conditioning specialists | 376 |
| 9.3.2 Test protocol | evolution | 377 |
| 9.3.3 Results obtai | ned | 377 |
| 9.3.1.1 Discarded t | ests | 377 |
| 9.3.3.2 Final test p | rotocol | 378 |
| 9.4 CONCLUSIONS | S AND RECOMMENDATIONS REGARDING STUDY | |
| HYPOTHESIS | | 379 |
| BIBLIOGRAPHY | | 380 |



LIST OF FIGURES

| FIGURE | PAGE |
|---|------|
| Figure 4.1: Developmental Model of Sport Participation | |
| (Côté et al., 2007:197) | 123 |
| Figure 4.2: Button and Abbott's (2007) Stages of Development | |
| previously identified within sport | |
| (adapted from Bloom, 1985 & Côté, 1999) | 125 |
| Figure 7.1: Illustration of the T-Test for agility | 293 |
| Figure 7.2: Illustration of the S-Test for passing accuracy | 299 |
| Figure 7.3: Illustration of the kick for accuracy (quadrant) test | 302 |
| Figure 7.4: Illustration of the scrumhalf tyre pass test | 303 |
| Figure 8.1: Differences between positions on anthropometrical | 329 |
| components | 329 |
| Figure 8.2: Differences between positions on anthropometrical | |
| Components | 330 |
| Figure 8.3: Differences between positions on physical- motor | |
| components (only best efforts) | 335 |
| Figure 8.4: Differences between positions on 3x5x22m | |
| Anaerobic Capacity Test | 338 |



Figure 8.5: Differences between positions on the Accuvision1000 "30 lights in fastest time" test (best efforts only)

340



LIST OF TABLES

| TABLE | | PAGE |
|-------------------|--|------|
| Table 4.1: | Heritability and genetic estimates on selected motor, physical and physiological abilities and variables | 98 |
| Table 4.2: | Characteristics of talented performers (and their mentors and parents) at various stages of their careers (Bloom, 1985). | 115 |
| Table 6.1: | Testing protocol of South African Rugby Union | 252 |
| Table 6.2: | Testing Protocol of New Zealand Rugby Union | 257 |
| Table 6.3: | Testing protocol of Australian Rugby Union | 261 |
| Table 6.4: | Performance rating scale of the ARU for rugby-specific Skills (Provided by Ben Whitaker, ARU) | 263 |
| Table 7.1: | Body fat % versus skinfold thickness-male subjects (Harpenden Skinfold Caliper, 2007:npn) | 290 |
| Table 8.1: | Teams included in the study | 312 |
| Table 8.2: | Grouped positions | 313 |
| Table 8.3: | Age | 313 |
| Table 8.4: | Injuries indicated by players | 315 |



| Table 8.5: Descriptive statistics for protocol one/test one-varia | ibles | |
|--|-----------|-----|
| changed and with small base sizes (Blue Bulls U/21) |) | 317 |
| Table 8.6: Descriptive statistics for protocol two/test two-varia | bles | |
| changed and with small base sizes (South Africa U/2 | 21) | 320 |
| Table 8.7: Descriptive statistics for protocol three/test three-va | ariables | |
| changed and with small base sizes (TUKS Rugby Ad | cademy) | 322 |
| Table 8.8: Results of Kruskall-Wallis Test on anthropometrical components | | 325 |
| Table 8.9: Descriptive statistics per group on anthropometrica components | ı | 326 |
| Table 8.10: Results of Kruskall-Wallis Test on physical-motor (best- effort) | variables | 331 |
| Table 8.11: Descriptive statistics per group on physical-motor variables (best effort) | | 332 |
| Table 8.12: Results of Kruskall-Wallis Tests on 3x5x22m Anael capacity test | robic | 336 |
| Table 8.13: Descriptive statistics per group on 3x5x22m Anaer capacity test | obic | 337 |
| Table 8.14: Results of Kruskall-Wallis Test on Accuvision 1000 accurate lights in fastest time test" |) "30 | 339 |
| Table 8.15: Descriptive statistics per group on Accuvision1000 |) "30 | |
| accurate lights in fastest time test" | | 339 |
| Table 8.16: Norms for tight-forwards on anthropometrical com | ponents | 344 |
| Table 8.17: Norms for tight-forwards on physical-motor: vertic | al jump | 345 |



| Table 8.18: | Norms for tight-forwards on physical-motor skills: | |
|-------------|--|-----|
| | 10/40m dash and T-Test | 346 |
| Table 8.19: | Norms for tight-forwards on physical-motor skills: | |
| | 3x5x22m Anaerobic Capacity and sport vision | |
| | skills: Accuvision1000 "30 lights in fastest time" test | 347 |
| Table 8.20: | Norms for loose-forwards on anthropometrical | |
| | Components | 348 |
| Table 8.21: | Norms for loose-forwards on physical-motor skills: | |
| | vertical jump | 349 |
| Table 8.22: | Norms for loose-forwards on physical- motor skills: | |
| | 10/40m dash and T-Test | 350 |
| Table 8.23: | Norms for loose-forwards on physical-motor skills: | |
| | 3x5x22m Anaerobic Capacity and sport vision | |
| | skills: Accuvision1000 "30 lights in fastest time" test | 351 |
| Table 8.24: | Norms for backs on anthropometrical components | 352 |
| Table 8.25: | Norms for backs on physical-motor skills: vertical jump | 353 |
| Table 8.26: | Norms for Backs on Physical Motor Skills – Dash and T-test | 354 |
| Table 8.27: | Norms for backs on physical-motor skills: 3x5x22m | |
| | Anaerobic Capacity and sport vision skills: | |
| | Accuvision1000 "30 lights in fastest time" test | 355 |



| Table 8.28: | Mean scores on recoded time taken to complete the | |
|-------------|--|-----|
| | S-Test per positional grouping | 358 |
| Table 8.29: | Frequencies for tight-forwards best attempt on S-Test computed total | 358 |
| Table 8.30: | Frequencies for loose-forwards best attempt on S-Test computed total | 359 |
| Table 8.31: | Frequencies for backs best attempt on S-Test computed total | 359 |

LIST OF APPENDICES-See Attached CD

| APPENDIX A: Questionnaire Pertaining to Talent Identification | |
|---|----|
| Structures in South African/New Zealand/Australian Rugby | CD |
| APPENDIX B: Interview form for DPhil study | CD |
| APPENDIX C: Final test protocol | CD |
| APPENDIX D: Descriptive statistics per group per variable | CD |
| APPENDIX F: Simulated data | CD |