The Associations between Sport Commitment, Explanatory Style, Physical Self-Concept and Athlete Selection and Acceptance in a Cycling Talent Identification Program

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The Associations between Sport Commitment, Explanatory Style, Physical Self-Concept and Athlete Selection and Acceptance in a Cycling Talent Identification Program

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Degree of

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ABSTRACT

The purpose of this study was to determine if anthropometric, performance and psychological measures could predict selection and acceptance of participants in a Talent Identification (TID) program for cycling. Participants (n = 72; male = 46; female = 26; age = 15.4 ± 2.0 yrs) underwent measurements of height, body mass, maximal aerobic power, sprint running speed, leg power, sport commitment, explanatory style and physical self-concept. Discriminant function analysis was used to determine which of these variables related to both selection and acceptance into the cycling TID squad. Maximal aerobic power, running speed, and leg power made significant (p <.05) contributions to selection into the TID program. Sport commitment was predictive of accepting the invitation into the TID program. The results suggest that although physical performance capacities were predictive of selection into the TID squad, sport commitment was the greatest predictor of acceptance. The findings suggest the importance of considering psychological measures in the initial phase of a TID program.

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CHAPTER ONE: INTRODUCTION

1.0 BACKGROUND

The recent 2008 Beijing Olympics may have audiences pondering the origins of the participating athletes' extraordinary talents. Understanding the collective integration of mechanisms and processes that underpin the identification and subsequent development of elite sporting performance remains a complex challenge for the sport scientist (Ollis, Macpherson, & Collins, 2006).

The aim of a talent detection/identification (TID) program is to provide an accurate prediction of those athletes who have the potential to reach an elite level in sport (Abbott, Collins, Martindale, & Sowerby, 2002). The Australian Sports Commission (ASC) TID program currently evaluates young athletes on anthropometric and performance tasks to identify individuals who exhibit the characteristics associated with success within a specific sport (Hoare, 1998). This process of TID is then followed with a talent development program in which selected athletes are placed in an accelerated and fast-tracked program of athletic development (Hoare, 1995).

Effective TID processes are vital to ensure resources are available to help athletes develop and limit the costs associated with dropout or failure to achieve (Abbott & Collins, 2004). However, there appears a lack of consensus both nationally and internationally regarding the theory and methodology of TID (Tranckle & Cushion, 2006). Sport-specific TID literature has been driven by the assumption that the underlying factors necessary for sport excellence exist at an early age. Researchers have thus tried to determine the abilities, traits and structures that might predict elite athletic performance (Regnier, Salmela, & Russell, 1993).

Researchers agree that sporting talent is a complex attribute that is genetically determined, complicated in structure, and subject to environmental conditions (Hoare, 2000; Reilly, Williams, Nevill, & Franks, 2000; A. M. Williams & Reilly, 2000; Abbott & Collins, 2002, 2004; Falk, Lidor, Lander, & Lang, 2004; Abbott, 2005; Critien & Ollis, 2006; Ollis et al., 2006; Pearson, Naughton, & Torode, 2006; Tranckle & Cushion, 2006). In establishing effective TID systems, national governing bodies and funding agencies need to recognise the multidimensional and dynamic nature of sporting talent, and promote the range of factors that enable children to develop into successful elite level performers (Simonton, 1999; Abbott & Collins, 2004; Abbott, 2005).

Practitioners and sport scientists accept that sporting expertise is governed by a multiplicity of biomechanical, physiological, anthropometric and psychological factors (Abbott & Collins, 2004). Despite the acknowledged complex nature of talent, current TID processes typically focus on a limited range of anthropometric and performance variables (Gore, 1998). These variables typically fail to include psychological characteristics that are required to achieve sporting excellence (Simonton, 1999; A. M. Williams & Reilly, 2000; Abbott & Collins, 2002; Baker, Horton, Robertson-Wilson, & Wall, 2003; Abbott & Collins, 2004; Abbott, 2005).

The current TID selection process in Australia is unidimensional in nature with a strong emphasis on anthropometric and performance measures of talent (Abbott & Collins, 2002). Despite unidimensional research still being popular (Pienaar, Spamer, & Steyn, 1998; Aitken & Jenkins, 1998; Hoare & Warr, 2000; Grove, 2001; Staerck, 2003; Falk et al., 2004; Lidor et al., 2005; Vaeyens et al., 2006; De Albuquerque & Farinatti, 2007; Gabbett, Georgieff, & Domrow, 2007; Stuelcken, Pyne, & Sinclair, 2007; Di Cagno et al., 2008; Mikulic & Ruzic, 2008; Veale,

Pearce, Koehn, & Carlson, 2008), an increasing number of researchers are examining the interaction between multidimensional determinants of talent, which include anthropometric, physiological, biomechanical, and psychological aspects of participation and performance (Reilly et al., 2000; Nieuwenhuis, Spamer, & Rossum, 2002; Holt & Dunn, 2004; Elferink-Gemser, Visscher, Lemmink, & Mulder, 2007).

TID procedures tend to be employed with children and adolescents at as early an age as possible in order to provide the ten years of developmental opportunities that research has suggested is required to excel in sport (Ericsson, Krampe, & Tesch-Romer, 1993; Starkes, 2000). However the necessity of identifying children during their pubescent years confounds a major criterion that is subsequently used to predict performance potential during adolescence (Simonton, 1999; Abbott et al., 2002; Abbott & Collins, 2002; Abbott, 2005). Specifically research has clearly shown that the anthropometrical and physiological factors that are assessed initially during puberty as being advantageous to performance in sport are highly unstable during adolescence (Ackland & Bloomfield, 1996).

Whilst motor abilities underpin skill acquisition, psychological factors appear to be the main determinants of an individual's potential within a sport (Abbott et al., 2002). While anthropometric and physiological measures are known to play a role in TID, the psychological disposition of an individual characterises the means by which they interact with their environment, and therefore the extent that they make the most of the opportunities they are given (Simonton, 1999; Abbott & Collins, 2002; Ziegler & Heller, 2002; Abbott et al., 2002; Abbott & Collins, 2004; Abbott, 2005).

A range of psychological characteristics appear to underpin an individual's true potential for growth (Abbott & Collins, 2004). However researchers have yet to identify specific personality characteristics, or a psychological profile that can predict subsequent success in sport (A. M. Williams & Reilly, 2000). Currently, there appears to be no psychological inventory to help select individuals with more or less potential for sporting success. Moreover, it is unlikely that any single inventory would have complete predictive power for sporting success.

Previous investigations linking psychological factors and sporting performance have focused on comparing elite and non-elite athletes (Vealey, 1992; Ikuleyo & Vipene, 1996) or successful and unsuccessful athletes (Schurr, Ashley, & Joy, 1977; Panda & Bisivas, 1989). Such approaches assume that the psychological qualities important for success as an adult athlete can be used to identify adolescents for early selection. However at present there is no evidence that psychological characteristics remain stable from adolescence to adulthood in the context of elite sport (Regnier et al., 1993).

Given the propensity for psychological characteristics to be unstable during adolescence (Regnier et al., 1993), a possible better approach to assessing psychological predictors of future sporting success may be to identify aptitudes predictive of the ability to cope with the many hours of training crucial to ensure success. These aptitudes could be measured early in the TID process as they are required to overcome the motivational and effort constraints evident during highly intensive and prolonged training (Ericsson et al., 1993).

Theorists propose that the psychological constructs of commitment and persistence in times of adversity are paramount to sporting success (Ericsson et al., 1993; Csikszentmihalyi, 1993;

Patrick et al., 1999; Howe, 2001). Sport commitment reflects the desire and resolve to persist in a sporting endeavour over time and may be indicative of the athletes' dedication to further develop their potential (Scanlan & Simons, 1992). Furthermore, individuals with an optimistic explanatory style when confronted with a challenge are likely to adopt an outlook of confidence and persistence while pessimists are doubtful and hesitant (Gould, Dieffenbach, & Moffett, 2002). An adolescent's physical self-esteem (known as physical self-concept) is also considered a major determinant of future motivated behaviour in sport (M. R. Weiss & Horn, 1990). When an individual feels a sense of efficacy in a physical domain, they tend to manifest ensuing motivated behaviour in that particular activity (M. R. Weiss & Horn, 1990). Such motivation is paramount to the long term success of a talent development program.

In summary current TID practices in Australia are based on a unidimensional approach. This approach measures anthropometric and physiological characteristics that have been shown to be unstable during adolescence. It is suggested that this model could be extended to a multidimensional approach which includes psychological measures indicative of an athlete's ability to cope with the many hours of training crucial to ensure success.

1.1 PURPOSE OF THE STUDY

The purpose of the present study was to determine if a range of anthropometric, performance and psychological measures (sport commitment, explanatory style and physical self-concept) can discriminate between successful and unsuccessful 13 – 21 year olds in terms of selection and acceptance into a TID program for cycling.

1.2 SIGNIFICANCE OF THE STUDY

The identification of talent in sport is viewed as a panacea for the development of successful elite level athletic performance, particularly in countries like Australia that do not have the luxury of selecting from a large population base (Simonton, 1999). The current study is the first to incorporate psychological measures into an established National TID program. To date, Australia has experienced great success from its TID program. This present study is aimed at refining the TID processes which underpin and broaden our conceptualisation of talent.

1.3 HYPOTHESES

Three hypotheses were generated in relation to the present study:

1. anthropometric and performance measures will discriminate between the selected and non-selected athletes;
2. psychological measures of sport commitment, physical self-concept and explanatory style will discriminate between the selected and non-selected athletes; and,
3. psychological measures of sport commitment, physical self-concept and explanatory style will discriminate between those athletes that accept the invitation into the TID program and those that decline.

1.4 ASSUMPTIONS

The following assumptions were made in the present study:

1. Participants followed the given directions when answering questionnaires.
2. Participants fully understood all the items in the questionnaires.
3. Participants answered all questions honestly and by themselves.

1.5 DELIMITATIONS

The following delimitations apply to this study:

1. Age group was delimited to athletes between 13 and 21 years of age.
2. Only athletes wanting to participate in a Cycling Talent Identification Program were included in the study.
3. Athletes were required to be residents of Rockhampton, Central Queensland.
4. Measures were only taken in the first phase of the TID program.

1.6 LIMITATIONS

The following limitations apply to this study:

1. Small sample size.
2. Reliance on young athlete's subjective responses to the psychology-based questionnaires.
3. Cross-sectional study design limits the generalisability of findings.

1.7 OPERATIONAL DEFINITIONS

Following are operational definitions of key terms which were utilised:

Talent Detection: Discovery of potential athletes who are not currently involved in the sport in question.

Talent Identification: Recognising current participants with the potential to become elite performers. Predicting performance over various periods of time by measuring physical, physiological, psychological and sociological attributes (Regnier et al., 1993).

TID: The combined process of both talent detection and talent identification. "TID" is an umbrella term used by the Australian Sports Commission to describe the detection of athletes not already involved in a sport and the identification of athletes currently within a sport.

Talent Development: Providing athletes with a suitable learning environment so that talent can be realised.

Talent Selection: Ongoing process of identifying at various stages individuals who demonstrate prerequisite levels of performance.

CHAPTER TWO: LITERATURE REVIEW

2.0 INTRODUCTION

This chapter presents an overview of the research literature relevant to the present study. Firstly, the review begins with a brief history of TID and the progression from the historical approach to the modern scientific approach. Secondly, the modern scientific approach is explored with a review of the conceptual models of talent detection and how these have been translated into the unidimensional and multidimensional studies undertaken by researchers. Thirdly, the limitations of the current scientific approach will be highlighted and the psychological predictors of sports performance reviewed. Finally, the current practices of TID in Australia are summarised and the dichotomy between theory and practice discussed.

2.0.1 Definition of Talent

In an earlier review of the role of talent, Howe and colleagues (1998) suggested an operational working definition of talent:

1. It originates in genetically transmitted structures and hence is at least partly innate.
2. Its full effects may not be evident at an early stage, but there will be some advance indications, allowing trained people to identify the presence of talent before exceptional standards of mature performance have been demonstrated.
3. These early indications of talent provide a basis for predicting who is likely to excel.
4. Only a minority are talented. If all children were talented, then there would be no way to predict or explain differential success.

5. Talents are relatively domain-specific.

These properties highlight the complex nature of talent and illustrate why there is currently no consensus of opinion regarding the theory and practice of TID in sport (A. M. Williams & Reilly, 2000).

2.1 HISTORY OF TALENT IDENTIFICATION

Identifying talented athletes has been operating since organised competitive sport began (Hoare, 1998). The process of identifying athletes has changed from an unstructured process that identified athletes through competition, to more systematic, structured TID and development programs (Ibrahaim, 2007).

2.1.1 Historical Approach

'Natural selection' is a term used by many authors to describe the traditional approach taken by many countries in the identification of athletes in sport (Bompa, 1994, 1999). This 'natural' approach identifies individuals already competing in a sport and is typically carried out by coaching staff. The natural approach is subjective and although the ability of coaches to identify talent should not be underestimated (A. M. Williams & Reilly, 2000), this process excludes those individuals that may have the psychobiological criteria to excel in a sport but have yet to undertake physical training (Abbott et al., 2002). Eastern European countries were the first to move away from this traditional approach which has persisted in western countries until this day (Abbott et al., 2002).

2.1.2 Scientific: Modern Approach

In the late 1960s and 1970s many Eastern European countries (Romania, Bulgaria, German Democratic Republic, Union of Soviet Socialist Republics) implemented state run, systematic TID programs which were founded on scientific theory and evidence (Bompa, 1999). The large number of medals won by these countries at the Olympic Games in the 1970s and 1980s were considered a direct outcome of the scientific selection process adopted in the late 1960s (Bompa, 1994). The scientific approach was focused on identifying the criteria for elite performance in sport as well as the optimal environment to nurture this criteria with the expectation of producing a larger number of outstanding performers (Abbott et al., 2002).

The most systematic TID program for sport was developed by the former German Democratic Republic (Hoare, 1998). The implementation of this highly structured and organised program included compulsory participation in physical education in schools, allowing for the early identification and specialisation of children in sports (Hoare, 1998). Selection into the program was on the provision that the child was healthy and free of medical anomalies; could tolerate high training loads; had a psychological capability for physical training; and maintained good academic achievement levels (Abbott et al., 2002). The selection and elimination of individuals was a continuous process with athletes reviewed at each stage of development with the inclusion of physical and performance measures correlated with success in that sport (Abbott & Collins, 2002). From a government level, substantial resources both financial and material were provided to ensure athlete development within these programs (Kozel, 1996).

The success of these programs has been attributed to the attention given to the foundation and development phases of the TID program (Abbott, 2005). The foundation training phase involved

a variety of sporting activities undertaken in early childhood, with the focus on developing general motor skills. The second development phase took on a more specialised approach, with the young athlete undertaking specific training in a sport, but also continuing involvement in other activities to ensure versatility (Thomson, 1992).

The sporting success achieved by Eastern Europe led to the increased deployment of systematic TID programs worldwide (Abbott & Collins, 2002). These programs adopted by western countries used similar procedures of mass screening tests consisting of general motor and physical tests; followed by sports-specific and sport-suitability tests, and finally, a sport-specific development program (Hoare, 1995).

2.1.3 Four stages in the pursuit of excellence

In a review on talent research, Williams and Reilly (2000) suggest four stages in the pursuit of sporting excellence: talent detection, identification, development, and selection (see Figure 1).

Talent detection refers to the discovery of potential performers who are currently not involved in the sport in question (A. M. Williams & Reilly, 2000). Talent identification refers to the process of recognising young athletes with the potential to become elite athletes whereas talent development implies that these athletes are provided with a suitable learning environment and resources so that they have the opportunity to realise their potential (Regnier et al., 1993). Finally, talent selection involves the ongoing process of identifying athletes at various stages who demonstrate prerequisite levels of performance for inclusion in a development squad (A. M. Williams & Reilly, 2000).

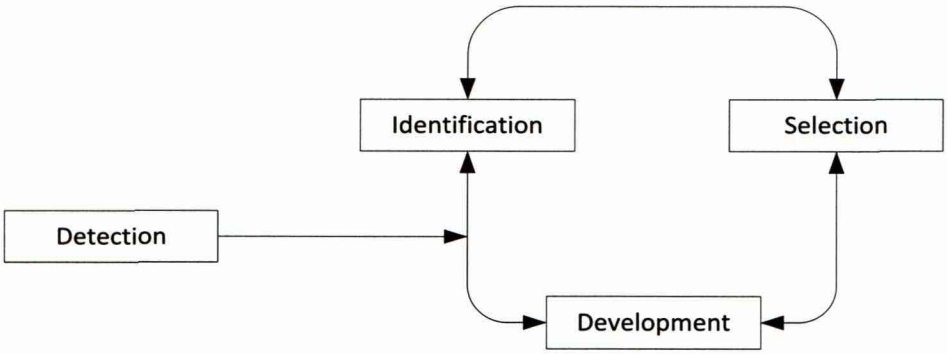


Figure 1: Key stages in talent identification and development process (adapted from A. M. Williams & Franks, 1998).

2.1.4 Talent detection conceptual models

Following is a review of sport talent detection models. These conceptual models were designed to identify the presumed underlying performance determinants and to search for those determinants within a population of potential athletes.

2.1.4.1 Harre's Model. The German researcher Harre's (1982) detection model is based on the assumption that physical training orients the developmental process of young athletes, thus allowing for the emergence of their talent. Harre recognised that physical attributes outside of the training environment are important and that athletic talent must be nurtured by the positive influence from both parents and peers. Harre suggested the following rules and principles for talent detection:

1. Talent detection is done in two stages – a general stage where children demonstrate all-around athletic ability; and, a more specific stage where individuals are classified according to skills associated with certain classes of sports. Classification of talent is

dependent on objective testing of the children's reaction to the physical training program.

2. Talent detection must rely on heredity to some extent when identifying critical factors that play a decisive role in top-level sports performance.
3. Characteristics and abilities of the children should be evaluated in relation to their biological maturity.
4. Talent detection should rely on physical, sociological and psychological variables which can help an athlete succeed. Attitude, participation in extra-curricular sporting activities and the socialist personality type are also additional factors.

Harre's (1982) detection model is carried out in two stages. The first is general detection from performance factors and the second stage is the confirmation of sports aptitudes during a physical training program. To determine a child's talent, the level of sports performance reached in the program, the rate of performance improvement, stability of performance under changing conditions and the reaction to physical training demands is measured to ascertain if elite level status in that sport is possible. This procedure depicts a close relationship between talent detection and talent development. Thus, Harre's model is considered one of the most complete sport talent detection models found in literature (Regnier et al., 1993).

2.1.4.2 Havlicek, Komadel, Komarik, and Simkova's Model. This Czechoslovakian model (Havlicek, Komadel, Komarik, & Simokova, 1982) is a similar approach to that of Harre (1982). The authors suggest ten principles for talent detection that are summarised below:

1. The objective of talent detection is to ensure that talented individuals in a sport train for that sport.
2. The following steps are crucial: (a) identification of children in physical education classes; (b) specialisation in a sports family (i.e. like sports) depending on abilities and attributes; (c) specialisation in one sport; and (d) determination of the probability of success in that sport.
3. Specialisation in sport should not be too early; adoption to a 'sports family' is the first step.
4. Detection criteria should rely on indicators of talent that have a strong genetic influence, development stability and demonstrated predictive value. Since an individual's ability is influenced by life conditions and previous training techniques, relying on genetic factors alone is not recommended.
5. Sports performance is multidimensional and thus all sport sciences should contribute to talent detection.
6. There is a hierarchy of predictive factors such as initial height, then speed and then unstable factors such as motivation.
7. The largest population base of potential athletes should be used.
8. Talent detection must be done in a humanitarian and democratic approach.
9. Talent detection should be planned and managed carefully.
10. Talent detection has to be done within a larger context of talent development.

Like Harre (1982), Havlickek's et al., (1982) model recognises the multidimensional nature of sport performance. They also highlight the importance of genetically-dependant and performance-related factors in talent detection. However, contrary to Harre's (1982) model, Havlickek and colleagues propose that relying exclusively on heredity factors is a mistake. This strategy is thus considered more realistic and less limiting that Harre's model (Regnier et al., 1993).

2.1.4.3 Gimbel's Model. The German model developed by Gimbel (1976) proposes that talent should be considered from three perspectives, (a) physiological and morphological variables, (b) trainability, and (c) motivation. Gimbel suggests that genetic factors are essential but that they can be muted by non-favourable environmental conditions. The model consists of four key principles:

1. Identify morphological, physical and psychological factors underlying performance for as many sports as possible.
2. Test children in schools on these variables and then guide children towards the best-fit model.
3. During a one to two-year physical training program, monitor children's progress by testing regularly. Any dropouts from the program are considered a natural consequence considering the psychological demands of training.
4. At the end of the training program each child's probability of success is predicted. A positive prognosis will see the athlete placed in an intensive training program. A

negative prognosis will see another year of training to be undertaken before a final decision is made.

Gimbel introduced the extension of the training period for the maturing athlete. This is one way to deal with the varying developmental rates among children entering adolescence (Regnier et al., 1993).

2.1.4.4 Montpetit and Cazorla's Model. Canadian and French scientists (Montpetit & Cazorla, 1982) proposed an improved version of Gimbel's model and applied it directly to swimming. Montpetit and Cazorla (1982) suggest that a profile of a top-level swimmer for each event should be identified and then through longitudinal studies the stability of these variables can be verified. This model supports the notion that underlying performance factors can be predicted. It also supports Gimbel's (1976) approach of ensuring extended periods of training for those athletes who are late maturers.

2.1.4.5 Dreke's Model. Dreke (1982) suggested a three-step approach to sport talent detection. The first step involved pre-selection and takes into consideration the general health status, academic achievement, sociability, somatotype and agility of the participant. The second step is the matching of the somatotype to an appropriate sport. The final step involves the child undergoing a physical training program during which their performance and psychological adaptation to training is evaluated. When compared to the three previous models, Dreke's model does not introduce any new concepts. However it is interesting to note that the evaluation of the reaction to the psychological demands of training is highly correlated to the practical models used in Eastern European countries (Regnier et al., 1993).

2.1.4.5 Bompa's Model. Bompa's (1985) model was strongly influenced by his observations of the use of talent detection in Eastern Europe and assumes that sports performance is determined by three factors: (a) motor capacities (perceptual and motor skills), (b) physiological capacities (endurance, strength and power), and (c) morphological attributes. Bompa's model is the only model where psychological variables are not considered. Bompa suggests that detection of potential champions can be made by directly comparing their physiological and morphological profiles to those of elite athletes.

2.1.4.6 Geron's Model. Geron's (1978) model is similar to both Gimbel (1976) and Montpetit and Cazorla (1982) models. That is, the profile of an elite athlete in a given sport is firstly determined, and then these genetically-related variables are assessed through longitudinal studies. Additionally, the age periods when the variables are most stable should also be identified. Geron (1978) highlights that the success-related variables to be identified must take into consideration that the characteristics of a current champion and the characteristics required to become a champion are different.

2.1.4.7 Bar-Or's Model. Bar-Or (1975) proposed a five-step approach to sport talent detection:

1. Evaluate children on a series of morphological, physiological, psychological, and performance variables.
2. Consider the biological age of the child when evaluating the results.
3. Test the reaction to training with the exposure to a short training program.
4. Evaluate family history, for example height and sporting activities.

5. Use multiple regression analysis models to predict performance from results on the first four steps.

Bar-Or does not specify what should be used as performance criteria, nor is sport-specific task analysis mentioned (Regnier et al., 1993).

2.1.4.8 Regnier's Guiding Principles. In the well known, and probably most extensive contribution to talent detection and development in sports to date, Regnier and colleagues (1993) reviewed the above sporting talent detection models and proposed the following six guiding principles:

1. Talent detection should be viewed as a process within the larger context of talent development.
2. Talent detection rests on a long-term prediction of an individual's performance.
3. Talent detection must take into account each sport's specific demands.
4. Since sport performance is multifaceted, talent detection must rely on a multidisciplinary approach.
5. Talent detection must assign a significant role to performance determinants that are strongly determined by genetics.
6. It must take into account the dynamic aspects of performance. That is, the relative contribution of performance determinants changes with age, and some performance determinants can improve through training and development.

Regnier and colleagues (1993) guiding principles to talent detection has contributed greatly in shaping the methodology that later investigators have used in TID research.

2.1.5 From unidimensional to multidimensional approaches

The talent detection models and Regnier's guiding principles described above have strongly influenced the methodology undertaken by more recent investigators in TID research. These models emphasised that sporting talent is based in some part on a genetic or innate predisposition that is responsive to training intervention. This conclusion has been the basis of many studies incorporating both anthropometric and physiological measures as predictors of sporting talent. These studies have been based on the pretext of matching young people whose physiques and body proportions match profiles of elite performers. Investigations to date have followed Regnier and colleagues (1993) suggestion that to predict the future performance of participants in sport, investigators must take as its starting point the present characteristics and abilities.

The majority of the research examining TID has been conducted from the 1990s onwards. Thus, in the past two decades the investigations linking anthropometric and physiological factors to sporting performance have focused on comparing elite and non-elite athletes and selected versus non-selected athletes for squads or successful opposed to unsuccessful athletes. Research on TID has been published for baseball (Thompson, Barnsley, & Stebelsky, 1991; R. E. Smith & Christensen, 1995; Grove, 2001), basketball (Hoare, 2000), cricket (Stuelcken et al., 2007), field hockey (Nieuwenhuis et al., 2002; Keogh, Weber, & Dalton, 2003; Elferink-Gemser et al., 2007), fencing (Tsolakis, 2006), gymnastics (De Albuquerque & Farinatti, 2007), hammer throwing (Staerck, 2003) , handball (Lidor et al., 2005), judo (Lidor, Melnik, Bilkevitz, Arnon, & Falk, 2005b), kayaking (Aitken & Jenkins, 1998), lacrosse (Vescovi, 2007), power lifting (Keogh, Hume, Pearson, & Mellow, 2007), rowing (Hahn, 1990; Falk et al., 2004; Mikulic & Ruzic, 2008),

, rugby (Pienaar & Spamer, 1996; Hare, 1997; Van der Merwe, 1997; Pienaar et al., 1998; Gabbett, 2002a, 2002b; Gabbett & Herzig, 2004; van Gent & Spamer, 2005; Ollis et al., 2006; Veale et al., 2008), soccer (Jankovic, Matkovic, & Matkovic, 1997; Panfil, Naglak, Bober, & Zaton, 1997; Badenhorst, 1998; Janssens, Van Renterghem, Bourgois, & Vrijens, 1998; A. M. Williams & Franks, 1998; Reilly et al., 2000; A. M. Williams & Reilly, 2000; Hoare & Warr, 2000; Morris, 2000; Helsen, Hodges, Van Winckel, & Starkes, 2000; Davids, Lees, & Burwitz, 2000; Thelwell, Greenlees, & Weston, 2006; Vaeyens et al., 2006; Gil, Ruiz, Irazusta, Gil, & Irazusta, 2007), tennis (Van Den Berg, 2006), volleyball (Thissen-Milder & Mayhew, 1991; D. J. Smith, Roberts, & Watson, 1992; Gabbett & Georgieff, 2005; Gabbett et al., 2007; Lidor, Hershko, Bilkevitz, Arnon, & Falk, 2007), and water-polo (Falk et al., 2004). Table 1 is a summary of studies in these sports that have in the context of TID investigated the predictive capability of different factors to distinguish outstanding performance in athletes. To date, no research on the measures to include in a cycling TID program has been conducted.

Soccer and rugby are the most common sports investigated (Badenhorst, 1998; Davids et al., 2000; Gil et al., 2007; Helsen et al., 2000; Hoare & Warr, 2000; Jankovic et al., 1997; Janssens et al., 1998; Morris, 2000; Panfil et al., 1997; Reilly et al., 2000; Thelwell et al., 2006; Vaeyens et al., 2006; Williams & Franks, 1998; Williams & Reilly, 2000; Gabbett, 2002a, 2002b; Gabbett & Herzig, 2004; Hare, 1997; Ollis et al., 2006; Pienaar & Spamer, 1996; Pienaar et al., 1998; Van der Merwe, 1997; van Gent & Spamer, 2005; Veale et al., 2008). This is interesting since early TID research was considered only appropriate for individual, repetitive sports (Hoare, 1995).

The results of these studies are not conclusive. The majority of these investigations used a unidimensional approach, attempting to identify anthropometric and physiological variables

Table 1: Summary of studies in sport using anthropometric and physiological measures to distinguish talent.

Sport	Author, Year	Country	Participants	Purpose	Test Items	Summary results
Rowing	(Hahn, 1990)	Australia	N = 500 Age=14 to 16 yrs	Select a squad of 24 (12 male and 12 females) for a talent development program	7 anthropometric, 2 physiological tests	Tests initially conducted in 1988, final selection of athletes was in 1990 (age = 16 to 18 yrs). Athletes competed at 1992 Olympics.
	(Mikulic & Ruzic, 2008)	Croatia	N = 48 (male) Age= 12 to 14 yrs	Predict rowing performance and determine the key parameters for TID in rowing	12 anthropometric, 6 physiological tests	Model comprising of the measures predicted 85% of the variance in selection. Higher aerobic capacity and larger body size beneficial for performance.
Artistic Gymnastics	(De Albuquerque & Farinatti, 2007)	Brazil	N = 55 (female) Age= 5 to 9 yrs	Examine variables for inclusion in TID program	22 skill tests	From the 22 tests a factor analysis revealed 8 measures that were validated for use in a simplified talent selection model.
Kayaking	(Aitken & Jenkins, 1998)	Australia	N=234 (m=137, f=97) Age=13 to 14 yrs	Identify children (10 talented, 10 not-talented) to enter 12 week development program and assess variables predictive of 'potential'	5 anthropometric, 2 physiological	Talented boys with more favourable anthropometric profile demonstrated greater improvements in 1 physiological test over 12 weeks.
Fencing	(Tsolakis, 2006)	Greece	N=152(m=84, f=68) Age=10 to 22 yrs	Establish anthropometric profile of young fencers in four different age groups to assist in TID	6 anthropometric tests	Lack of significant difference between males and females for 10-13 years groups in most of anthropometric characteristics should be taken into account for talent selection.
Lacrosse	(Vescovi, 2007)	USA	N=84 (female) Age=18 to 21 yrs	Describe anthropometrical and physical performance characteristics of college players	2 anthropometric, 4 physiological	Tests used did not discriminate players on their positions in the team.
Judo	(Lidor et al., 2005b)	Israel	N = 10 (male) Age=12 to 15 yrs	Examine benefits of a unique judo-specific ability test of athletes	3 anthropometric, 5 physiological, 2 skill tests	Measures taken 3 times over 8 months. No significant correlations found between performance in

				in talent development program		testing and the ranking of the judokas.
Power Lifters	(Keogh et al., 2007)	New Zealand	N = 54 Age = 20 to 51 yrs	Examine anthropometric profiles to assist with TID	37 anthropometric tests	Significant differences found between lightweight, middleweight and heavy weight power lifters.
Volleyball	(Lidor et al., 2007)	Israel	N = 15 (male) Age=16 yrs	Examine contribution of variables to early phases of TID	2 anthropometric, 8 physiological, 2 skill tests	Measures taken 6 times over 15 months. Comparisons between non-starters and starters were significant in all but two tests.
Cricket	(Stuelcken et al., 2007)	Australia	N=52 (m=26, f=26) Age = 22 to 24 yrs	Comparing elite level athletes to assist in TID	6 anthropometric measures	Anthropometric profile for male cricketer was significant, female non-significant
Hammer throwing	(Staerck, 2003)	United Kingdom	N=32 (female) Age = 13 to 32 yrs	Develop profile for TID comparing elite and non-elite athletes	5 anthropometric, 2 skill tests	Significant differences only in skill tests of rotation and speed.
Handball	(Lidor et al., 2005)	Israel	N=405 (m=279, f=126) Age=12 to 13 yrs	Selection process for junior national team	2 anthropometric, 5 physiological, 1 skill test	Only slalom dribbling predictive of national success 2 to 3 years later.
Baseball	(Grove, 2001)	Australia	Study 1: N=40 (male) Age= 14.5 to 18 yrs Study 2: N=72(male) Age=19 to 21 yrs	Identify physical capacity tests related to baseball to be used for TID	5 physiological	Significant differences were found between professional players and junior players on two power measures.
Tennis	(Van Den Berg, 2006)	South Africa	N= 25 (female) Age= 12 to 13 yrs	Determine the effect of biological maturation on the motor performance and physical TID determinants of u-14 provincial, girl tennis players	21 anthropometric, physiological tests	Significant differences were not found. Anecdotally later maturing girls were advantaged at a young age in tennis as they obtain higher scores on some variables.
Basketball	(Hoare, 2000)	Australia	N = 248(m=125, f=123) Age = <16 yrs	Compare performance profiles and playing positions	5 anthropometric, 10 physiological tests	Anthropometric and physiological measures accounted for approximately 40% of variance in performance.

Water-polo	(Falk et al., 2004)	Israel	N = 24 (male) Age = 12 to 14 yrs	Identify variables to assist in selection process for TID	9 skill, 1 physiological, coach's subjective rating (gaming intelligence)	Three repeated tests over two years. Baseline results accounted for 67% of results 2 years later.
Rugby	(Gabbett, 2002a)	Australia	N= 66 (male) Age = 20 to 28 yrs	Identify if characteristics of players influence selection	1 anthropometric, 7 physiological tests	Selected players were significantly older, heavier and more experienced. Physiological capacities were not significantly different.
	(Pienaar et al., 1998)	South Africa	N= 173 (male) Age= 10 yrs	Identify predictor variables for TID programs	6 anthropometric, 8 physiological, 6 skill tests	Classification functions were developed based on the outcome of the tests – 88% predicted for selection.
	(van Gent & Spamer, 2005)	South Africa	N= 80 (male) Age= 12 to 19 yrs	Distinguish between talented and less-talented players	5 anthropometric, 10 physiological, 9 skill tests	Positional requirements of players differ among age groups and adults. Need to compile scientific tests for each age group.
	(Veale et al., 2008)	Australia	N= 54 (male) Age= < 18 yrs	Compared selected and non-selected in elite Rugby squad	2 anthropometric, 4 physiological tests	Physical measures discriminated between selected/non-selected groups.
Soccer	(Hoare & Warr, 2000)	Australia	N = 71 (female) Age = 14.5 to 18 yrs	Target competitive athletes from other sports and using normative data on soccer players, test, and select athletes for talent development program	2 anthropometric, 6 physiological, coach's subjective rating (attitude and attendance)	Using the physical tests to rank athletes, the top 24 were selected for a talent development program. After 6 weeks of training this squad was reduced further to 17 based on the coach's subjective rating. Following one season 10 players were in state teams.
	(Reilly et al., 2000)	United Kingdom	N= 31 (male) Age= 15 to 16 yrs	Comparing elite and sub-elite groups	5 anthropometric, 7 physiological, 3 psychological, 2 skill tests	Significant differences in most test items – supporting a multivariate approach to TID.
	(Gil et al., 2007)	Spain	N= 194(male) Age= 14 to 17 yrs	Distinguish anthropometric and physiological profiles	4 anthropometric, 4 physiological	Significant difference among selected and non-selected soccer players on measures tested.

				of successful versus non-successful players		
Volleyball	(Gabbett et al., 2007)	Australia	N= 28 (not specified) Age = 14 to 16 yrs	Determine variables that could discriminate players competing for selection in TID program	4 anthropometric, 7 physiological, 4 skill, 4 coach's subjective rating of technique	Significant difference found in skill tests and coach's subjective rating on technique.
	(Lidor et al., 2007)	Israel	N = 15 (male) Age = 15 to 17 yrs	Contribution of multi-faceted battery of tests to early phases of TID and development	2 anthropometric, 8 physiological, 2 skill test	Tested six times over 15 months. Only one physiological test was significantly different.
Field Hockey	(Elferink-Gemser et al., 2007)	Nether-lands	N= 126 (m=63, f= 63) Age = 12 to 16 yrs	Comparing players in a talent development program	3 anthropometric, 4 physiological, 3 skill, 3 tactical and 6 psychological tests	Three repeated tests over three years. Significant difference on technical and tactical variables between elite and sub-elite.
	(Keogh et al., 2003)	New Zealand	N= 74 (female) Age = 18 to 23yrs	Comparing club and rep players to distinguish talent predictors	5 anthropometric, 9 physiological and 5 skill tests	Significant differences found between the two groups on a limited number of tests which may then be included in future TID testing.

that could distinguish elite from non-elite athletes, predict selection for development squads, and discriminate between successful and unsuccessful athletes. These studies predominantly focused on comparisons of athletes already in the respective sport (talent identification) with only a small number (Hoare & Warr, 2000) testing non-athletes (talent detection) for inclusion into a development training squad. Sample sizes also varied considerably (n = 10-126) and those studies with a relatively low number of participants identified this as a consequence of investigating an elite population (Reilly et al., 2000; Staerck, 2003; Falk et al., 2004; Lidor et al., 2005; Lidor et al., 2005b; Lidor et al., 2007). Moreover, the cross-sectional nature of many of the studies (Pienaar et al., 1998; Hoare, 2000; Reilly et al., 2000; Gabbett, 2002a; Keogh et al., 2003; Staerck, 2003; van Gent & Spamer, 2005; Tsolakis, 2006; Van Den Berg, 2006; De Albuquerque & Farinatti, 2007; Gabbett et al., 2007; Gil et al., 2007; Keogh et al., 2007; Stuelcken et al., 2007; Vescovi, 2007; Veale et al., 2008) limits the generalisability of the findings and those studies that did take on a longitudinal methodology did not look beyond three years (Aitken & Jenkins, 1998; Hoare & Warr, 2000; Falk et al., 2004; Lidor et al., 2005; Lidor et al., 2005b; Elferink-Gemser et al., 2007; Lidor et al., 2007).

Regnier's et al. (1993) recommendations for a multidisciplinary approach to talent detection has seen a shift in research emphasis with investigators evolving from focusing solely on the physical and physiological capacities of potentially talented athletes to an examination of the psychological attributes (Simonton, 1999; Reilly et al., 2000; Abbott & Collins, 2002, 2004; Bailey & Morley, 2006; Thelwell et al., 2006; Vaeyens et al., 2006; Elferink-Gemser et al., 2007). This approach is more prevalent in team sports where it has been commonly asserted that technical, tactical and psychological factors may be better discriminators for future

performance than anthropometric and physiological attributes (Reilly et al., 2000; A. M. Williams & Reilly, 2000; Hoare & Warr, 2000; Thelwell et al., 2006).

Sport-specific TID research is still in its infancy and to date cycling TID research has received little attention. To the current author's knowledge, no studies have been conducted concerning the measures to include in a cycling TID program. However many researchers have investigated the physiological demands of the sport (Craig & Norton, 2001; Martin et al., 2001; Mujika & Padilla, 2001; Schumacher, Mroz, Mueller, Schmid, & Ruecker, 2006).

2.1.6 Profile of Elite Cyclists

Elite cycle racing is considered one of the most demanding of all sports combining extremes of exercise duration, intensity and frequency (Martin et al., 2001). Riders are required to perform on a variety of surfaces (track, road, cross-country, mountain), terrains (level, uphill and downhill), and race situations (criterions, sprints, time trials, mass start road races) in events ranging in duration from 10 seconds to three-week stage races covering between 200 metres and 4,000 kilometres (Jeukendrup, Craig, & Hawley, 2000). The specific physiological requirements for participation in elite road and track cycling have been well documented (Craig & Norton, 2001; Martin et al., 2001; Mujika & Padilla, 2001; Schumacher et al., 2006). Because of the diversity of the sport, no one profile exemplifies an elite cyclist and research has shown a wide range of values in their physical characteristics (Craig & Norton, 2001; Martin et al., 2001; Mujika & Padilla, 2001). Researchers contend that anthropometric and physiological characteristics play a major role in performance in different cycling conditions (Craig & Norton, 2001; Martin et al., 2001; Mujika & Padilla, 2001). Researchers consider that road cycling competitions generally require submaximal power outputs (Martin et al., 2001; Mujika &

Padilla, 2001), with the shorter track events requiring the cyclist to tax maximally both the aerobic and anaerobic (oxygen independent) metabolic pathways (Craig & Norton, 2001). To date, no research has identified the capacities or attributes to measure in a cycling TID program.

2.1.6 Limitations of the scientific approach

Despite its intuitive appeal, many investigators consider the 'scientific' approach to talent detection to be flawed as anthropometric and physical measures are unstable during adolescence and determinants of performance vary with growth, maturation and development (Abbott & Collins, 2002, 2004; Abbott, 2005; Bailey & Morley, 2006). Certainly this constraint was identified within the conceptual talent detection models already reviewed (Bar Or, 1975; Geron, 1978; Harre, 1982; Montpetit & Cazorla, 1982; Regnier et al., 1993).

Table 2 demonstrates that the common anthropometric and physiological variables employed to predict future performers in sport are highly unstable during adolescence in males (Pearson et al., 2006). Corresponding data for pubescent females is not available, although it has been suggested that inter-individual variations in all the anthropometric and physiological characteristics described do exist for both sexes (Malina & Bouchard, 2001). Moreover the physiological factors shown to be unstable during adolescence (Table 2) are also known to genetically constrain sporting performance. These factors include sub-maximal aerobic capacity (Perusse et al., 2001), resting heart rate (An et al., 1999), information processing (Chorney et al., 1998), and an individual's response to training (Bouchard et al., 1998).

Table 2: The effect of puberty in males on anthropometric and physiological parameters tested in Phase 1 of the National Talent Identification (NTID) Program. (Adapted from Pearson et al., 2006.)

Characteristic	Corresponding NTID Phase 1 Tests	Effect of puberty	Approximate change during puberty	Age at greatest increase (years)	Trainability
Height	Height (cm)	Increase in height	↑ 17 – 18%	13.5	No
Body mass	Body mass (kg)	Increase in total body mass	↑ 40%	13.5	Yes
Aerobic capacity (VO_2 max ($L.min^{-1}$))	Multi-stage fitness test	Steady increase (8-16 years) throughout adolescence as a function of fat-free mass and improved cardiovascular system.	↑ 70%	11-15	Yes
Anaerobic power	Vertical jump (cm) 40-m sprint (secs) Basketball throw	Steady increase in childhood, with rapid increase at the onset of puberty	↑ 50%	14-15	Yes

Growth and maturation varies for each individual as such factors are predominantly under genetic and neuroendocrine control (Malina & Bouchard, 2001). Helsen and colleagues (2000, 2005) suggest that early maturation of adolescents influences talent selection. Certainly research in the team sports of American football (Glamser & Marciani, 1990), ice-hockey (Boucher & Mutimer, 1994), baseball (Thompson et al., 1991), cricket (Edwards, 1994), and soccer (Barnsley, Thompson, & Legault, 1992; Verhulst, 1992; Dudink, 1994; Brewer, Balsom, & Davis, 1995; Baxter-Jones, 1995; Helsen, Starkes, & Van Winckel, 1998a; Helsen et al., 2000; Musch, 2001; Helsen, Van Winckel, & Williams, 2005) have demonstrated a strong linear relationship between month of birth (January to December) and the proportion of players selected for development squads. That is, youth players born earlier in the year are more likely to be identified as talented since they have maturational developmental advantages (Helsen et al., 2005). Helsen and colleagues (1998a) proposed that this relative age effect is the result of current TID procedures being heavily biased towards a child's physical attributes rather than his or her technical skill. Abbott and Collins (2002) emphasise the need to distinguish between determinants of performance and determinants of potential/skill acquisition.

Many of the physical qualities that distinguish elite and sub-elite players may not be apparent until late adolescence, confounding the early selection of performers (Fisher & Borms, 1990). In a review of talent research in soccer, Williams and Reilly (2000) advocate that anthropometric and physiological measurements are useful but such measures do not appear to be sensitive performance indicators on a global basis and cannot be used reliably on their own for TID purposes.

Since late maturing children can compensate for any apparent disadvantage in size and strength by working on their technical capabilities or by improvements in other areas such as agility and muscular power, it is important that the TID process is not overly biased towards the early maturing child (A. M. Williams & Reilly, 2000). Any potential bias can result in late maturing and potentially talented athletes dropping out of the sport at an early age (A. M. Williams & Reilly, 2000). Furthermore, late maturing athletes are more likely to miss out on the experience of high-quality coaching (A. M. Williams & Reilly, 2000). The key message is that young athletes should be selected on skill and ability rather than on physical size (A. M. Williams & Reilly, 2000).

In summary, despite the considerable literature reviewed above attesting to the instability of biological factors through adolescence, a large number of investigators continue to conduct TID research focusing solely on these factors. It might be suggested that psychological factors might also be important in predicting future elite sports performers.

2.2 PSYCHOLOGICAL PREDICTORS OF PERFORMANCE

2.2.1 General studies

It is widely accepted that successful athletes are distinguished from less successful athletes on the basis of psychological factors (A. M. Williams & Reilly, 2000). In their review of the psychological predictors to athletic performance, Williams and Reilly (2000) contend that researchers have yet to identify the specific personality characteristics, or an overall psychological profile that is predictive of success in sport. Morgan and colleagues (1978, 1980) conducted some of the earliest investigations examining the personality characteristics of

national and Olympic runners, rowers and wrestlers. They suggested that more successful athletes exhibited greater positive mental health than less successful athletes.

More recent investigators (Vealey, 1992; Morris, 2000; Auweele, Mele, Nys, & Rzewnicki, 2001) have yet to establish a consistent relationship between personality and sporting expertise. Personality traits are to a certain degree inherited, with heritability estimates between 30 and 60 percent (Plomin, Owen, & McGuý n, 1994; Saudino, 1997). Any role that personality traits may have in sporting success is likely to be in conjunction with other measures depending on different contexts and with the probability of explaining only a small proportion of variance in sports performance (Morris, 1995; Auweele et al., 2001).

Other researchers have taken a different approach, by examining cognitive strategy differences between more-and less-successful athletes (Mahoney & Avener, 1977; Gould, Weiss, & Weinberg, 1981; R. E. Smith, Schutz, Smoll, & Ptacek, 1995). For example, Smith and colleagues (1995) developed the *Athletic Coping Skills Inventory–28*, a multidimensional measure of sport-specific psychological skills (coping with adversity, peaking under pressure, goal setting and mental preparation, concentration, freedom from worry, confidence and achievement motivation, and coachability) and found that the inventory discriminated between more-and less-successful professional baseball players. Specifically, more successful players and players who remained in the league longer demonstrated higher psychological skills scores.

Other investigators (Orlick & Partington, 1988; Gould, Eklund, & Jackson, 1992a, 1992b; Gould, Guinan, Greenleaf, Medbery, & Peterson, 1999; Greenleaf, Gould, & Dieffenbach, 2001) have examined psychological variables affecting the performance of Olympic athletes, chiefly

through qualitative interviews. For example, Orlick and Partington (1988) observed that successful athletes had (a) greater ability to focus attention, (b) better control of performance imagery, (c) a total commitment to the pursuit of excellence, (d) more effective setting of practice goals, (e) better competition simulation, (f) greater mental preparation, (g) more detailed competition plans, and (h) less distraction plans than less successful athletes.

After methodically reviewing this earlier research, Williams and Krane (2001) concluded that a number of specific mental skills and psychological characteristics were associated with peak performance. These mental skills included (a) having a well developed competitive routine and plan, (b) high levels of motivation and commitment, (c) coping skills for dealing with distractions and unexpected events, (d) heightened concentration, (e) high levels of self-confidence, (f) self-regulation of arousal, (g) goal setting, and (h) visualisation. These findings were further supported in Gould's et al., (2002) quantitative and qualitative study into the mental skills and characteristics of highly successful Olympic athletes. Their results mirrored Williams and Krane's (2001) list of characteristics above, with the additions of high levels of dispositional optimism, hope, and adaptive perfectionism. In addition to these above qualities, researchers have recently been interested in the psycho-behaviour of mental toughness and its development throughout the sporting career (Gould et al., 2002; Golby & Sheard, 2004; Bull, Shambrook, James, & Brooks, 2005; Crust & Clough, 2005; Levy, Polman, Clough, Marchant, & Earle, 2006; Jones, Hanton, & Connaughton, 2007; Nicholls, Polman, Levy, & Backhouse, 2008; Connaughton, Wadey, Hanton, & Jones, 2008).

2.2.2 Specific TID studies

TID research to date has seen studies conducted from a unidimensional physicality approach (Pienaar et al., 1998; Aitken & Jenkins, 1998; Hoare & Warr, 2000; Grove, 2001; Staerck, 2003; Falk et al., 2004; Lidor et al., 2005; Vaeyens et al., 2006; De Albuquerque & Farinatti, 2007; Gabbett et al., 2007; Stuelcken et al., 2007; Di Cagno et al., 2008; Mikulic & Ruzic, 2008; Veale et al., 2008). More recently, studies (Reilly et al., 2000; Nieuwenhuis et al., 2002; Holt & Dunn, 2004; Elferink-Gemser et al., 2007) have extended to a broader multidimensional approach considering psychological and sociological variables. Certainly the latter is supported by the talent detection conceptual models suggested over twenty years ago (Bar Or, 1975; Gimbel, 1976; Dreke, 1982; Harre, 1982; Havlicek et al., 1982; Regnier et al., 1993). Table 3 provides a summary of the studies conducted specifically in a TID context that included psychological measures. There is a clear lack of studies in individual sports, with all the available research in team sports only. This may be linked to a common assertion by researchers that in team sports tactical and psychological factors may be better discriminators of performance than physical attributes (Hoare, 1995; Hoare & Warr, 2000).

Table 3 illustrates that some studies included subjective ratings such as attitude (Hoare & Warr, 2000) or game intelligence (Falk et al., 2004), whereas others took on a quantitative approach (Reilly et al., 2000; Elferink-Gemser et al., 2007) looking at psychological and tactical skills that may discriminate between elite versus sub-elite field hockey and soccer players. Falk et al., (2004) and Hoare and Warr's (2000) research verified the relative accuracy coaches display in distinguishing talented players. These results are supported by Williams and Reilly (2000) who suggest that the ability of a coach to identify talent should not be underestimated. In

Table 3: Summary of studies in sport using psychological measures to distinguish talent.

Sport	Author, Year	Country	Participants	Purpose of psych measures	Test Items	Summary of results for psychological measures
Water-polo	(Falk et al., 2004)	Israel	N = 24 (male) Age = 12 to 14 yrs	Identify variables to assist in selection process for TID	1) Coach's subjective rating of game intelligence. Game intelligence reflected the players' ability to anticipate game plays and to make decisions as observed by the coach at 2-3 league games. Criteria include decision making, positioning, anticipation and timing	1) Game intelligence measured two years earlier was a significant predictor of selection into the junior national team
Soccer	(Hoare & Warr, 2000)	Australia	N = 71 (female) Age = 14.5 to 18 yrs	Select final squad of athletes for talent development program	1) Coach's subjective rating of attitude	1) Assessed over a 6 week trial this measure assisted staff to make final selection of squad for a talent development program
	(Reilly et al., 2000)	United Kingdom	N=31 (male) Age=15 to 16 yrs	Comparing elite and sub-elite groups	1) Motivation orientation (Task and Ego Orientation in Sport Questionnaire) 2) Anxiety intensity and direction (Competitive State Anxiety Inventory 2) 3) Anticipation test (film-based temporal occlusion approach – players responded verbally to film clips to anticipate the intended direction of an opponent's dribble or pass).	1) Elite players significantly more task-orientated that sub-elite players 2) Elite players significantly less likely to experience somatic anxiety and more inclined to perceive cognitive and somatic anxiety, and self-confidence as facilitative to performance 3) Elite players significantly better in 1 of the 3 anticipation activities
	(Holt & Dunn, 2004)	USA	N=40 (male) Age=15 to 19 yrs	Identification and construction of four psychosocial competencies associated with elite youth soccer success	Qualitative interviews were analysed using grounded theory methodology to identify competencies central to success: 1) Discipline 2) Commitment 3) Resilience 4) Social support	1) Players appeared to adopt similar behaviours/attitudes to those of adults and limited social interaction with peers – making sacrifices and delaying gratification. 2) Players possessed idiosyncratic reasons for pursuing soccer including intrinsic, extrinsic and social factors. 3) Players were generally able to cope with parental pressure 4) Players parents were generally

						supportive
Field Hockey	(Elferink-Gemser et al., 2007)	Netherlands	N=126 (m=63, f= 63) Age = 12 to 16 yrs	Comparing players in a talent development program	1) Psychological skills: motivation, confidence, anxiety control, mental preparation, team emphasis, and concentration (Psychological Skills Inventory for Sports) 2) Tactical skills: general, when in possession of the ball, when not in possession of the ball (Tactics in Field Hockey Questionnaire).	1) Female elite players significantly higher scores on motivation and confidence than sub-elite players. Male elite players significantly lower scores on concentration. 2) Female and male elite players scored significantly higher on all tactical skills

quantitative studies (Reilly et al., 2000; Elferink-Gemser et al., 2007) there appears to be no consistency with the instruments used, with a variety of psychological skills and behaviours measured. Furthermore, all of these studies were cross-sectional in design, limiting the generalisability of the findings.

2.2.3 Development of Expertise: the theory of deliberate practice.

The acquisition and manifestation of expert sporting performance requires specific psychological characteristics (Baker & Horton, 2004). Empirical evidence suggests that psychological factors are consistent predictors of elite performance (Orlick & Partington, 1988; R. E. Smith & Christensen, 1995). However, research examining the psychological makeup of athletes in the first phase of a TID program is yet to be conducted. The question of which psychological characteristics (personality traits, psycho-skills, psycho-behaviours) are necessary for the acquisition of expertise and those necessary for the demonstration of sporting expertise is yet to be answered.

Researchers interested in identifying the factors that distinguish the exceptional from the ordinary performer in any activity have created numerous theories to explain the development of expertise. Since Francis Galton wrote the phrase *'nature or nurture'* in 1874, scientists (Ericsson et al., 1993; Ericsson & Charness, 1994; Hodges & Starkes, 1996; Ericsson, 1996; Ericsson & Lehmann, 1996; Simonton, 1999; Baker et al., 2003; Abbott & Collins, 2004; Bailey & Morley, 2006; Miah & Rich, 2006; W. M. Weiss & Weiss, 2006; Davids & Baker, 2007; Martindale, Collins, & Abraham, 2007; Ericsson, 2007; Ericsson, Roring, & Nandagopal, 2007)

have used and overused this phrase to describe factors that interact to promote high levels of human expertise.

An emphasis on nurturing talented individuals is widely proposed by Ericsson and colleagues (Ericsson et al., 1993; Ericsson & Charness, 1994; Ericsson, 1996; Ericsson & Lehmann, 1996). They have argued that talent plays only a limited role in the development of expertise. They suggest that the level of performance is directly related to accumulated practice and that, regardless of natural abilities or genetically predisposed traits, at least ten years of intensive practice is necessary to acquire the skills and experience required to become an expert within any domain. While this theory emerged from studies on the practice habits of eminent musicians (Ericsson et al., 1993), findings have been validated when applied to the domain of sport (Hodges & Starkes, 1996; T. Hodge & Deakin, 1998; Helsen, Starkes, & Hodges, 1998b; Starkes, 2000; Young & Salmela, 2002).

Ericsson and colleagues (1993) suggest that natural ability is not a prerequisite for the development of expertise; but that expertise depends on the amount of time spent on `highly structured, effortful' activity with the specific goal of improving performance (Howe et al., 1998; Simonton, 1999). Ericsson and Lehmann (1996) argue that motivation is a pre-requisite for sustained engagement in deliberate practice over days, years and even decades. This view is consistent with the suggestion that individuals who possess high levels of intrinsic motivation are typically most committed to their domain of expertise (Csikszentmihalyi, 1993). An individual's commitment to deliberate practice is one of the factors that distinguish skilled participants from everyday individuals who may struggle to meet practice demands (Ericsson et al., 1993). Although this environmentalist view is contrary to empirical evidence supporting the

contribution of genetics to expert performance (Bouchard & Lortie, 1985; Bouchard, Malina, & Perusse, 1997; Bouchard et al., 1998), a supportive learning environment, effective practice and high-quality coaching can help overcome perceived shortcomings in initial ability (Helsen et al., 2000). Thus, it could be proposed that the *'nature or nurture'* argument is no longer relevant and the priority of TID research should be on the identification of the psychological attributes conducive to individuals undertaking the ten years of intensive training required to develop expertise.

There is general agreement that to achieve sporting success, individuals require single-mindedness, commitment, determination, and the ability to persevere in the face of difficulties and distractions (Csikszentmihalyi, 1993; Ericsson et al., 1993; Howe et al., 1998; Patrick et al., 1999). Talent development requires high levels of practice and commitment, and decisions about the level of one's commitment are often made during adolescence (Csikszentmihalyi, 1993). However, only some adolescents who show indications of promise choose to respond to the need for increased effort and commitment in order to develop their talent, whereas others elect to maintain involvement at lower levels or quit altogether (Csikszentmihalyi, 1993). The answer to the question of what factors support or hinder the commitment to talent development of adolescents may be found in the psychological constructs of physical self-concept, explanatory style and sport commitment.

2.2.4 Physical Self Concept and Athletic Performance

Throughout the existing research literature, the constructs of self-esteem and self-concept are irrefutably intertwined, and are at times used interchangeably (Findlay & Bowker, 2007). Adolescents make competence judgments about, and evaluations of the self (Craft, Pfeiffer, &

Pivarnik, 2003). Such evaluations can lead to either positive or negative feelings of self-esteem and self-worth (Trent, Cooney, Russell, & Warton, 1996). These can in turn influence feelings of overall well-being, motivation, interest and persistence at a task, and emotional responses to engaging in a task (Harter, 1981; Feltz & Petlichkoff, 1983; Horn & Hasbrook, 1987; Pope, McHale, & Craighead, 1988).

Self-concept is considered one of the most important constructs in the social sciences, as demonstrated by the consistency with which self-concept enhancement is identified as a major focus of interest in diverse settings (Branden, 1994; Marsh & Craven, 1997). According to Shavelson and colleagues (1976), self-concept is a person's self-perceptions, which are formed through experience with, or interpretations of, his or her environment. These perceptions are especially influenced by the evaluations of significant others, reinforcements, and the way people explain their own behaviours to themselves (i.e. their attributions or reasons for their behaviours). According to Shavelson et al. (1976), self-concept is not an entity within a person, but a hypothetical construct that is potentially useful in explaining and predicting how that person acts or will act. A person's self-perceptions influence the way he or she acts, and these acts in turn influence his or her self-perceptions. Consistent with this perspective, Shavelson et al. (1976) noted that self-concept is significant as both an outcome and as a mediating variable that help to explain other outcomes.

Research has suggested that a multidimensional approach is most appropriate for examining the self-system (Findlay & Bowker, 2007). The most commonly cited and extensively investigated model of the self is that suggested by Shavelson et al. (1976). Shavelson and colleagues (1976) demonstrated support for a model that is multi-faceted, becomes

increasingly differentiated with age, and is hierarchically structured. Under the top-level apex of general self-esteem, the next level of the model includes academic and non-academic self-worth. Subsequently, specific areas of self-concept (i.e., academic, emotional, social and physical domains) are at the subsequent level.

Within the four lower-level domains of the Shavelson et al. (1976) model, researchers have revealed that specific self-concept domains may be particularly pertinent to adolescents. For instance, Harter (1990) found that physical self-concept (i.e. perceptions and attitudes toward the physical self) was the domain most strongly associated with general self-esteem. To date, Marsh and colleagues (1994; 1996; 1997; 1997; 2002; 2005; 2006) have conducted the most comprehensive studies evaluating the Shavelson et al. (1976) model.

A positive self-concept has been shown to facilitate the attainment of a number of positive outcomes (M. R. Weiss & Ebbeck, 1996; M. R. Weiss & Ferrer-Caja, 2002) such as perceptions of control (Weigand & Broadhurst, 1998), motivational orientation (M. R. Weiss & Horn, 1990), global self-esteem (M. R. Weiss, McAuley, Ebbeck, & Wiese, 1990), enjoyment (Scanlan & Simons, 1992), attraction to physical activity (Brustad, 1988), and decrease in anxiety and stress (Scanlan, Stein, & Ravizza, 1991).

In sport and exercise settings, self-concept is frequently suggested as a mediating variable that facilitates the attainment of other desired outcomes such as physical skills, health-related physical fitness, physical activity, exercise adherence, and dealing with the demands of training and competition (Gould, Finch, & Jackson, 1993; Gould & Damarjian, 1996; Marsh et al., 1997; Marsh, 2002). The foundation behind this research is that individuals who feel positively about

themselves in a physical domain are more likely to pursue and achieve desirable outcomes in that domain than individuals who do not feel positively about themselves (Marsh et al., 2006).

The relationship between physical self-concept and athletic performance has been studied by Marsh (2002) who reported that physical self-concept contributed to the prediction of the performances of elite swimmers at international events beyond what could be explained in terms of their previous performances (personal bests and international rankings). Marsh (2002) suggested that physical self-concept explains about 10% of the residual variance in championship swim performance. To establish causality of such findings, subsequent research conducted by Marsh and colleagues (2005; 2006) has incorporated the *reciprocal effects model*. The *reciprocal effects model* implies that physical self-concept and athletic performance are reciprocally-related and mutually-reinforcing. Improved physical self-concepts will lead to better sporting performance, and improved sporting performance will lead to better physical self-concepts (Marsh et al., 2006).

Marsh and colleagues (2006) also examined the reciprocal effects of physical self-concept and performance skills in physical education classes. More specifically, they evaluated predictions about the effects of previous gymnastics self concept and gymnastics performance skills collected at the start of a gymnastics training program on subsequent self concept and performance skills collected at the end of a ten-week program. Even after controlling for the effects of gender and age, the effect of previous gymnastics self-concept on subsequent gymnastics performance and the effect of previous gymnastics performance on subsequence

gymnastics self concept were both highly significant. In summary, gymnastics self-concept and gymnastics performances were both determinants and consequences of each other.

Marsh and Perry's (2005) research tested the causal ordering of self-concept and performance of swimmers competing at international swimming championships. They measured elite swimming self-concepts of participants in the Pan Pacific Swimming Championships in Australia and the World Short Course Championships in Greece. Results demonstrated that elite athlete self-concept contributed significantly to the prediction of subsequent championship performance.

The above research findings highlight the interest researchers have in the link between athletic performance and physical self-concept. This interest seems to stem from the recognition of physical self-concept as a valued outcome, its important role as a moderator variable, and its relationship with other constructs.

In summary, the available research strongly suggests a positive relationship between sports performance and physical self-concept. However, to date, it appears no research has examined the relationship of physical self-concept to selection and acceptance in a TID program.

2.2.5 Explanatory Style and Athletic Performance

One key psychological factor influencing how athletes react to adversity may be explanatory style (Peterson & Seligman, 1984; Peterson, 1991; Buchanan & Seligman, 1995). Originally proposed in the context of the attributional reformulation of *learned helplessness theory* (Abramson, Seligman, & Teasdale, 1978), explanatory style reflects the way that people usually explain disparate bad or good events (Peterson & Park, 1998; Peterson, 2000; Peterson &

Vaidya, 2001; Peterson & Steen, 2002). People who usually explain bad events by causes that are stable in time ("it's going to last forever"), global in effect ("it's going to undercut everything that I do"), and internal ("it's me") and who explain good events with unstable, specific, and external causes are said to have a pessimistic explanatory style. People with the opposite attributional pattern are said to have an optimistic explanatory style (Martin-Krumm, Sarrazin, Peterson, & Famose, 2003). Scheier and Carver (1992) consider optimism to be a relatively stable personality disposition characterised by a general expectancy that good things will happen.

Explanatory style has been extensively studied as a correlate of helplessness-related outcomes such as depression, illness, and failure in academic, athletic and vocational realms (Martin-Krumm et al., 2003). People with an optimistic explanatory style fare usually better in many life events than those with a pessimistic explanatory style (Peterson & Park, 1998).

Very few studies have investigated the link between explanatory style and a high level athletic performance. In a cross-sectional survey with fifty young elite tennis players, Prapavessis and Carron (1988) found that players presenting cognitive, motivational, and emotional maladaptive achievement patterns gave ratings that were internal, persistent, and recurrent for explaining failure performances, and were judged by their coaches to be less persistent in their matches. The cross-sectional nature of the design makes the inference of causality difficult between the explanatory style and the maladaptive achievement patterns.

Two later studies using *Content Analysis of Verbatim Explanation* (CAVE) were reported by Rettew (1995). Baseball and basketball teams with a more optimistic explanatory style won

more games in the target season, and performed significantly better in games following a loss than teams with a pessimistic explanatory style. Nevertheless, because the CAVE technique measures explanatory style only in an indirect way and employs retrospective data, this design does not evidence a causal association between explanatory style and athletic performance.

In prospective and quasi-experimental research with members of highly-ranked US university swimming teams, Seligman (1990) explored the links between explanatory styles and sporting performance. Results revealed that an athlete's explanatory style and coaches' judgments of swimmers' resilience after defeat predicted how many unexpectedly poor swims the team members would show over the competitive season. Swimmers were purposely given negative feedback following a swim (i.e. a bad swim time regardless of performance). The results found that the more optimistic swimmers performed better on a subsequent swim 30 minutes later compared to the pessimistic swimmers who under-performed. This study was the first attempt to test recovery after failure as a function of the explanatory style.

Martin-Krumm (2003) replicated the above study with high school students and assessed resilience after failure in basketball dribbling as a function of explanatory style. The results showed that participants with a more optimistic style performed better at the second test after failure feedback, whereas those with a more pessimistic style did not improve. Participants with the pessimistic style had a greater decline in success expectations after failure than those who were more optimistic. This finding is in support of previous research showing that pessimism correlates negatively with expectations (Peterson & Vaidya, 2001). Taken together, the above findings also showed that participants with a pessimistic style had greater stress reactivity than those with the optimistic style. This supports previous research showing that pessimism

correlates positively with anxiety (Mineka, Pury, & Luten, 1995; Helton, Dember, Warm, & Matthews, 2000; Jackson, Sellers, & Peterson, 2002).

Gould's (2002) quantitative and qualitative study into the mental skills and characteristics of ten highly successful Olympic athletes found that these elite athletes had a high level of dispositional optimism which was positively correlated with mental toughness. Gould (2002) postulated that this personality trait supported the athlete's who, when confronted with a challenge, take on a posture of confidence and persistence. Recent research by Nicholls et al. (2008) into the relationship between mental toughness and optimism has supported Gould's (2002) research. Nicholls (2008) investigation found evidence to suggest that coping is highly related to optimism and pessimism, with more optimistic athlete's using coping strategies that resulted in higher levels of achievement. Additionally research conducted by Norlander and Archer (2002) also found that optimism was the best predictor of performance in elite male and female cross country skiers and ski-marksman and swimmers during Senior National Swedish Championships.

The reviewed literature pertaining to sports performance and explanatory style empirically links an optimistic explanatory style to higher levels of athletic performance. Therefore, this could be extended to athletes participating in a TID program, where a positive explanatory style may discriminate between selected and non-selected athletes, when selection is based on athletic performance. Additionally, a positive explanatory style has been related to athletes taking on a posture of persistence and this may be extended to selected athletes within a TID program accepting the opportunity to further their training.

2.2.6 Sport Commitment and Athletic Performance

Uncovering the motivational factors which enable young people to engage in the years of practice needed to become an expert performer is an important area for investigation (Ericsson, 1996; Durand-Bush & Salmela, 2001; Starkes, Helsen, & Jack, 2001) . To examine motives for participation in youth sport, Scanlan et al. (1993) proposed a model of sport commitment. Scanlan and her colleagues (Scanlan et al., 1993; Carpenter & Coleman, 1998; Carpenter & Scanlan, 1998; Scanlan, Russell, Beals, & Scanlan, 2003; Scanlan, Russell, Wilson, & Scanlan, 2003) have described the development of the *Sport Commitment Model* (SCM), a conceptual framework designed to account for persistence in youth sport settings.

The SCM delineates the psychological processes underpinning commitment, defined as the desire and resolve to continue ongoing participation that draws on both Rusbult's (1983) *Investment Model* and previous participant motivation research in youth sport (Scanlan et al., 1993). Ultimately psychological commitment should predict behavioural commitment, such as effort and persistence (M. R. Weiss & Ferrer-Caja, 2002; W. M. Weiss & Weiss, 2003).

Six constructs are theorised to predict sport commitment: enjoyment, attractive alternatives, personal investments, involvement opportunities, social constraints, and social support (Carpenter, Scanlan, Simons, & Lobel, 1993; Scanlan et al., 1993). Enjoyment refers to feelings of pleasure, liking, and fun associated with participation and should increase sport commitment. Attractive alternatives are activities that compete with one's current activity and negatively influence commitment. Personal investments are resources such as time and effort put into an activity that would be lost if one discontinued participation; investments are positively related to commitment. Involvement opportunities are potential benefits of

continued participation, such as scholarships, travelling, and meeting new people. Higher involvement opportunities relate to higher commitment. Social constraints refer to perceived obligation to important others to continue participation, such as parents, coaches, and teammates. Higher social constraints should positively influence commitment. Social support refers to the unconditional encouragement and positive regard of supporters and should positively relate to commitment. In summary, the SCM theorises that higher enjoyment, involvement opportunities, personal investments, social constraints and social support, and lower attractive alternatives should translate to stronger resolve to continue participation in an activity (W. M. Weiss & Weiss, 2007).

Scanlan and colleagues (Carpenter et al., 1993; Scanlan et al., 1993; Carpenter & Scanlan, 1998) provided preliminary support for the propositions proposed within the framework of their original SCM. Using structural equation modeling analyses in a large sample (n= 1342) of youth sport participants, Carpenter et al. (1993) supported the positive contributions of enjoyment, personal investments, and involvement opportunities to the prediction of sport commitment. Later studies that have examined the relationship between social support and sport commitment have found a positive correlation (Carpenter & Scanlan, 1998; M. R. Weiss, Kimmel, & Smith, 2001; Scanlan, Russell, Beals et al., 2003; Scanlan, Russell, Wilson et al., 2003). Following the original development and validation studies, Carpenter and Scanlan (1998) demonstrated that longitudinal changes in SCM determinants predicted concomitant changes in sport commitment in a manner consistent with SCM propositions among a sample of youth soccer players.

Research has consistently supported the predicted relationships within the SCM. Enjoyment has emerged as the strongest predictor of commitment (Carpenter et al., 1993; Scanlan et al., 1993; W. M. Weiss & Weiss, 2007). Higher involvement opportunities and personal investments have also been positively related to commitment (Carpenter et al., 1993; M. R. Weiss et al., 2001), while higher attractive alternatives are associated with lower commitment (Carpenter & Coleman, 1998; Carpenter & Scanlan, 1998; Raedeke, Warren, & Granzyk, 2002). Mixed results for social constraints may be due to both competitive and recreational participants being used as samples, where there was not a constant pressure from significant others to continue participation (Carpenter et al., 1993; Scanlan et al., 1993).

In addition to the relative influence of determinants, sport commitment has been studied from other perspectives. These include types of commitment (Raedeke, 1997; W. M. Weiss & Weiss, 2003), the dynamic nature of commitment (Carpenter & Coleman, 1998; Carpenter & Scanlan, 1998) and behavioural correlates (Van Yperen, 1998; W. M. Weiss & Weiss, 2003). Sport commitment has been studied in basketball (Zahariadis, Tsorbatzoudis, & Alexandris, 2006; Sousa, Torregrosa, Viladrich, Villamarîn, & Cruz, 2007), cricket (Carpenter & Coleman, 1998; Carpenter & Scanlan, 1998), gymnastics (W. M. Weiss & Weiss, 2003, 2006, 2007; Di Cagno et al., 2008), handball (Guillet, Sarrazin, Carpenter, Trouilloud, & Cury, 2002; Zahariadis et al., 2006), masters' athletes (Maharam, Bauman, Kalman, Skolnik, & Perle, 1999; K. Hodge, Allena, & Smelliea, 2008), rugby (Scanlan, Russell, Beals et al., 2003; Scanlan, Russell, Wilson et al., 2003), soccer (Holt & Dunn, 2004; Zahariadis et al., 2006; Sousa et al., 2007), swimming (Raedeke, 1997), tennis (Theodorakis, 1996; M. R. Weiss et al., 2001), volleyball (Zahariadis et al., 2006), and water-polo (Zahariadis et al., 2006). All of these researchers agree unequivocally

that a high level of sport commitment is positively correlated to undertaking the tasks necessary to develop sporting excellence.

In summary, the available research strongly suggests a positive relationship between sports performance and sport commitment. However, to date, it appears no research has examined the relationship of sport commitment to selection and acceptance in a TID program.

2.3 CURRENT TID PRACTICES IN AUSTRALIA

2.3.1 History of National Talent Search Program

The relatively small population of Australia makes it necessary for sporting organisations to nurture all available talent (Hoare, 1995). The *Talent Search* program in Australia was initially founded on pioneering research conducted within the sport of rowing in 1988 (Hahn, 1990). Allan Hahn and colleagues commenced a project at the Australian Institute of Sport, testing 500 students in the Canberra region and selecting a squad of 24 (12 males and 12 females) to participate in a talent development program for rowing (Hoare, 1998). Outstanding success was achieved, with representatives from this TID program competing in rowing at 1992 Barcelona Olympics (Hoare, 1998). In response to the announcement of Sydney hosting the 2000 Olympic Games, the Australian Sports Commission (ASC) instituted the nationally-coordinated program of *Talent Search* (currently known as the National Talent Identification Program (NTID)) in 1994 to assist in the identification and development talented athletes (Hoare, 1998).

The aim of the NTID was to conduct mass testing of secondary school students, with athletes identified based on a model of desirable characteristics considered relevant to a variety of

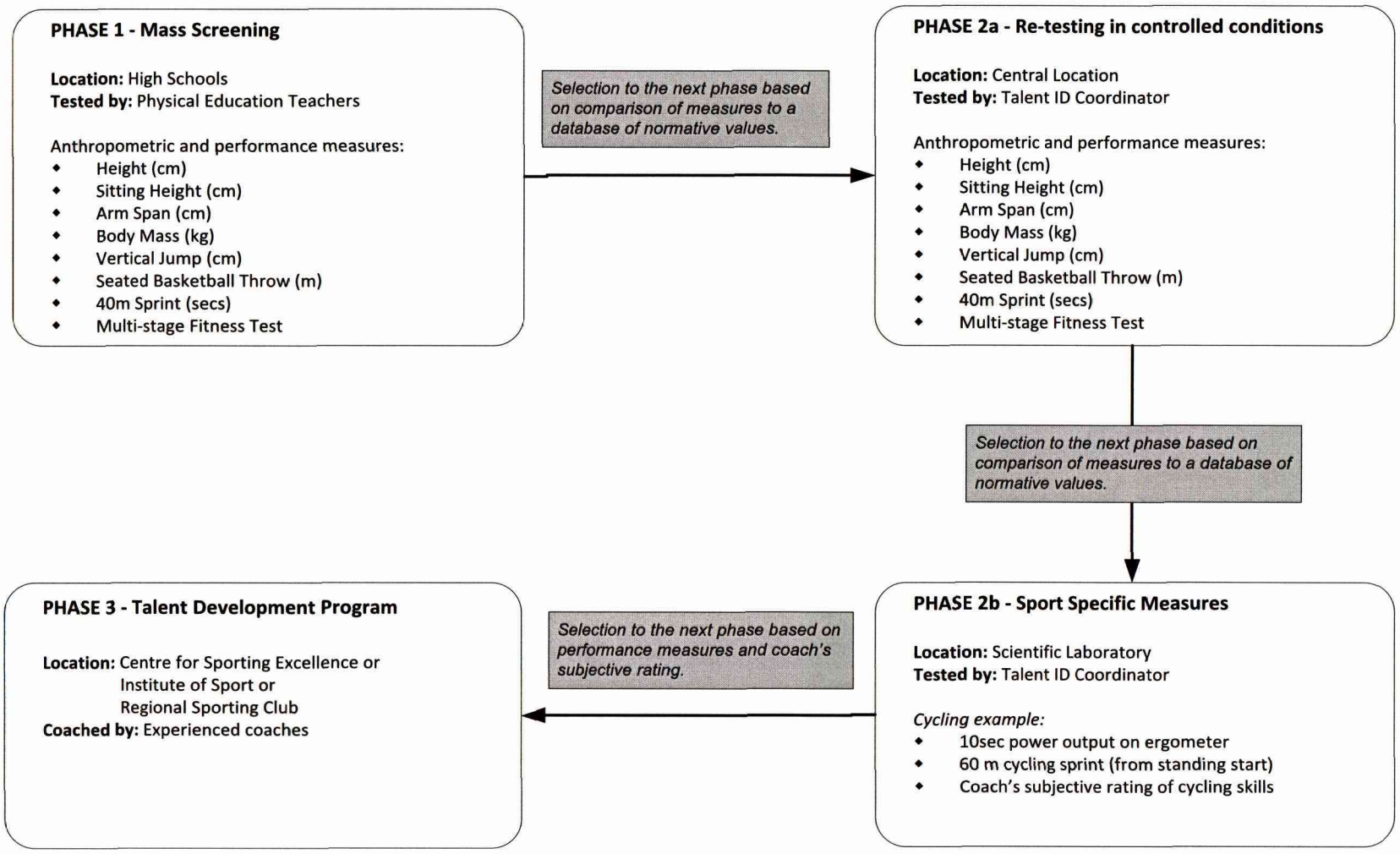
sports. The NTID initially focused on identifying talent in sports (athletics, canoeing, rowing, cycling and weightlifting) that were individual, repetitive and considered to have distinct anthropometric and physiological profiles (Hoare, 1995). Team sports such as basketball and soccer and skill-specific sports such as archery were not initially included as anthropometric and physiological attributes were considered only a small factor for success in these sports (Hoare, 1998). Research in Australian soccer using a multifactorial approach has since been conducted (Hoare & Warr, 2000). This research was founded on the consideration that in team sports, technical, tactical and psychological factors may be better discriminators of performance than anthropometric and physiological attributes (Hoare, 1995; Hoare & Warr, 2000).

The NTID is based on a number of premises. Firstly, that distinct anthropometrical and physical profiles characterise and determine successful performance in different sports. Secondly that these profiles of adolescents are the best indicators of potential talent; and finally that determinants of both performance and potential during adolescence are synonymous (Abbott et al., 2002).

2.3.2 Phases of NTID Testing

The NTID is structured to include three phases (Figure 2). The first phase consists of screening students in the school environment using a battery of anthropometric and physiological tests (Hoare, 1995). Results from the mass screening are then compared against a national database for subsequent identification of students invited to participate in phase 2 testing. Phase 2 is a two-stage process. The first stage is to re-test the measures taken in the schools, and the second to conduct sport-specific tests. The results of these sport-specific tests which often include a coach/expert subjective rating of performance are used as the criteria to

Figure 2: Three phases of the Australian National Talent Identification Program (NTID)



subsequently select athletes for the third phase of the NTID, a structured talent development program under the supervision of a coach.

2.3.3 Why such success for Australia?

The NTID was widely considered as being a factor in successfully identifying potential elite performers, with the often-cited example of an Olympic gold medalist identified from the 1988 rowing program (Hahn, 1990). As illustrated in Table 4, multiple world junior championship medalists and representatives were identified as a result of the NTID. As such, many elements of that program have subsequently been adopted by the United Kingdom.

Table 4: Athlete achievements in Australian *Talent Search* Program 1994-97 (Abbott et al., 2002).

Achievement:	**Number of athletes**
World junior championships - medalist	16
World junior championships representation	54
National junior championships	201
National junior championships - placing (1st - 3rd)	491
State sport institute/ academy of sport scholarship	31

2.3.4 Evaluating the Australian Experience

Despite the available literature discussed earlier that highlights the instability of biological factors through adolescence, the NTID in Australia has achieved great success. However, from a scientific perspective, the NTID can be considered fundamentally flawed (Abbott et al., 2002).

Table 2 highlights that the anthropometric and physiological measures taken in the first phase of the NTID are highly unstable during adolescence in males (Pearson et al., 2006). It is logical to extend this instability of biological factors to females, although corresponding data for pubescent females is not currently available (Malina & Bouchard, 2001).

A comprehensive review (Abbott et al., 2002) of the NTID program argues that the program's success is due to a combination of factors including the complexity of the sports involved, the age at which individuals were profiled, and the sporting culture of Australia. The review by *Sports Scotland* (Abbott et al., 2002) argues that the initial emphasis of the NTID on closed sports characterised by stable and predictable environments (e.g. rowing) has contributed to the inflated success of the program.

In response to the Australian NTID being adopted by United Kingdom, Abbott and Collins (2002) evaluated the processes and proposed an evidence-based approach to TID (Figure 3). Abbott and Collins (2002) propose that the early focus of TID should be towards developmental aspects (i.e. psycho-behaviours and transferable skills) rather than early identification. As an individual matures and develops within their chosen sport, Abbott and Collins (2002) the emphasis should gradually shift from determinants of potential (transferable perceptual elements) to determinants of performance (specific adaptations to the unique perceptual constraints of their chosen sports). The key features of this approach include:

1. Primary emphasis should be placed on the capacity of an individual to develop as opposed to performance levels at the time of testing.

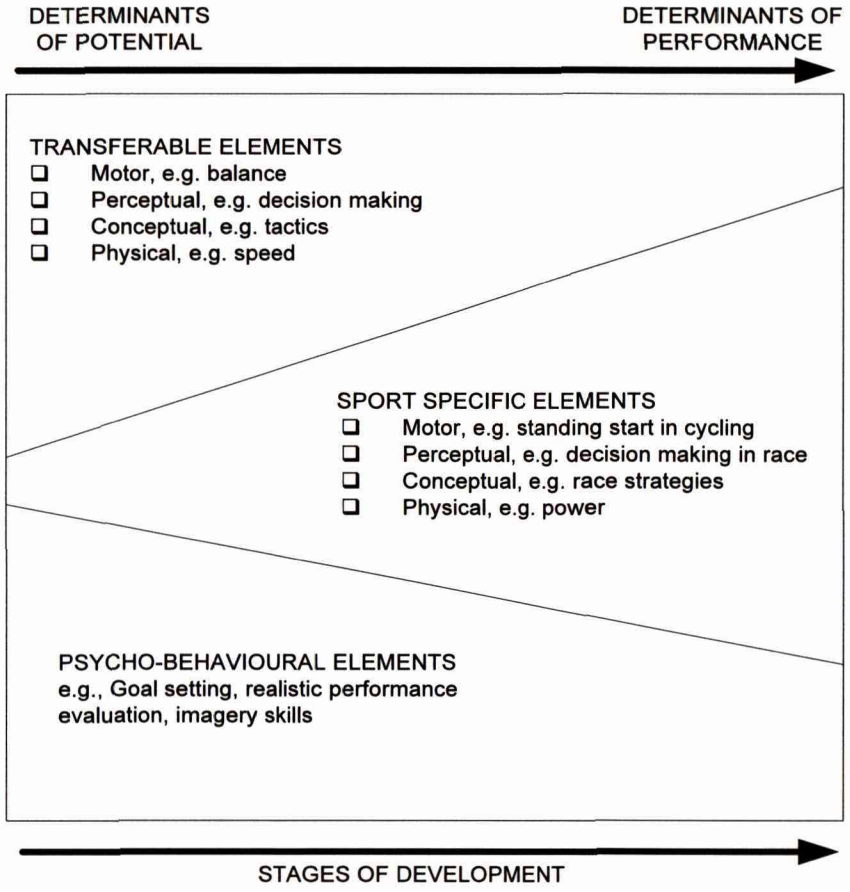


Figure 3: Proposed contribution of motor, perceptual, conceptual, physical and psychological elements to the development and performance of an athlete (Abbott & Collins, 2002, 2004; Abbott, 2005).

2. Given appropriate support, the key determinants of the capacity that an individual has to develop are suggested to be psycho-behavioural.
3. Key fundamental movement skills are needed to ensure development in a sport.
4. Talent identification and talent development processes should be combined. Children should be provided with opportunities to develop psychomotor and psycho-behavioural factors that are proposed as precursors to successful development in sport. These development opportunities should be provided and progress monitored prior to any selection into and elimination from a development program.

Abbott and Collins (2002) model has many similar features to the historical models discussed earlier. Certainly the focus on a dynamic approach (Bar Or, 1975; Gimbel, 1976; Dreke, 1982; Havlicek et al., 1982; Regnier et al., 1993) with a multidimensional focus on the determinants of potential (Bar Or, 1975; Gimbel, 1976; Dreke, 1982; Harre, 1982; Havlicek et al., 1982; Regnier et al., 1993) is not new. However, the Abbott and Collins (2002) model does broaden previous models taking into account the latest scientific evidence available. The model proposes a shift from the traditional emphasis on selection and elimination to one of development and continual monitoring. This model is currently being piloted for several sports in Scotland with the results of these investigations potentially offering a greater understanding of the best approach to identifying and developing talent in sport.

2.4 Dichotomy between theory and practice

Theorists as far back as the mid-1970s were advocating the need for a multidimensional approach towards TID in sport. Certainly the talent detection, identification, selection and

development stages cannot each be seen in a vacuum. They are inter-related in a complex way to such a degree that no studies to date have developed a comprehensive, all encompassing conceptual model of TID.

Numerous studies continue to be conducted that focus on one-off proficiency measures, predominantly using a limited range of physical measures. These studies fail to acknowledge the confounding factor of physical maturity and the instability of biological factors during adolescence. Some researchers have shifted towards a multi-faceted approach, acknowledging that talent is dynamic and complex and factors contributing to it change as a function of time (Simonton, 1999; Abbott, 2005). Unfortunately, current research cannot offer practitioners an objective basis for incorporating psychological measures in the process of identifying and selecting talented athletes for development programs. The recommendation from Abbott and colleagues (2002, 2005) of the need for researchers to design studies less focused on the determinants of performance and more on the determinants of potential although prolific does not expand on what the exact determinants of potential might be. Thus, future research is still needed to narrow this dichotomy between theory and practice.

The current review of the literature pertaining to TID in sport suggests that extending the current NTID in Australia to incorporate psychological measures is valid. Exploring the psychological measures that may discriminate between selected and non-selected athletes as well as those that accept the opportunity to develop their talent is an important first step to clarifying those aptitudes conducive to undertaking the many years of intensive training involved in a talent development program.

CHAPTER THREE: JOURNAL ARTICLE FOR SUBMISSION

THE JOURNAL OF SPORT SCIENCES

Written to comply with Author Guidelines for submission to the *Journal of Sport Sciences* (Appendix A).

The Associations between Sport Commitment, Explanatory Style, Physical Self-Concept and Athlete Selection and Acceptance in a Talent Identification Program.

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ABSTRACT

The purpose of this study was to determine if anthropometric, performance and psychological measures could predict selection and acceptance of participants in a Talent Identification (TID) program for cycling. Participants (n = 72; male = 46; female = 26; age = 15.4 ± 2.0 yrs) underwent measurements of height, body mass, maximal aerobic power, sprint running speed, leg power, sport commitment, explanatory style and physical self-concept. Discriminant function analysis was used to determine which of these variables related to both selection and acceptance into the cycling TID squad. Maximal aerobic power, running speed, and leg power made significant (p <.05) contributions to selection into the TID program. Sport commitment was predictive of accepting the invitation into the TID program. The results suggest that although physical performance capacities were predictive of selection into the TID squad, sport commitment was the greatest predictor of acceptance. The findings suggest the importance of considering psychological measures in the initial phase of a TID program.

Running Head: Psychological correlates of talent identification

Keywords: discriminant analysis, talent identification, talent development, cycling

INTRODUCTION

The aim of a talent identification (TID) program is to provide an accurate prediction of those athletes who have the potential to reach an elite level in sport (Abbott, Collins, Martindale, & Sowerby, 2002). The identification of talent in sport is viewed as a panacea for successful elite level athletic performance, particularly in countries without the luxury of selecting from a large population base (Simonton, 1999). The Australian Sports Commission (ASC) TID program evaluates children on anthropometric and performance tasks to identify individuals who exhibit the characteristics associated with success within a specific sport (Hoare, 1998). This process of TID is followed with a talent development program in which selected athletes are placed in an accelerated program and fast-tracked in their athletic development (Hoare, 1995).

Effective TID processes are vital to ensure resources are available to help athletes develop and limit the costly mistakes of dropout or failure to achieve (Abbott & Collins, 2004). However, there appears a lack of consensus both nationally and internationally regarding the theory and methodology of TID (Tranckle & Cushion, 2006). Sport-specific TID literature has been driven by the assumption that the underlying factors necessary for sport excellence exist at an early age. Researchers have thus tried to determine the abilities, traits and structures that might predict elite athletic performance (Regnier, Salmela, & Russell, 1993).

Researchers agree that talent is a complex attribute that is genetically determined, complicated in structure, and subject to environmental conditions (Abbott, 2005; Abbott & Collins, 2004; Abbott et al., 2002; Critien & Ollis, 2006; Falk, Lidor, Lander, & Lang, 2004; Hoare & Warr, 2000; Ollis, Macpherson, & Collins, 2006; Pearson, Naughton, & Torode, 2006; Reilly, Williams, Nevill,

& Franks, 2000; Tranckle & Cushion, 2006; Williams & Reilly, 2000) . In establishing effective TID systems, national governing bodies and funding agencies need to recognise the multidimensional and dynamic nature of sporting talent, and promote the range of factors that enable children to develop into successful elite level performers (Abbott, 2005; Abbott & Collins, 2004; Simonton, 1999).

Practitioners and sport scientists accept that sporting expertise is governed by a multiplicity of biomechanical, physiological, anthropometric and psychological factors (Abbott & Collins, 2004). Despite the acknowledged complex nature of talent, current TID processes typically focus on a limited range of variables (Gore, 1998). These anthropometric and performance measures typically fail to include psychological characteristics that are required to achieve sporting excellence (Abbott, 2005; Abbott & Collins, 2002, 2004; Baker, Horton, Robertson-Wilson, & Wall, 2003; Simonton, 1999; Williams & Reilly, 2000).

The current TID selection process in Australia is unidimensional in nature with a strong emphasis on anthropometric and performance measures of talent (Abbott & Collins, 2002). Despite unidimensional research still being popular (Aitken & Jenkins, 1998; De Albuquerque & Farinatti, 2007; Di Cagno et al., 2008; Falk et al., 2004; Gabbett, Georgieff, & Domrow, 2007; Grove, 2001; Hoare & Warr, 2000; Lidor et al., 2005; Mikulic & Ruzic, 2008; Pienaar, Spamer, & Steyn, 1998; Staerck, 2003; Stuelcken, Pyne, & Sinclair, 2007; Vaeyens et al., 2006; Veale, Pearce, Koehn, & Carlson, 2008), an increasing number of researchers are examining the interaction between multidimensional determinants of talent, which include anthropometric, physiological, biomechanical, and psychological aspects of participation and performance

(Elferink-Gemser, Visscher, Lemmink, & Mulder, 2007; Holt & Dunn, 2004; Nieuwenhuis, Spamer, & Rossum, 2002; Reilly et al., 2000).

TID procedures tend to be employed with children and adolescents at as early an age as possible in order to provide the ten years of developmental opportunities that research has suggested is required to excel (Ericsson, Krampe, & Tesch-Romer, 1993; Starkes, 2000). The necessity of identifying children during their pubescent years confounds the criterion that is used to predict performance potential (Abbott, 2005; Abbott & Collins, 2002; Abbott et al., 2002; Simonton, 1999). Research has clearly shown that the anthropometrical and physiological factors that are assessed as being advantageous to performance in sport are highly unstable during adolescence (Ackland & Bloomfield, 1996).

Whilst motor abilities underpin skill acquisition, psychological factors appear to be the main determinants of an individual's potential within a sport (Abbott et al., 2002) . Anthropometric and physiological measures are known to play a role in TID, however the psychological disposition of an individual characterises the means by which they interact with their environment, and therefore the extent that they make the most of the opportunities they are given (Abbott, 2005; Abbott & Collins, 2002, 2004; Abbott et al., 2002; Simonton, 1999; Ziegler & Heller, 2002). A range of psychological characteristics appears to underpin an individual's true potential for growth (Abbott & Collins, 2004). However researchers have yet to identify specific personality characteristics, or a psychological profile that can predict success in sport (Williams & Reilly, 2000). Currently, there is no psychological inventory to help select individuals with more or less potential and it is unlikely that any single inventory would have complete predictive power for sporting success.

Previous investigations linking psychological factors and performance have focused on comparing elite and non-elite athletes (Ikuleyo & Vipene, 1996; Vealey, 1992) or successful opposed to unsuccessful athletes (Panda & Bisivas, 1989; Schurr, Ashley, & Joy, 1977). This approach assumes that the psychological qualities important for success as an adult athlete can be used to identify adolescents for early selection. At present there is no evidence that psychological characteristics remain stable from adolescence to adulthood in the context of elite sport (Regnier et al., 1993).

Given the propensity for psychological characteristics to be unstable during adolescence (Regnier et al., 1993), a better approach to assessing psychological predictors of future sporting success may be to identify aptitudes predictive of the ability to cope with the many hours of training crucial to ensure success. These aptitudes should be measured early in the TID process as they are required to overcome the motivational and effort constraints evident during highly intensive and prolonged training (Ericsson et al., 1993). Theorists propose that the psychological constructs of commitment and persistence in times of adversity are paramount to sporting success (Csikszentmihalyi, 1993; Ericsson et al., 1993; Howe, 2001; Patrick et al., 1999). Sport commitment reflects the desire and resolve to persist in a sporting endeavour over time and may be indicative of the athletes' dedication to further develop their potential (Scanlan & Simons, 1992). Furthermore, individuals with an optimistic explanatory style when confronted with a challenge are posited to adopt an outlook of confidence and persistence while pessimists are doubtful and hesitant (Gould, Dieffenbach, & Moffett, 2002). An adolescent's physical self-esteem (known as physical self-concept) is also considered a major determinant of future motivated behaviour in sport. When an individual feels a sense of efficacy in a physical domain,

they tend to manifest ensuing motivated behaviour in that particular activity (Weiss & Horn, 1990). Such motivation is paramount to the long term success of a TID program.

The aim of the present study was to determine if a range of anthropometric, performance and psychological measures (commitment, explanatory style and physical self-concept) could discriminate between successful and unsuccessful 13 – 21 year olds in terms of selection and acceptance into aTID program for cycling.

METHODS AND MATERIALS

Overview

The aim of the present study was to determine if a range of anthropometric, performance and psychological measures (commitment, explanatory style and physical self-concept) can discriminate between successful and unsuccessful 13 – 21 year olds in terms of selection and acceptance into an ASC TID program for cycling.

The recruitment of participants for the study will be discussed first, followed by a detailed explanation of the anthropometric and physiological tests conducted. The instruments used to assess the psychological measures of physical self-concept, explanatory style and sport commitment will then be presented, followed by an explanation of the selection protocol.

This study was approved by the CQUniversity *Human Ethics Review Panel* (Appendix B) and financially supported jointly by the ASC and the Department of Health and Human Performance at CQUniversity. Both parents/guardians and participating athletes signed a written informed consent document prior to all testing sessions (Appendix C).

Participants

Seventy-two athletes (males= 46, females= 26) participated in this study. An initial open invitation to trial for the program was extended to students from all secondary schools (aged 13 – 18 years) and community-based athletes (up to 21 years) within the Rockhampton (Central Queensland) area. This initial screening was the first of two phases of testing for the selection into a 12-month TID for cyclists under the auspices of a high performance coach. All participants received a verbal explanation of the study, including the risks and benefits of participation, and written parental/guardian consent was obtained.

Anthropometric and Performance Measures

The first phase of the TID testing included the measures of age, height, body mass, leg power (vertical jump), speed (40-m sprint) and maximal aerobic power (multi-stage fitness test). Each test was conducted in accordance with standardised TID testing protocols (Australian Sports Commission, 2000) (Appendix D). The testing session began with anthropometric measurements, followed by vertical jump and 40-m sprint. Participants were encouraged to perform low-intensity activities and stretches between performances. Upon completion of the above tests, the session concluded with participants performing the multi-stage fitness test. All testing was conducted on a grass-surfaced sporting oval on the same day.

Age, height and body mass

Age was calculated from the date of birth and date of examination. Standing height was measured to the nearest 0.1 cm using a stadiometer (Blaydon Lugarna, NSW, Australia) and the stretch height method (Norton and Olds, 1996). Body mass was determined using a previously calibrated electronic platform scale (Tanita Corporation, Tokyo, Japan) with measurements

recorded to the nearest 0.1kg. For both measures candidates were bare foot and wearing minimal sports clothing.

Leg power

Leg power was evaluated using a vertical jump. The test procedure employed the counter-movement jump technique described by Adams (1998) using a Vertec™ (Sports Imports, Columbus, OH) apparatus that records values in 1 cm increments. Using the dominant hand and keeping the feet together, each participant performed a standing reach. The difference between (cm) the standing reach and the greater of two jumps was recorded for data analysis.

Speed

The maximal running speed of the candidates was evaluated over a 40-m sprint effort using dual beam electronic timing gates (Swift Performance Equipment, NSW, Australia). The timing gates were positioned 20 and 40-m from a pre-determined starting point. Candidates were instructed to run as quickly as possible along the 40-m distance from a standing start. Speed was recorded to the nearest 0.01s with the best value obtained from two trials, with a recovery of approximately two minutes between trials.

Maximal aerobic power

Maximal aerobic power was estimated using the multi-stage fitness test (Ramsbottom, Brewer, & Williams, 1988). Participants were required to run back and forth (i.e. shuttle run) between markers placed 20-m apart, keeping in time with a series of signals on a compact disc. The frequency of the audible signals (and hence running speed) was progressively increased, until

participants reached volitional exhaustion. Maximal aerobic power (VO_2max) was estimated using regression equations described by Ramsbottom et al. (1988).

Psychological Measures

Three questionnaires (Appendix E) were administered to athletes prior to the physical testing session. Athletes were advised that their responses would be confidential and would have no bearing on the selection outcome. Due to the small sample size, some variables from all questionnaires were deliberately excluded to avoid model overspecification. Furthermore, Brace, Kemp and Snelgar (2000) stated that sample size should ideally exceed the number of predictor variables by a factor of five to ensure statistical rigour. All four psychological variables measured achieved satisfactory Cronbach alpha levels (Table 1), indicating moderately high internal consistency.

Physical Self-Concept

Physical self-concept was assessed through the 70-item *Physical Self Description Questionnaire* (PSDQ) (Marsh, 1996). The PSDQ has previously demonstrated good test-retest reliability and high alpha coefficients for each of the 11 scales (Marsh et al., 1994). Participants indicated the degree to which they agreed with declarative statements about themselves on a 6-point true-false response scale. The PSDQ scales measure nine specific components of physical self-concept and two components of global self-concept. The present study only focused on the global values of physical self-concept ($\alpha = .89$) and self-esteem ($\alpha = .83$).

Sport Commitment

A modified version (Alexandris, Zahariadis, Tsorbatzoudis, & Grouios, 2002) of the sport commitment measure initially developed by Scanlan, Simons, et al. (1993) was used to assess the psychological desire and resolve of athletes to continue their participation in the TID cycling program if selected. Athletes completed four questions using a 5-point Likert response format ranging from "not at all / nothing" to "very much so / a lot". For example, one item was "How dedicated are you to this talent identification program?" The sport commitment measure has shown good validity and reliability in studies with adolescents (Scanlan et al., 1993; Carpenter et al., 1993).

Explanatory Style

Explanatory style was measured using the *Sport Attributional Style Scale* which consists of 10 hypothetical situations: 5 good outcomes and 5 bad outcomes (Hanrahan & Grove, 1990). The positive and negative items were matched for content. Candidates were asked to imagine each event happening to them and attribute one major cause of the event, and then use 7-point bipolar scales in each case to rate the degree of stability and globality of the cause. In the present sample, a composite score for explanations of 'bad events' (CN) was obtained by averaging the participant's score on the stability + globality dimensions for the bad events (α = .77). Similarly, a composite for 'good event' explanations (CP) was calculated by averaging the respondent's score on the two dimensions for the good events (α = .75). Finally, subtracting CN from CP yielded a full scale score. The more positive this score, the more optimistic the participant. In contrast, the more negative this score, the more the participant is pessimistic (see Peterson, 1991 and Reivich, 1995, for a more detailed explanation).

TID Selection Procedure

The results of the anthropometric and performance measures were entered into an *Excel* spreadsheet and forwarded to the National Talent Identification Coordinator for Cycling at the ASC. Candidates were evaluated solely on the outcome of the physical measures taken at the initial screening and then categorised into either a "selected" or "not selected" group. Selected candidates were invited to a second phase of testing which included cycling-specific skill testing (60-m sprint on velodrome) and a subjective rating (1-10) of their movement coordination in cycling-specific tasks. The results of the second phase of testing are outside the scope of this study.

Statistical Analysis

Descriptive statistics (means and standard deviations) were calculated for each of the variables of interest. A simultaneous discriminant function analysis (DFA) was conducted to determine whether anthropometric, performance and psychological measures could predict group selection into the TID program. The predictor variables were age, height, body mass, leg power, speed, maximal aerobic power, sport commitment, explanatory style, and physical self-concept. The criterion variables were the candidates 'selected' and those that were 'not selected' into the TID program. Within the selected group, a further delineation was made between those candidates, who accepted the invitation into the squad, and those that declined selection. All analysis was conducted using SPSS Version 15.0 and an α level of $p < .05$ was used as a criterion for statistical significance.

RESULTS

Descriptive statistics for all variables are detailed in Table 1. The DFA revealed that the overall Wilk's Lambda for selected and non-selected candidates was significant ^=.44, χ^2 (10, N=72) =53.29, p <.001, indicating that the overall predictors differentiated between the two groups (selected and not selected). The F tests were significant for leg power, speed, and maximal aerobic power indicating that selected and non-selected candidates differ on these predictors. The discriminant function accounted for 56% variance of the selected TID athletes. Furthermore, the discriminant function correctly classified 86% of all cases, indicating a valid model. The discriminant function was slightly better at predicting the non-selected candidates (87%) then predicting the selected candidates (85%).

A further DFA was conducted to examine whether the psychological variables within the selected group influenced acceptance of the invitation to the next phase of testing. The overall Wilk's Lambda for accepted and not accepted candidates was significant ^ =.60, χ^2 (5, N=33) =16.42, p <.05, indicating that the psychological predictors differentiated between the two groups (accepted and not accepted). The F tests were significant for sport commitment indicating that acceptance and non-acceptance differed on this predictor. The discriminant function accounted for 40% of the dependent variable. Furthermore, the discriminant function correctly classified 76% of all cases, indicating a valid model. The discriminant function was slightly better at predicting acceptance (78%) than predicting the non-accepted candidates (73%).

[Insert table 1 & 2 here]

Table 2 presents the within-group correlations between the predictors and the discriminant function as well as the standardised weights. Based on these coefficients, speed made the greatest contribution to the prediction of TID selection than any other variable, followed by leg power and maximal aerobic power. Moreover, sport commitment had the greatest effect for predicting acceptance into the next phase of testing.

DISCUSSION

The purpose of the present study was to determine if anthropometric, performance and psychological characteristics of potential cyclists influenced selection and acceptance into a TID program. To our knowledge this is the first study to incorporate psychological measures into an established National TID Program.

The DFA revealed that the performance measures of maximal running speed, leg power and maximal aerobic power significantly predicted selection into the TID squad. Thus, the better the candidates performed on these three tests, the more likely they were to be selected into the TID program. Maximal running speed and leg power were more strongly related to the discriminant function than maximal aerobic power. The exact process with which the National Talent Identification Coordinator chose the athletes is not known, but these results suggest that the power measures weighed more heavily in the decision than the aerobic fitness measure. This outcome could be explained by the fact that the coach and cycling club that would be responsible for the development of the selected talent squad has a strong track record of developing sprint track cyclists who have gone on to achieve international success. Thus the National Talent Identification Coordinator may have been bias towards the more powerful athletes.

The DFA analysis also revealed that the selected athletes could not be distinguished from the unsuccessful athletes on the three psychological measures of physical self-concept, explanatory style and sport commitment. The similar results between the selected and non-selected candidates on the psychological measures by no means suggest that these characteristics are unimportant in athletic performance. However, they suggest that the psychological constructs aren't distinguishable at this early stage in an athlete's development.

The present results also strongly suggest that athletes selected into the TID squad do not necessarily accept the opportunity to further develop their talent. The current findings suggest that sport commitment was the sole predictor of a selected athlete accepting the opportunity to partake in the next phase of the TID program. These results are supported by Csikszentmihalyi (1993) who stated that only a minority of adolescents who show early indications of talent respond to the need to increase effort and commitment to develop their talent.

The present results also suggest that physical self-concept and explanatory style did not influence acceptance of an athlete into the TID program. Thus while physiological capacities alone influenced athlete selection, sport commitment indicated whether the athlete had the motivation to convert their talent into sporting achievement. These findings suggest that when selecting athletes for a future TID program, the commitment of the candidates to the program should be assessed, possibly using the sport commitment scale (Carpenter et al., 1993; Scanlan et al., 1993).

Both sport scientists and coaches are aware of the multidimensional nature of talent and accept that talent goes beyond the physical (Thomas & Thomas, 1999). Research has consistently shown that it takes years of dedicated practice to achieve excellence (Ericsson et al., 1993). Not only does an aspiring athlete require the physiological capacities to train extensively but also the motivation and commitment to acquire and refine skills and to develop within a specific sport setting with its inherent psychosocial complexity (Abbott, 2005; Abbott & Collins, 2002, 2004; Abbott et al., 2002; Auweele, Mele, Nys, & Rzewnicki, 2001; Baker et al., 2003; Holt & Dunn, 2004; Morris, 2000; Regnier et al., 1993; Simonton, 1999; Thelwell, Greenlees, & Weston, 2006).

The concept of psychological factors being evaluated within the TID process is not new (Abbott, 2005; Abbott & Collins, 2002, 2004; Abbott et al., 2002; Auweele et al., 2001; Baker et al., 2003; Holt & Dunn, 2004; Morris, 2000; Regnier et al., 1993; Simonton, 1999; Thelwell et al., 2006). However, to date it appears that the Australian TID process does not attempt to measure any psychological variables and is focused only on performance measures (Hoare, 1995, 1998; Hoare & Warr, 2000). The contradiction between what research suggests and the current TID system in Australia highlights that investigators are yet to pinpoint the specific psychological measures that should be incorporated into the TID process. Moreover, to date no research has identified how these measures correlate with an athlete's potential (Abbott, 2005). The results of the current study strongly suggest that the measure of sport commitment may be incorporated in the early stages of the TID selection process.

As mentioned previously, the unstable nature of physiological markers in adolescence is not conducive to predicting athletic performance capacity in adulthood. While discrete

performance variables may be helpful in identifying potential athletes for development, in isolation these variables when measured during adolescence are a poor predictor of future elite performance (Abbott, 2005).

The present study sought to identify psychological attributes of young athletes that might predict their dedication to developing their potential. The current results suggest that physical self-concept and explanatory style were not significant in predicting an athlete's selection and acceptance into a TID program. While these attributes may play a role during the development of an athlete, the current results suggest they may have no role in the initial identification phase. However, these aptitudes should not be undervalued in a developing athlete as previous research has shown a positive explanatory style is present in Olympic athletes and plays a significant role in an athlete's development, overcoming failure and persisting in their course of action (Gould, Dieffenbach, & Moffett, 2001; Gould et al., 2002; Seligman, 1990; Seligman & Csikszentmihalyi, 2000). Moreover, research has found that a high physical self-concept in elite athletes contributed significantly to performance at an international level (Marsh, 1992). Additionally, studies have shown a consistent correlation between high levels of physical self-concept and high levels of physical activity, though the direction of causality has yet to be established (Crocker, Sabiston, Kowalski, McDonough, & Kowalski, 2006; Fox, 2000; Martin, Engles, Wirth, & Smith, 1997).

In the present study, sport commitment represents motivational forces and a psychological attachment towards pursuing a cycling career (Holt & Dunn, 2004). Research conducted by Zahariadis and colleagues (2006) found that intrinsic motivation has a positive relationship with sport commitment. Motivation is crucial to successful development in any form of pursuit

(Abbott, 2005; Ericsson, 2007). Motivation has been identified as playing an important role in the attainment of expert level status in sport (Ericsson, 2007). However, to date there is little understanding of the motivational processes that underpin the years of investment in high-quality training required for elite performance in most sports (Ericsson, 2007). It is the 'elephant in the room' with many sport scientists acknowledging its importance but knowing little about 'how it got there or what to do with it' (Starkes, 2000). The present study suggests that motivation in the form of sport commitment predicts whether an athlete will interact with their environment and take the opportunity to develop their talent.

Although the present study is the first to investigate psychology measures in the TID process, refinement of these measures is required. The small sample size limits the generalisability of the findings and the psychological measures taken only in the first phase of testing could be extended into the second phase. To avoid model overspecification the measure of sport commitment was limited to its presence only. However, further research could extend to the determinants of such commitment (Scanlan & Simons, 1992). Furthermore, longitudinal research is needed to more completely understand the dynamic nature of sport commitment, the influence of changes in the determinants of such commitment over time, and the corresponding variation in commitment during the training of an athlete from TID through talent development to elite sports performance.

CONCLUSION

In conclusion, the results of this study suggest that the capacities of maximal running speed, leg power and maximal aerobic power of the athletes directly influenced their selection into the cycling TID program. Furthermore, the results suggest the psychological attribute of sport

commitment predicts the acceptance of a candidate into a cycling TID program. Thus, the present results suggest the need for more psychological measures to be taken during the initial TID process.

Table 1. Descriptive statistics for TID candidates (n=72).

	Selected (*n*=33)	Non-Selected (*n*=39)	Accepted (*n*=18)	Not Accepted (*n*=15)	
	$\bar{x}$	$\bar{x}$	$\bar{x}$	$\bar{x}$	α
Leg power (cm)	44.30 ± 10.76*	35.87 ± 6.87	42.78 ± 10.28	46.13 ± 11.39	
Speed (seconds)	5.83 ± .37*	6.42 ± .40	5.82 ± .04	5.84 ± .34	
Maximal aerobic power (ml.kg.min^{-1})	49.45 ± 5.01*	44.02 ± 4.52	50.53 ± 3.95	48.16 ± 5.92	
Height (cm)	169.30 ± 8.87	164.06 ± 16.41	169.34 ± 9.07	169.24 ± 8.93	
Weight (kg)	58.02 ± 9.95	56.62 ± 11.88	59.12 ± 10.08	56.69 ± 9.98	
Age (years)	14.64 ± 1.65	15.38 ± 2.94			
Physical self-concept	5.26 ± .79	5.35 ± .65	5.37 ± .72	5.13 ± .86	.89
Self esteem	5.25 ± .58	5.41 ± .60	5.38 ± .47	5.10 ± .68	.83
Sport commitment	4.11 ± .68	3.83 ± .73	4.41 ± .49#	3.75 ± .72	.83
Explanatory style	6.17 ± 5.03	6.15 ± 4.93	5.00 ± 3.27	6.55 ± 5.35	.76

Note: $\bar{x}$ = mean; *n* = number of participants; sd = standard deviation; α = Cronbach's alpha, * Selected significantly different from non-selected (p <.001); # Accepted significantly different from not accepted (p = <.05);

Table 2. The Standardised Coefficients and Correlations of Predictor variables of the Discriminant Function.

	Selected and Non-Selected Group (n=72)		Accepted and Not Accepted Group (n =33)	
Predictors	Correlation Coefficients	Standardised Coefficients	Correlation Coefficients	Standardised Coefficients
Years (age)	-.137	-.336		
Height (cm)	.174	-.138		
Weight (kg)	.057	-.311		
Leg Power (cm)	.427	.507		
Speed (seconds)	-.683	-.614		
Maximal Aerobic Power ($ml.kg.min^{-1}$)	.512	.482		
Physical self-concept	-.055	-.286	.191	-.104
Self esteem	-.124	-.131	.303	.255
Sport commitment	.181	.444	.702	.965
Explanatory style	.001	.067	-.330	-.805

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CHAPTER FOUR: SUMMARY AND CONCLUSIONS

4.0 SUMMARY

The relationship between psychological characteristics and sport behaviour is one of the most widely researched topics in sport psychology. However, despite the vast amount of research in this area, there is limited evidence identifying a psychological profile of successful sport performers, either for selection at adult elite standard or for junior TID.

In cycling there is a distinct lack of empirical research concerning TID and athlete development. This thesis aimed to gain an understanding of the underlying factors relevant to the initial phase of a TID program. The overall objective was to determine if a range of anthropometric, performance and psychological measures could discriminate between successful and unsuccessful participants in a TID program for cycling.

In order to determine predictor variables contributing to the selection and acceptance of athletes in a TID program, the study specifically examined:

1. The relationship between a range of anthropometric and physiological measures and selection into the next phase of TID testing.
2. The relationship between three psychological constructs and selection into the next phase of TID testing.
3. The relationship between the anthropometric and physiological measures and acceptance to attend the next phase of TID testing.
4. The relationship between three psychological constructs and acceptance to attend the next phase of TID testing.

A total of 72 adolescents participated in the testing day. Participants underwent measurements of height, body mass, maximal aerobic power, sprint running speed, leg power, sport commitment, explanatory style and physical self-concept. Candidates were evaluated solely on the outcome of the physical measures with the NTID Coordinator for the ASC categorising the participants into either a "selected" or "not selected" group. Within the selected group, a further delineation was made between those candidates who accepted the invitation for further testing, and those that declined the offer of selection.

Descriptive and correlation statistics were analysed for all variables of interest. Discriminant function analysis was used to determine which of the above variables related to selection and acceptance of athletes into the cycling TID squad.

4.1 MAJOR FINDINGS

This study identified that those athletes selected for the TID program recorded faster times for the 40-m sprint (speed), jumped higher in the vertical jump (leg power) and performed better at the multi-stage fitness test (maximal aerobic power) than those athletes not selected. The psychological measures of sport commitment, explanatory style and physical self-concept did not discriminate between the selected and non-selected athletes. However, further analysis of these psychological constructs revealed that high levels of sport commitment were predictive of athletes accepting the opportunity to participate in further TID testing. The psychological commitment measure was predictive of behavioural commitment and these findings support the suggestion that the psychological disposition of an individual characterises the means by which they interact with their environment, and therefore the extent that they make the most

of the opportunities they are given (Simonton, 1999; Abbott & Collins, 2002; Ziegler & Heller, 2002; Abbott et al., 2002; Abbott & Collins, 2004; Abbott, 2005).

It is anticipated that the present results found within this study may provide a evidence to suggest that TID practitioners and sport scientists include psychological measures within TID programs. Such measures may help identify those psychological aptitudes that need to present at the first stages of the TID process as indicators of an individual's intention to undertake the intense training required to reach a higher level of performance.

Whilst the addition of psychological measures in a TID system requires a major shift in the way that talent is currently conceptualised, measured and promoted, such a change is required if scarce resources are appropriately guided towards those individuals who have the true potential to develop. It appears that the current NTID's focus on anthropometric and physiological measures maybe fraught with inherent methodological limitations. Considering the fact that we are attempting to predict inherently variable human behaviour in such a complex environment as sport, it might be suggested that the current unidimensional approach is not a solution (Regnier et al., 1993). The results of the present study together with the recent empirical evidence on TID and elite performance suggests the need for a more multidimensional approach to TID that includes psychological measures such as sport commitment.

CHAPTER FIVE: FUTURE RECOMMENDATIONS

5.0 RECOMMENDATIONS

A number of research questions emerged as a result of the findings of the current study. These include:

1. Examining both the antecedents of sport commitment and the factors that underpin and fosters sport commitment during the development of an athlete. Researchers agree unequivocally that sport commitment is required in the talent development phase (Bompa, 1985; Orlick & Partington, 1988; Ericsson et al., 1993; Scanlan et al., 1993; Borms, 1996; Theodorakis, 1996; Carpenter & Coleman, 1998; Carpenter & Scanlan, 1998; Patrick et al., 1999; Simonton, 1999; Thomas & Thomas, 1999; Holt & Dunn, 2004; Zahariadis et al., 2006; Ericsson et al., 2007; Sousa et al., 2007; W. M. Weiss & Weiss, 2007). Consequently future research might examine the influence of changes in commitment over time to elaborate more clearly on the mechanisms that may affect the motivational resolve to continue training. This research is suggested to include a longitudinal design.
2. This study was limited to only anthropometric, physiological and psychological indicators of talent. Future research might examine the environmental, sociological, biomechanical and genetic factors that may affect the identification and development of an athlete. Additionally a wider range of psychological measures could be explored. In particular the construct of mental toughness, which is suggested to be positively correlated to sports performance (Golby & Sheard, 2004; Bull et al., 2005; Levy et al., 2006; Jones et al., 2007; Connaughton et al., 2008; Nicholls et al., 2008).

3. The success of the Eastern European TID processes in the 20th century can be associated to their integration into the national education system. Linking identification and development to the education system allows for the wide participation of all socio-economic groups and aids development of a wider range of motor skills. Abbott and Collins (2002) espouse that TID and development should be complimentary rather than exclusive processes. In order to most effectively evaluate these combined processes, longitudinal research is required. To overcome the difficulty in obtaining funding for longitudinal research to test such models, a sliding population research design may enable athletes to be evaluated from the TID phase through the stages of the development process. This testing could be conducted in all primary and secondary schools in Australia. The sliding population approach (first cited in Regnier et al., 1993) is a mixture of longitudinal and cross-sectional designed studies which would allow a faster coverage of athletes over a developmental period, while still taking into account the dynamic stages of sports performance. Instead of following the population of athletes from childhood to maturity, it is suggested that the process be broken down into a number of smaller steps that can be carried out simultaneously. The developmental continuum should be broken down into different age groups. For every age group an instrument (measuring anthropometric, physiological, psychological and sociological variables) might be designed allows the estimation of the probability for the athletes from the age group of reaching the elite level of the following age group, or the target population. For example an instrument might be designed to estimate the probabilities of 10-year-old athletes reaching the target population made up of the 13

year old elite athletes. Another instrument would be elaborated to estimate the probabilities of 13 year old athletes reaching the target population made up of the 15 year old athletes and so on, until the total dynamic developmental profile can be constructed as the comparisons slide across the various populations. These instruments might be designed simultaneously by means of a cross-sectional approach.

4. Sporting clubs and associations at regional, state and national level should allow sport scientists greater access to those young athletes involved in their sport. Scientists need to determine the nature of both the subjective and objective criteria that coaches use to identify talented players.

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APPENDIX A: AUTHOR GUIDELINES

Instructions for Authors

1. Scope

Journal of Sports Sciences is published on behalf of the *British Association of Sport and Exercise Sciences*, in partnership with the *World Commission of Science and Sports* and in association with the *International Society for Advancement of Kinanthropometry*. The emphasis is on the human sciences applied to sport and exercise. Topics covered also include technologies such as design of sports equipment, research into training, and modelling and predicting performance; papers evaluating (rather than simply presenting) new methods or procedures will also be considered.

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2. Submission

All submissions should be made online at ***Journal of Sports Sciences*** Manuscript Central site. New users should first create an account. Once a user is logged onto the site submissions should be made via the Author Centre.

On submission, authors should select the relevant Section Editor (see journal homepage) or, in case of any doubt, submit to the Editor-in-Chief. Authors should keep a copy of all materials sent for later reference. Papers submitted to the Journal will be refereed **anonymously** by acknowledged experts in the subject; at least two such referees will be involved in this process. In the event of conflicting reviews, the Section Editor will normally seek a further independent review. As the Journal operates an anonymous peer-review policy, please ensure that your manuscript submission has all information identifying the author(s) removed. If you are submitting a revised manuscript and have used track changes, please make sure that any comments are anonymous in order to ensure your anonymity. Alternatively, please highlight your text changes through the use of red font.

The Section Editor will forward papers recommended for publication to the Editor-in-Chief, who has the final decision on publication. Manuscripts should not exceed 4,000 words, without the specific consent of the Editor-in-Chief or a Section Editor. Discursive treatments of the subject matter are discouraged. Section Editors will not accept manuscripts in two or more parts unless this has been agreed in advance by the Editor-in-Chief. As well as normal length communications of original research, shorter communications are also considered subject to the same refereeing process. Review papers will normally be by invitation of a Section Editor; authors wishing to submit a review paper are advised to consult the appropriate Section Editor before doing so. Book reviews are by invitation only. The Journal does not normally publish letters to the editor. **When preparing manuscripts, please use a standard word-processing package, such as WordPerfect, Microsoft Word or TEX. Where manuscripts are prepared as TEX files, please upload both the original files (as 'Supplementary Files'and a converted PDF (as the 'Main Document') when you reach the 'Upload Files' stage of online submission.**

On submission, authors are required to nominate up to four expert referees for their paper; these potential referees must not have been informed that they have been nominated or be members of the authors' institutions. The nominated referees may or may not be used, at the Section Editor's discretion, and at least one of the referees involved in the review of the paper will be independent of the nominated list.

3. Originality

We require authors to confirm the originality of material by ticking the appropriate checkbox on submission of the manuscript. Material submitted will not enter the refereeing process until such an undertaking has been received.

We discourage the practice of publishing parts of one study in different journals. Authors who submit a manuscript to the ***Journal of Sports Sciences*** from a study, some of these data from which has been or will be published elsewhere, must provide a strong justification in the accompanying letter to the Section Editor. The justification for not publishing all of the data together in one manuscript or as multiple papers in a single issue of the ***Journal of Sports Sciences*** must also be included in the covering letter.

4. Effective communication

Papers should be written and arranged in a style that is succinct and easy to follow. An informative title, a concise abstract and a well written introduction will help to achieve this. Authors should avoid some of the more common pitfalls, such as excessive use of the passive voice and past tense and **unnecessary use of fabricated abbreviations** within the text. The Journal would prefer authors to describe human volunteers as **participants rather than subjects** in the methods section. Figures and tables should be used to add to the clarity of the paper, not to pad it out. At all times, please try to think about your readers, who will not all be specialists in your discipline.

5. Manuscript

(a) *General*

The manuscript must be in English; UK English spellings and words should be used in preference to other versions of English. It must be word-processed, double-spaced throughout, with a 4 cm margin on the left side, with no 'headers and footers' (other than page numbers), and without footnotes unless these are absolutely necessary. Arrange the manuscript under headings (such as Introduction, Methods, Results, Discussion, Conclusions) and subheadings. Ideally, the main body of the text should not exceed 4,000 words, excluding references. Longer manuscripts may be accepted at the discretion of the respective Section Editor. Authors must make every effort to ensure that manuscripts are presented as concisely as possible. The Editors cannot consider for publication papers that are seriously deficient in presentation or that depart substantially from these 'Notes and Guidelines'.

(b) *Ethics of human experimentation*
The Journal will accept only papers that conform to the highest standards of safety and ethics. All experimental work involving human volunteers must conform to the laws of the country in which the work took place. The manuscript should, where appropriate, include a statement to the effect that the work reported has been approved by an institutional ethics review committee. If such approval has not been obtained, the reasons for this should be clearly stated in the submission letter that accompanies the manuscript.

(c) *Anonymous refereeing*
Because of the adoption of anonymous refereeing by the Journal with effect from 1 January 1998, the title page and manuscript should include no information that clearly identifies the authors or their affiliations. Authors should submit a separate cover letter, which is not part of the manuscript, that can include the following information: the full title; the names of the authors without qualifications or titles; the affiliations and full addresses of the authors; the name, address, telephone and fax numbers, and e-mail address of the author responsible for all correspondence and correction of proofs. Any acknowledgements should also appear on this page, not in the manuscript. These acknowledgements will appear in the printed version if the manuscript is accepted.

(d) *Title page*
Include the following information on the first page of the manuscript: the full title; a running title of no more than 75 characters and spaces; and up to five keywords for indexing purposes.

(e) *The abstract*
The abstract must not exceed 200 words and it must summarize the paper, giving a clear indication of the conclusions it contains.

(f) *Tables and illustrations*
Illustrations and tables must accompany the manuscript but not be included in the text. Authors may wish to express a preference for the location of tables and figures by including comments such as ****Table 1 near here**** or ****Figure 2 near here**** separated by at least one line space from the main text. Tables, referred to as 'Table 1', 'Table 2', and so on, must be numbered in the order in which they occur in the text. Tables must be clearly and simply laid out with clear row and column legends, units where appropriate, no vertical lines and horizontal lines only between the table title and column headings, between the column headings and the main body of the table, and after the main body of the table.

Photographs and line drawings, referred to as 'Figure 1', 'Figure 2', and so on, must be numbered in the order in which they occur in the text. Diagrams and drawings should be produced using a computer drawing or graphics package. All illustrations must be suitable for reduction to single column (84 mm) or page width (174 mm) of the Journal, with particular attention to lettering size. Photographs must be reproduced as black and white image files.

(g) *Symbols, units and abbreviations*

For a comprehensive guide to symbols, units and abbreviations, please consult the following text:
- The Symbols Committee of the Royal Society (1975, addenda 1981). Quantities, Units, and Symbols. London: The Royal Society.

(h) *References*
The Journal uses the APA reference style, which is a variation of the Harvard system. The following examples should make clear the most important points. References in the text are cited as follows: Smith (1985) . . . or (Brown & Green, 1996). Where there are between three and five authors, all authors should be given in the first citation in the text; subsequent references to the same source should give the first

author only followed by *et al.*. Where there are six or more authors, the first author only, followed by et al., should be cited in all instances. In the reference list, the first six authors only should be listed, followed by et al. Citations of different publications by the same author(s) are differentiated as Green (1993a) . . . (Brown *et al.*, 1995b); the a, b, c, etc., are normally in order of citation in the text. Multiple citations are listed in ascending chronological order. Within a year, they are organized in alphabetical sequence of the first author. Examples: Smith (1995), Brown & Green (1996), Jones *et al.* (1996); or (Smith, 1995; Brown & Green, 1996; Jones *et al.*, 1996). The following should make clear how multiple publications by the same authors are treated in such lists: Smith (1991, 1995), Brown & Green (1992, 1993), Jones *et al.* (1993, 1996a,b); or (Smith, 1991, 1995; Brown & Green, 1992, 1993; Jones *et al.*, 1993, l996a,b).

A list of all cited references should be collected at the end of the paper in alphabetical order by, in the first instant, the first author¡¦s surname. Where the name of the first author appears more than once, the order is determined by: first, the number of co-authors (zero, one, or more than one); secondly, for one co-author, the first co-author¡¦s surname then the year; for two or more co-authors, year then order as dictated by the use of 1990a,b,c (for example) in the citations. The following is an example of how references would be ordered in the reference list: Brown (1980), Brown (1990), Brown & Jones (1977), Brown & Smith (1973). Brown & Smith (1975), Brown, Smith & Jones (1990a), Brown, Jones, Smith, Jones & Brown (1990b), Brown, Jones & Smith (1990c). Note that the last three examples would all have been cited as Brown *et al.* in the text, with the a, b and c relating to the order of citation. The names and initials of all authors should be given in the list of references. The style should follow the examples below:

Books
Zatsiorsky, V.M. (1995). *Science and Practice of Strength Training.* Champaign, IL: Human Kinetics.

Journals (Papers or Abstracts)
Elliott, B., Marshall, R. & Noffal, G. (1996). The role of upper limb segment rotations in the development of racket-head speed in the squash forehand. *Journal of Sports Sciences, 14,* 159-165.

Chapters in Books
Stephenson, D.G., Lamb, G.D., Stephenson, G.M.M. & Fryer, M.W (1996). Mechanisms of excitation¡Vcontraction coupling relevant to skeletal muscle fatigue. In *Fatigue: Neural and Muscular Mechanisms* (edited by S.C. Gandavia, R.M. Enoka, A.J. McManus, D.G. Stuart & C.K.Thomas), pp. 45-56. New York: Plenum Press.

Chapters in Published Books of Conference Proceedings or Abstracts
Howe, B.L. & Bell, G.J. (1986). Mood states and motivation of triathletes. In *Sports Science: Proceedings of the VII Commonwealth and International Conference on Sport, Physical Education, Dance. Recreation and Health* (edited by J. Watkins, T. Reilly & L. Burwitz), pp. 273-278. London: E & FN Spon.

The issue number of a journal should be included only to avoid confusion, as when for example the pagination starts from 1 in each issue rather than being continuous across a volume; in such cases use *16(4)*, etc. Authors should seek to minimize references to non-published material, including collections of conference abstracts that are not generally available through libraries or electronic databases. When it is absolutely necessary to reference unpublished material, this must be done within the citation in the body of the paper, for example (Bartlett & Bremble, unpublished data); the material must not be included in the list of references. Secondary references should be avoided if at all possible; if not, the reference should be listed as, for example: Full reference (cited in Zatsiorsky, V.M., 1995, *Science and Practice of Strength Training.* Champaign, IL: Human Kinetics).

6. Disclosure of Potential Conflicts of Interest
It is the sole responsibility of authors to disclose any affiliation with any organisation with a financial interest, direct or indirect, in the subject matter or materials discussed in the manuscript (such as

consultancies, employment, expert testimony, honoraria, speakers'bureaus, retainers, stock options or ownership) that may affect the conduct or reporting of the work submitted. If uncertain as to what might be considered a potential conflict of interest, authors should err on the side of full disclosure. Information about potential conflict of interest should be clearly stated at the point of submission (for example in a cover letter, or where available within the appropriate field on the journal' Manuscript Central site). This may be made available to reviewers and may be published with the manuscript at the discretion of the Editors.

7. Disclosure of Sources of funding
All sources of funding for research are to be explicitly stated, at the point of submission. This may be published with the manuscript at the discretion of the Editors.

8. Proofs
Proofs will be sent to the corresponding author for correction in electronic form. The difficulty and expense involved in making **amendments** at proof stage make it essential for authors to prepare their manuscript carefully; any alterations to the original text are strongly discouraged. Our aim is rapid publication; this will be helped if authors provide good copy, follow the above instructions, and return their proofs as quickly as possible.

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Corresponding authors will receive free online access to their article through our website (www.informaworld.com) and a complimentary copy of the issue containing their article. Reprints of articles published in this journal can be purchased through Rightslink® when proofs are received. If you have any queries, please contact our reprints department at reprints@tandf.co.uk

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APPENDIX B: ETHICS SUBMISSION AND INFORMATION SHEETS

HUMAN RESEARCH ETHICS COMMITTEE

REQUEST FOR ETHICAL APPROVAL

Information Privacy Notice: The Human Research Ethics Committee of CQUniversity is collecting the information on this form to carry out its functions under the *National Statement on Ethical Conduct in Research Involving Humans* 1999. The Committee or University staff servicing the Committee must disclose some, or all of this information, to appropriate agencies, including the National Health and Medical Research Council.

NOTE: The references next to questions on this form (e.g. S3.1) relate to the relevant sections of the *National Statement on Ethical Conduct in Research Involving Humans*.

SECTION 1: RESEACHER(S) DETAILS

1.1.	**Name of Principal Researcher**		Morwenna Kirwan	
	Faculty/Division/Organisation		Faculty of Sciences, Engineering and Health, College of Health, Department of Health and Human Performance	
	Address		Building 77, 1.10, Rockhampton Campus	
	Telephone	4930 9697	**Email**	m.kirwan@cqu.edu.au
1.2.	**Name of Other Investigator (1)**			
	Faculty/Division/Organisation			
	Address			
	Telephone		**Email**	
	Name of Other Investigator (2)			
	Faculty/Division/Organisation			
	Address			
	Telephone		**Email**	
1.3.	**Name of Supervisor (1)**		Associate Professor Peter Reaburn	
	Faculty/Division/Organisation		Faculty of Sciences, Engineering and Health, College of Health, Department of Health and Human Performance	
	Address		Building 77 Room 1.15 , Rockhampton Campus	
	Telephone		**Email**	p.reaburn@cqu.edu.au
	Name of Supervisor (2)		Professor Kerry Mummery	
	Faculty/Division/Organisation		Faculty of Sciences, Engineering and Health, College of Health	
	Address		Building 18 LG.11, Rockhampton Campus	
	Telephone	4930 6749	**Email**	k.mummery@cqu.edu.au

SECTION 2: PROJECT DETAILS

2.1.	**Please state the Project Title**			
	What are the effects of explanatory style, physical self-concept, sports commitment and physical ability on adolescent's performance in a talent identification program?			
	2.1.1.	**Please indicate the commencement date and completion date of involvement with human participants**		
		Commencement Date	26/05/07	**Completion Date**	30/06/08
IMPORTANT NOTE: ***The project may not begin until clearance is granted by the Human Research Ethics Committee (S1.16).***				
2.2.	**Will this research project be conducted by you or any other researchers at, or in conjunction with, any other institution or research centre which is also subject to the need for ethics approval for research? (S3)**			
	YES		**Go to question 2.2.1.**	
	NO	X	**Go to question 2.3.**	
	2.2.1	**Provide the full name of the each institution /centre where, or by which, the research will be undertaken, including this University, the name of the lead investigator at each site, advice on whether ethics approval has been sought from or given by the relevant Human Research Ethics Centre for each site and if approval has been granted, the ethics approval number for the research project and the period of approval. (S3.3)**		
2.3.	**Briefly describe the research purpose (S1.13-1.14).**			
	To examine the biopsychosocial factors influencing performance in a Cycling Talent Identification Program (TIP). Identifying individuals with the greatest potential to excel in sport presents a major and relevant challenge for sporting practitioners. With limited resources available to help athletes develop, effective talent identification and development processes are of paramount importance to minimise costly mistakes through dropout or failure to achieve. Talent identification processes have typically focused on the role of physiological variables, specifically 'one-off' proficiency measures that fail to acknowledge the psychological and sociological variables which may predict an athletes potential for growth and resilience in a sporting context. The adoption of a broader approach (i.e. investigating psychological, sociological and physiological constructs simultaneously) has important practical and theoretical implications. It may result in a different profile of athlete being selected, that is, athletes who possess an ideal combination of mental, emotional, and physical characteristics conducive to performance excellence. Historically some of these 'potentials' may have been overlooked based on physicality alone. Additionally, this preliminary research may provide practitioners with the opportunity to identify psychological and social constraints within formerly selected athletes and administer interventions to address these limitations. Extant psychological literature suggests that positive self-concept, commitment and an individual's optimistic explanatory style can mitigate the effects of adverse life occurrences (e.g., Peterson, 1991; Seligman, 1990). Given these findings, it is logical to extend this application and test these factors in a sporting domain.			

Self-concept is considered by some researchers as one of the most important constructs in the social sciences. According to Purkey (1988), self concept is defined as the totality of a complex, organised, and dynamic system of learned beliefs, attitudes and opinions that each person holds to be true about his or her personal existence. A positive self-concept is considered to facilitate the attainment of a number of positive outcomes (Weiss & Ebbeck, 1996; Weiss & Ferrer-Caja, 2002) such as perceptions of control (e.g., Weigand & Broadhurst, 1998), motivational orientation (e.g., Weiss & Horn, 1990), global self-esteem (e.g., Weiss, McAuley, Ebbeck, & Wiese, 1990), enjoyment (e.g., Scanlan & Simons, 1992), attraction to physical activity (e.g., Brustad, 1988) and decrease in anxiety and stress (e.g., Scanlan, Stein, & Ravizza, 1991). The physical aspect of self-concept can be defined as the visible, tangible features of the self i.e. what we look like, our sex, height, weight, etc.; what kind of clothes we wear; and so on. Most researchers concede that physical self-concept is a relatively stable quality, and hence can be measured as a global trait.

The theoretical model of sports commitment examines the motivation underlying persistence in organised sports. The notion of commitment most prominently held in psychological theory and research, is that commitment reflects factors supporting persistence in a course of action, even in the face of adversity (Becker, 1960, Kelley, 1983). The sports commitment model proposes that commitment to sport participation is a function of an athlete's sport enjoyment, the attractiveness of involvement alternatives, the involvement opportunities afforded by continued participation, and social constraints to continue participating (Scanlan et al., 1993). The more athletes enjoy playing, the more opportunities they feel involvement offers, the more constrained they feel to continue playing, and the less attractive their alternatives to involvement, the greater their commitment (Scanlan et al., 1993).

An individual's explanatory style reflects the way that a person usually explains disparate good or bad events (Peterson, 2000). Whether an individual perceives these occurrences in an adaptive or maladaptive manner can profoundly influence the general quality of his or her life (Seligman, 1990). Researchers contend that when an individual is faced with a bad situation, he or she will tend to attribute that situation to some cause (Abramson, Seligman, & Teasdale, 1978). Abramson and her colleagues stated that such causal attributions lie along three polar dimensions: internal versus external; stable versus unstable; and global versus specific. The individual, who habitually implements the internal-stable-global ends of the poles, or the pessimistic explanatory style, is at a greater risk for exhibiting depression-like deficits in cognition, mood, and motivation (Peterson & Seligman, 1984). Furthermore, research has shown that a pessimistic explanatory style may lead to a poorer quality of life in many different domains. In the sporting arena, Seligman, Nolen-Hoeksema, Thornton, and Thornton, (1990) found that world-class swimmers with pessimistic explanatory styles experienced diminished performance during swims following an artificially induced failure condition; whereas their more optimistic teammates either showed no such decline or showed an improvement in time.

The primary purpose of this study is to assess the possible links between explanatory style, physical self-concept, sports commitment and subsequent athletic performance. To the best of the author's knowledge, this is the first study of its kind to systematically examine the mix of psychological and biosocial factors conducive to being selected in a talent identification program. This research may facilitate the reconceptualisation of talent, identifying a multifaceted approach in the identification of athletes and a better understanding of the psychosocial constraints undermining their performance.

2.4.	**Does this research contribute towards a formal qualification?**		
	YES	X	**Go to question 2.4.1.**
	NO		**Go to question 2.5.**
	2.4.1	**Please indicate qualification and name of the institution**	
		CU 90 Masters of Human Movement Science ~ CQUniversity. To commence T2/2007 with permission already approved by Research Office and PVC (Research and Innovation).	
2.5.	**Provide statement of methods in plain English to be adopted and/or implemented for the conduct of the proposed research (methodology) (S1.4, 1.14).**		

In accordance with the National Talent Identification Program by the Australian Institute of Sport (AIS), there will be three phases to the study. Physiological measures will be taken across all three phases and psychological and social measures will be administered in phases one and two. Please note that all physiological testing will adhere to the Testing Protocols outlined by the Australian Institute of Sport under the auspices of the ASC (see attached).

PHASE 1 - *Physiological Measures*

Assess height, body mass, vertical jump, electronic timed 40-metre sprint, and 20 metre multi-stage fitness test.

PHASE 1 - *Psychological Measures*

A questionnaire will be given to participants containing items assessing explanatory style and physical self-concept. The final questionnaire includes the Sport Explanatory Style Questionnaire (SESQ; Martin-Krumm, Sarrazin, Fotayne, & Famose, 2001) and the Physical Self-Description Questionnaire (PSDQ; Marsh, 1996; Marsh, Richards, Johnson, Roche, & Tremayne, 1994).

Explanatory Style: To assess explanatory style specific to the domain of sport the Sport Explanatory Style Questionnaire (SESQ) by Martin-Krumm, Sarrazin, Fotayne, & Famose (2001) will be used. This self-report instrument consists of 10 hypothetical situations: five with good outcomes and five with bad outcomes. The positive and negative items are matched for content. Respondents will be asked to imagine each event happening to them and provide in writing the one major cause of this event, and then use seven-point bipolar scales in each case to rate the degree of stability and globality of the cause. The SESQ has demonstrated satisfactory indices of reliability and concurrent validity (Martin-Krumm et al., 2001).

Physical Self-Concept: To assess self-concept specific to the physical domain the Physical Self-Description Questionnaire (PSDQ) by Marsh et al., (1994) will be used. The PSDQ is designed for use by adolescents age 12 years and older and utilises 70 items to assess 11 scales: Appearance (6 items), Body Fat (6), Co-ordination (6), Endurance (6), Esteem (8), Flexibility (6), Global Physical (6), Health (8), Physical Activity (6), Strength (6), and Sports Competence (6). The PSDQ has demonstrated adequate validity and reliability (Marsh et al., 1994; Marsh, 1996).

Sports Commitment: To assess sports commitment the Sports Commitment Questionnaire (SCQ) by Scanlan et al., (1993) will be used. This instrument consists of a number of questions measuring an athlete's sport enjoyment, the attractiveness of involvement alternatives, the involvement opportunities afforded by continued participation and social constraints to continue participating. The SCQ has been successfully validated with a sample of youth-sport athletes (Scanlan et al., 1993) and is considered reliable (Scanlan et al., 1993).

PHASE 2 - *Physiological Measures*

Assess 10-second power test and 60 metre standing sprint start on a track bicycle.

PHASE 3 - *Physiological Measures*

Assess VO_{2max} combined with blood lactate transition test (LT) and a 30-minute time trial bike test. These measures will be taken every 3 months over a 12 month period. As identified in item 5.1 (Risk Management), in the event a participant fails to progress to the next round of testing, the unsuccessful will be debriefed by the research team and will be issued a letter explaining this outcome and will be invited to join the Rockhampton Cycling Club. The research team will encourage any participants that feel disappointed, embarrassed or have a sense of failure to contact Lifeline for counselling.

NOTE: *Where an agency (e.g., government department, statutory authority and recognised cultural collective) is the source of either participants or confidential information, attach a statement(s) from an authorised officer confirming the agency's support for the proposed research.*		
2.6.	**Please indicate what research instruments will be used.**	
	Questionnaire	X
	Survey	
	Interviews	
	Focus Groups	
	Archival Records	
	Other, please provide details	Physical testing - see testing protocols attached.
2.7.	**What is the duration required for participants to complete the research instrument(s)?**	
	Questionnaire	Phase 1: SESQ (10 minutes); PSDQ (10 minutes), Demographic (5 minutes).
	Survey	
	Interviews	
	Focus Groups	
	Archival Records	
	Other	Physical testing during Phase 1 will be approximately sixty minutes in duration. Physical testing during Phase 2 will be approximately sixty minutes in duration. Physical testing during Phase 3 will be approximately two hours in duration, every three months over a 12 month period.
2.8.	**Briefly describe the research benefits of this project to the participants, community and researcher. Explain how any benefits to participants or others outweigh the perceived risks of the research (S1.13-1.15).**	

	The benefit to the participant from this study will be the possible selection into a 'Talent Identification Program' funded by the Australian Sports Commission (ASC), CQUniversity and Rockhampton Cycling Club. Selection into this program means the participant will possibly be given free cycling coaching from one of Australia's leading coaches, in a 12 month intensive cycling program coordinated by Rockhampton Cycling Club (RCC). The participant's progress will be tracked and extensive scientific monitoring resources will be offered to the participant to enhance their cycling skills. The participants will also have the benefit of the possibility of achieving success at state/national/international level of competition. Community partners will benefit from the project by achieving the grant outcomes through CQU's involvement in Phase 1, 2 and 3. RCC specifically will benefit from the project by having 12 to 20 talent-identified athletes that enhance the club's competitive profile at state/national/international level. The other community, the ASC who funded the project will benefit by similar means. This research is significant as it will assess the role that biopsychosocial indicators have on athletic performance. The linking of explanatory style, physical self-concept and social support to the identification of talented athletes has not been systematically addressed elsewhere to date. At least one publication in a peer reviewed journal will result from the data gathered here, thus adding to CQU's research profile. Additional projects gained on the basis of data gathered here will contribute to the University's strategic interest by establishing alliances and working relationships with external agencies through collaborative research. Such projects will add to the reputation of the university for high quality, applied scientific research.		
2.9.	**Will participants be deceived about the nature of the research? (S17)**		
	YES		**Go to question 2.9.1.**
	NO	X	**Go to question 2.10.**
	2.9.1.	**If yes, please explain why the real purpose needs to be concealed?**	
2.10.	**How will stakeholders obtain details of outcomes from the proposed research? (S1.18)**		

	Phase 1: Participants will be provided with feedback in a written form indicating the results for each test and if they had been selected for Phase 2. Phase 2: Participants selected from Phase 2 for Phase 3 will be issued a letter of invitation to participate and a report indicating the general findings from Phase 2, including their individual physiological testing results. Participants not selected for Phase 3 will be issued a letter explaining this outcome and will be invited to join the Rockhampton Cycling Club. Phase 3: The participants will be provided with feedback in both written and verbal forms. A comprehensive written report will be given to each subject explaining the general findings of the research and their individual results, with an explanation of how these results may assist them in their training. Verbal feedback will be provided throughout the period of the study.

NOTE: *The Consent Form should include a separate tear off section for participants to fill in if they wish to receive a plain English version of the outcomes of the project.*

2.11	**Will the research involve payments/rewards/inducements to participants?**			
	YES	X	**If yes, explain why?**	Participants who demonstrate certain physical parameters during the performance of Phase 1 and Phase 2 will be considered "talent identified" for cycling and will be given the opportunity to participate in a 12 month supervised cycling training program (Phase 3).
	NO		**Go to section 3**	
2.12	**Does the proposed project have research funding?**			
	YES	X	**If yes, please specify funding source and amount.**	The Australian Sports Commission and CQU Department of Health and Human Performance jointly fund this research project. Total value: $30,000.
	NO		**Go to question 3.1**	

SECTION 3: PROPOSED PARTICIPANTS

3.1.	**Who are the proposed participants and what is the sample size? (S1.5)**		
	Adolescents aged 13 years and over. Sample size will be approximately 100 participants.		
	3.1.1.	**Please indicate if people from the following groups will be research participants:**	
		Children or young humans under 18 years (S4) (If yes, please provide information on Blue Card or exemption if relevant in the State where research will be conducted)	Blue Card Rego No: 39682/3
		Humans with an intellectual or mental impairment (S5)	
		Humans highly dependent on medical care (S6)	
		Students taught by the researcher/s or other people who could be regarded as being in dependent relationships with the researcher/s or persons acting on behalf of the researcher/s in helping to inform or select or supervise participants, e.g. doctors and patients, guards and prisoners, supervisors and staff they supervise, employers and employees (S7)	
		A Collectivity (distinct human group with its own social structure that links members with a common identity, common customs and with designated leaders or others who represent collective interests, e.g. Philippines) (S8)	
		Indigenous Australians (S9)	
3.2.	**How will the proposed participants be selected / recruited? (S1.5 (b))**		
	The proposed research will be conducted out of school hours and has no direct involvement with both Education Queensland and Catholic Education Offices. The proposed research will be promoted as per Education Queensland Policy (as discussed with Regional Sports Officer Keran Maguire), through Rockhampton Secondary School Principals, who at their discretion may filter this information to Health and Physical Education Teachers, hopefully encouraging their students to become involved in this out of school testing. The sample will comprise of two populations: school aged and the general public between the ages of 13 and 23 . The researcher will invite (via email, mail, and phone) the Principals of the Rockhampton secondary schools to promote the first phase of the ASC, National Talent Identification Program, that will be occurring on university property out of school hours. An invitation to the general public to participate in the phase one screening will be issued via the media. Those participants who are in the top 5th percentile based on physical parameters will be eligible to participate in phase two. Results from phase two will determine the top twenty performing athletes and these will be eligible to participate in phase three which is a 12 month intensive cycling training program.		
	3.2.1.	**Is access to employees/clients of organisations / schools required?**	
		YES		**Go to question 3.2.2.**
		NO	X	**Go to question 3.2.3.**
	3.2.2.	**Has permission been sought from / or granted by that organisation?**	

		YES		**If yes, please attach a copy of approval**	
		NO		**If no, justify why?**	
	3.2.3.	**Is the timing of required access to the organisation, appropriate to causing minimal disruption to that organisation?**			
		YES			
		NO			
3.3.	**What mechanisms will be adopted to protect the rights of those unable to provide informed consent?**				
	Parents/guardians will be informed in writing of all the risks and procedures involved (see Information Sheet attached) in each phase of the study and will sign an Informed Consent Document (see attached).				
3.4.	**What are the processes or steps involved in obtaining informed consent? (S1.7)**				
	All participants will be provided with an information sheet and consent form (see attached).				
3.5.	**How will the participants be informed of their right to withdraw from the study?(S1.8, 1.12)**				
	Participants will be informed both verbally and in written form of their right to withdraw from the study at any time without prejudice.				
3.6.	**Specify how the results will be used and what the participant is consenting to (including any publications, conferences etc) (S1.18).**				
	Results will be used to generate a final report to the funding body. In addition, data will be analysed to produce conference papers and refereed journal submissions.				
3.7.	**Have you attached a copy of the Research Instrument(s), Information Sheet and Consent Form (S1.9)?** *Please note that any project proposing to use participants under the age of 18 years must obtain consent from parent/guardians as well as from the participants.*				

Information Sheet		**Consent Form**		**Research Instrument (s)**	
YES	X	**YES**	X	**YES**	
NO		**NO**		**NO**	X

NOTE: *Any written information provided to a participant or subject must contain the statement, "Please contact CQUniversity's Office of Research (Tel 07 4923 2607) should there be any concerns about the nature and/or conduct of this research project."*

SECTION 4: CONFIDENTIALITY/ANONYMITY

<table>
<tr><td>4.1.</td><td colspan="4">Does this project involve gaining access to personal information from a Commonwealth Agency? (S18)</td></tr>
<tr><td></td><td>YES</td><td></td><td colspan="2">Go to question 4.1.1.</td></tr>
<tr><td></td><td>NO</td><td>X</td><td colspan="2">Go to question 4.2.</td></tr>
<tr><td></td><td colspan="4">4.1.1. If yes, which Commonwealth Agency and detail how it is proposed to meet provisions of the Privacy Act 1988.</td></tr>
<tr><td></td><td colspan="4"></td></tr>
<tr><td>4.2.</td><td colspan="4">Please indicate if this project involves the collection, use or disclosure of health information from a private sector organisation for use for research which is related to any of the following:</td></tr>
<tr><td></td><td colspan="3">Research relevant to public health or safety</td><td></td></tr>
<tr><td></td><td colspan="3">The compilation or analysis of statistics relevant tot public health or safety</td><td></td></tr>
<tr><td></td><td colspan="3">Management, funding or monitoring of a health service</td><td></td></tr>
<tr><td>4.3.</td><td colspan="4">How is it proposed to maintain confidentiality and/or anonymity in respect of collected data/information? (S1.19) Particular attention to detail is necessary in the case of research involving any of the following:

• structured questionnaires
• participant observation
• audio or video-taping of participants and/or events
• access to personal information (including student, patient or client details)</td></tr>
<tr><td></td><td colspan="4">The participants' records will be kept confidential. The following steps will be taken to ensure records are secure:

1. Hard copy of all results will be kept in a locked filing cabinet.
2. All computer data will be coded to ensure anonymity of the participant.
3. Back-up data stored on floppy disks or CD's and will be stored in a locked cupboard.
4. Back up of hard drive information will be stored on Faculty of Sciences, Engineering and Health computer network.</td></tr>
<tr><td colspan="5">NOTE: Please note that all original data arising from the project must be stored in a secure location for a minimum period of five years (This includes audio cassettes that are later transcribed and data relating to identification of participants).</td></tr>
</table>

SECTION 5: RISK MANAGEMENT

5.1.	**Identify the possible risks, harms, stresses, discomforts etc likely to affect the participants and any interested parties. Particular attention to detail is necessary where the proposed research involves any of the following:** • ***administration of any stimuli, tasks, investigations or procedures which participants might experience as physically or mentally painful, stressful or unpleasant;*** • ***performance of any acts which might diminish the self esteem of participants or cause them to experience depression, embarrassment or regret;*** • ***deception of participants;*** • ***collection of body tissues or fluid samples.***

	The following procedures are applicable to the specific phases: Phase 1 and 2 • All physiological testing will be conducted according to the test protocols outlined by the Australian Sports Commission (see attached). All the physical tests are typical tests that high school students would regularly be exposed to. • Familiarisation trials will take place prior to the testing period to ensure all subjects are familiar with testing protocols used. • All results will remain strictly confidential with published results maintaining the anonymity of the subjects. • Subjects will be free to withdraw at any time for any reason. • Individual results report will be provided to all participants. • In the event a participant fails to progress to the next round of testing, the unsuccessful will be debriefed by the research team and will be issued a letter explaining this outcome and will be invited to join the Rockhampton Cycling Club. The research team will encourage any participants that feel disappointed, embarrassed or have a sense of failure to contact any individual in the research team and/or their school counsellor. Phase 3 • All micro-blood sampling from fingertips will be undertaken under sterile conditions in accordance with the Test Protocols outlined in the Test Methods Manual – Laboratory Standards Scheme, Australian Institute of Sport (Gore, 2000) (routinely undertaken within the Human Performance Laboratory at CQU and approved numerous times by the HERP), Prevention of transmission of infectious diseases - ANCA and NHMRC guidelines (1996). • All pieces of equipment related to gas analysis; such as mouth pieces will be sterilised and maintained according the Prevention of transmission of infectious diseases - ANCA and NHMRC guidelines (1996) and Manufacturer's Technical Specifications. • The exercise protocols will be progressive in accordance with standard procedures (Gore, 2000). The risks of fatigue or injury shall be minimal, as the cyclists will be closely monitored during each testing session, by highly trained sports science staff and highly experienced elite coaches. • Familiarisation trials will take place prior to the testing period to ensure all subjects are familiar with testing protocols used. For participants under 18 years of age, parents will be in attendance, for both the familiarisation and each testing session. • All results will remain strictly confidential with published results maintaining the anonymity of the subjects. • Subjects will be free to withdraw at any time for any reason. • Individual results report will be provided to all participants.
5.2.	**How will the risks of harm or discomfort be minimised (S1.3)?**
	In the event a participant feels the need to discuss the effects of the project, they will be referred to Lifeline, a phone counselling service. Capricornia Lifeline has been contacted regarding this project and has provided verbal confirmation of their willingness to support participants. Written confirmation will be provided (waiting on the email).
5.3.	**Detail proposed support for participants who experience negative sequelae.**

	See above.
NOTE: *For monitoring purposes (see National Statement 2001, page 20) the Principal Researcher is required to lodge documentation to the Office of Research as necessary upon completion of the project or annually whichever is sooner, the progress to date or outcome in the case of completed work, maintenance and security of records, compliance with the approved protocol and compliance with any conditions of approval. This may also include immediate reports from researchers in the event of serious or unexpected adverse effects on participants, proposed changes in the protocol, any unforeseeable events or if the project is discontinued before the expected date of completion.*	

SECTION 6: DECLARATION

6.1.	**Principal Researcher and co-investigators to sign and date** I/We declare that • I/we am/are qualified and authorised to perform the research and/or procedures described in this application (and associated attachments) submitted for ethics review by the Human Research Ethics Committee; and • All research assistants, student researchers and other members of the research team for the research project have been briefed on procedures and relevant ethical considerations in the project or will be fully briefed before the project begins; and • The research project will be conducted consistent with any relevant government legislation, guidelines and policies; the National Statement on Ethical Conduct in Research Involving Humans; CQUniversity's Code of Conduct for Research; other relevant University policies, codes, guidelines and procedures; and • In the event that the proposed research project receives ethics approval, I/We will comply with all conditions of ethics approval for the research project (including any modifications) which the Human Research Ethics Committee might impose.		
	Signature(s) of Principal Researcher and Co-Investigator		
	Name	**Signature**	**Date**
	Morwenna Kirwan		08/05/07

6.2.	**Principal Supervisor of a Student Researcher(s) to sign and date** I declare that • I am qualified and authorised to supervise the research and/or procedures described in this application (and associated attachments) submitted for ethics review by the Human Research Ethics Committee; and • All research assistants, student researchers and other members of the research team for the research project have been briefed on procedures and relevant ethical considerations in the project or will be fully briefed before the project begins; and • The research project will be conducted consistent with any relevant government legislation, guidelines and policies; the National Statement on Ethical Conduct in Research Involving Humans; CQUniversity's Code of Conduct for Research; other relevant University policies, codes, guidelines and procedures; and • If the proposed research project receives ethics approval, I will ensure that the research student/s under my supervision for this project will comply with all conditions of ethics approval for the research which the Human Research Ethics Committee might impose.		
	Signature(s) of Supervisor **Name**	**Signature**	**Date**
	Peter Reaburn		08/05/07
	Kerry Mummery		08/05/07

What are the effects of explanatory style, physical self-concept, familial support and physical ability on adolescent's performance in a talent identification program?

INFORMATION SHEET

Project Overview

To examine the biopsychosocial factors influencing performance in a Cycling Talent Identification Program (TIP). Identifying individuals with the greatest potential to excel in sport presents a major and relevant challenge for sporting practitioners. With limited resources available to help athletes develop, effective talent identification and development processes are of paramount importance to minimise costly mistakes through dropout or failure to achieve.

Talent identification processes have typically focused on the role of physiological variables, specifically 'one-off' proficiency measures that fail to acknowledge the psychological and sociological variables, which may predict an athlete's potential for growth and resilience in a sporting context. The adoption of a broader approach (i.e. investigating psychological, sociological and physiological constructs simultaneously) has important practical and theoretical implications. It may result in a different profile of athlete being selected, that is, athletes who possess an ideal combination of mental, emotional, and physical characteristics conducive to performance excellence. Historically some of these 'potentials' may have been overlooked based on physicality alone. Additionally, this preliminary research may provide practitioners with the opportunity to identify psychological and social constraints within formerly selected athletes and administer interventions to address these limitations.

Participation Procedure

In accordance with the National Talent Identification Program by the Australian Sports Commission (ASC), there will be three phases to the study. After each phase of the study, the participants will be notified if they have qualified to enter the next round of testing.

Please note that all physiological testing will adhere to the Testing Protocols outlined by the ASC (see attached).

Phase	Time Taken	Tests
One	*40 minutes*	*Physiological Measures* • Height, body mass, vertical jump, electronic timed 40-metre sprint, and 20 metre multi-stage fitness test.
	20 minutes	*Psychological Measures* • A questionnaire containing items assessing explanatory style, physical self-concept and sports commitment.
Two	*60 minutes*	*Physiological Measures* • 10-second power test and 60 metre standing sprint start on a track bicycle.
Three	*90 minutes*	*Physiological Measures* • VO_{2max} combined with blood lactate transition test (LT) and a 30-minute time trial bike test. These measures will be taken every 3 months over a 12 month period.

Benefits and Risks

You may be required to complete vigorous anaerobic and aerobic tests during the period of this study. As you may be unaccustomed to such physical efforts you may experience slight muscle soreness. The risks shall be minimal as you will be closely monitored during each testing phase. You will have been pre-screened, and your parents/guardian interviewed, to ensure that you do not have any existing medical conditions that may indicate that you should not undertake exercise and participate in this study. If any health risk factors are found that may affect your health or contra-indicate exercise participation, then you will be referred to a medical doctor to obtain approval to participate in the study.

Test	Risks	Explanation
Phase 1: Vertical jump, 40 metre sprint, multi-stage fitness test.	Fatigue	The tests will be conducted in a controlled environment supervised by qualified staff and will be similar to that experienced during training for school team sports and competitions. All physiological testing will be conducted according to the test protocols outlined by the Australian Sports Commission (see attached).
Phase 2: 60 metre standing sprint.	Injury-fall off bike	You will be under the instruction of an experienced cyclist and given bike handling skills at all times.
Phase 2: 10 second cycling power test.	Fatigue, injury	Testing will conducted in controlled conditions at the Human Performance laboratory at CQUniversity and conducted by qualified staff. The risk of injury and fatigue will be no greater than during a normal school training sessions and competitions. First aid kits, Oxygen therapy, Emergency phone and Qualified first aid trained personnel will be present.
Phase 2: Blood taking	Infection, bruising to finger tips	Taken in a sterile environment, only 30 micro mills of blood from a finger prick is required.
Phase 3: Gas Analysis	Cross infection	All equipment – mouthpieces/nose clips are sterilised and maintained in accordance with Manufacturer's Technical specifications.

The benefit to the participant from this study will be the selection into a 'Talent Identification Program' funded by the Australian Sports Commission, CQUniversity and Rockhampton Cycling Club. Selection into this program means the participant will be given free coaching in a 12 month intensive cycling program coordinated by Rockhampton Cycling Club. The participant's progress will be tracked and extensive resources will be offered to the participant to enhance their cycling skills.

Confidentiality / Anonymity

The participants' records will be kept confidential. The following steps will be taken to ensure records are secure:

5. Hard copy of all results will be kept in a locked filing cabinet, securely stored for 5 years in accordance with the CQU policy.
6. All computer data will be coded to ensure anonymity of the participant.
7. Back-up data stored on floppy disks or CD's and will be stored in a locked cupboard.

8. Back up of hard drive information will be stored on Faculty of Sciences, Engineering and Health computer network.

Outcome / Publication of Results

Results will be used to generate a final report to the funding body (Australian Sports Commission, Rockhampton Cycling Club and CQUniversity Department of Health and Human Performance). In addition, data will be analysed to produce conference papers and refereed journal submissions.

Consent

All participants will be required to provide written consent before participating in any aspect of the study. For those participants under the age of 18 years consent will need to be given for a parent or guardian.

Right to Withdraw

Participants are free to withdraw from the study at any time for any reason.

Feedback

Phase 1:

Participants will be provided with feedback in a written form indicating the results for each test and if they had been selected for Phase 2.

Phase 2:

Participants selected from Phase 2 for Phase 3 will be issued a letter of invitation to participate and a report indicating the general findings from Phase 2, including their individual physiological testing results. Participants not selected for Phase 3 will be issued a letter explaining this outcome and will be invited to join the Rockhampton Cycling Club.

Phase 3:

The participants will be provided with feedback in both written and verbal forms. A comprehensive written report will be given to each subject explaining the general findings of the research and their individual results, with an explanation of how these results may assist them in their training. Verbal feedback will be provided throughout the period of the study.

Questions/ Further Information

Morwenna Kirwan

Talent Identification Coordinator

Ph: (07) 4930 9697

Email: m.kirwan@cqu.edu.au

Concerns / Complaints

Please contact CQUniversity's Office of Research (Tel: 07 4923 2607; E-mail: ethics@cqu.edu.au; Mailing address: Level 4, Building 351, CQUniversity, Rockhampton QLD 4702) should there be any concerns about the nature and/or conduct of this research project.

APPENDIX C: INFORMED CONSENT FORMS

Australian Sports Commission and CQUniversity

National Talent Identification and Development Program

Phase 1 and 2 - Physiological & Psychological Assessment

STATEMENT OF INFORMED CONSENT

I (print name) ..... hereby agree to participate in any physiological or psychological assessment on 26/05/2007 on the following terms:

1. The safety procedures as well as the risks associated with the selected physiological or anthropometric tests have been fully explained to me by one of the scientific staff and I understood their explanation. A copy of the document "Information for Participating Athletes" and a description of any risks and discomforts have been provided to me and have been discussed in detail with me.

2. I am provided with an opportunity to ask questions and receive a satisfactory explanation about how each test is performed and of any associated risks prior to commencing any assessment.

3. I understand that the information obtained from the assessments will be treated confidentially with my right to privacy assured. However, the sport scientist may use my data for research and education purposes (coaches workshops, conferences, publications, discussions) whilst maintaining my confidentiality.

4. I hereby agree that I will present myself for testing in a suitable condition having abided by the requirements for diet and activity prescribed for me by sports science staff. I will inform sports science staff of any physical or mental illness or weakness that would increase the risk of undertaking any of the selected physical tests.

5. I realise that my participation in testing is voluntary. I understand that I will not be penalised by the sport scientist if I do not participate in testing or stop during a test (e.g. we will not withhold information or limit future test opportunities).

6. **I release the Australian Sports Commission and CQUniversity and its employees from any liability for any injury or illness that I may suffer while undertaking the assessment, or subsequently occurring in connection with the assessment, or that is to any extent contributed to by it.**

Initial:_____

Signature of Athlete:_____ Date: _____/_____/_____

Parent/Guardian name (required if age under 18): _____

Parent/Guardian signature:_____ Date: _____/_____/_____

I, the undersigned was present when the test procedures was explained to the athlete in detail and to my best knowledge and belief it was understood.

Witness name:_____ Date:_____/_____/_____

Witness signature:_____ Date:_____/_____/_____

EXPLANATION OF

PHYSIOLOGICAL & ANTHROPOMETRIC

ASSESSMENT PROCEDURES

Information for Participating Athletes

(A) Anthropometry

This involves simple measurement of body stature using a portable stadiometer and body mass using portable digital scales. No shoes are worn for either of these measurements.

(B) Testing

Vertical Jump

The vertical jump task measures the ability to spring in a vertical direction. Explosive power in the legs is related to performance in sports such as sprint cycling.

40 Metre Sprint

Speed is also important in sports requiring short bursts of activity at high intensity such as sprint cycling.

Multistage Fitness Test

Aerobic fitness is an important component of a number of endurance based sports such as road cycling. The multistage fitness test, also known as the 20 meter shuttle run test, beep or bleep test among others, is nowadays a very common test of aerobic fitness. The objective of the Multi-Stage Fitness Test (MSFT) is to monitor the development of the athlete's maximum oxygen uptake (VO2 max).

10 Second Power Test

The 10 s power test is conducted to determine the peak power output, time to reach peak power, average power over 10 s and peak pedal cadence. The individual is required to cycle as

hard as possible for 10 s. The test is conducted on a cycle ergometer fitted with a power measuring device.

60 metre Standing Sprint on Track Bicycle

This test will be preceeded by a velodrome familiarisation session consisting of a 60 metre standing sprint start on a track bicycle. This task will be timed and observed by an expert cycling coach. The cycling training background for each individual will be considered.

Australian Sports Commission and CQUniversity

National Talent Identification and Development Program

Phase 3 – Physiological and Anthropometric Assessment

STATEMENT OF INFORMED CONSENT

I (print name) ..... hereby agree to participate in any

physiological or psychological assessment on __/__/____ on the following terms:

7. The safety procedures as well as the risks associated with the selected physiological or anthropometric tests have been fully explained to me by one of the scientific staff and I understood their explanation. A copy of the document "Information for Participating Athletes" and a description of any risks and discomforts have been provided to me and have been discussed in detail with me.

8. I am provided with an opportunity to ask questions and receive a satisfactory explanation about how each test is performed and of any associated risks prior to commencing any assessment.

9. I understand that the information obtained from the assessments will be treated confidentially with my right to privacy assured. However, the sport scientist may use my data for research and education purposes (coaches workshops, conferences, publications, discussions) whilst maintaining my confidentiality.

10. I hereby agree that I will present myself for testing in a suitable condition having abided by the requirements for diet and activity prescribed for me by sports science staff. I will inform sports science staff of any physical or mental illness or weakness that would increase the risk of undertaking any of the selected physical tests.

11. I realise that my participation in testing is voluntary. I understand that I will not be penalised by the sport scientist if I do not participate in testing or stop during a test (e.g. we will not withhold information or limit future test opportunities).

Initial:____

12. **I release the Australian Sports Commission and CQUniversity and its employees from any liability for any injury or illness that I may suffer while undertaking the assessment, or subsequently occurring in connection with the assessment or that is to any extent contributed to by it.**

Signature of Athlete: _____ Date: _____/_____/_____

Parent/Guardian name (required if age under 18): _____

Parent/Guardian signature:_____ Date: _____/_____/_____

I, the undersigned was present when the test procedures were explained to the athlete in detail and to my best knowledge and belief it was understood.

Witness name:_____ Date:_____/_____/_____

Witness signature:_____ Date:_____/_____/_____

EXPLANATION OF

PHYSIOLOGICAL & ANTHROPOMETRIC

ASSESSMENT PROCEDURES

Information for Participating Athletes

The following tests will be conducted in conjunction with your normal cycling training sessions under the supervision of your coach. You will be required to attend the School of Health and Human Performance, CQUniversity - Exercise Physiology Laboratory over a 12-month period to perform specific Laboratory Tests as outlined below.

On each laboratory-testing occasion, you will undergo a series of tests conducted at CQUniversity (Human Performance Laboratory) over ***two days*** that include:

1) A measure of height, weight, skin folds using callipers;
2) A measure of leg power taken by your maximal vertical jump height;
3) A 10 second power output bike test as you did in the laboratory in Phase 2 testing.

Post a 90 minute rest – you will complete Test 4.

4) A Laboratory 30 minute time trial. During this test the following will occur:
    a. You will be instructed to achieve the highest averaged power output over the 30 minutes;
    b. Expired air will be collected 0-5, 10-15 and 20-25 minutes;
    c. Heart rate, accumulated work and cadence will be recorded every minute;
    d. Your perception of effort and a blood lactate sample will be obtained at 5-minute intervals throughout the test.
5) A measure of your aerobic or endurance fitness using a bike test performed on an electronic bike. This is a continuous bike test, with incremental workloads. During this test the following will be collected:
    a. Expired air through a Medgraphics gas analysis system (you will be required to wear a mouth piece (similar to a snorkel fitting and nose clip);
    b. Heart rate via a recordable Polar Vantage NV heart rate monitor; and;
    c. Blood lactate measured from a drop of blood from your fingertip using a sterile lancet.

INSTRUCTIONS WILL BE FULLY EXPLAINED PRE AND DURING EACH TEST

Prior to each testing occasion;

1. Please refrain from strenuous exercise 24 hours prior to testing;
2. Please refrain from drinking alcohol and coffee within a 24 hour period;
3. Please drink plenty of water or electrolyte drinks;
4. Please bring/wear cycling clothes, cycling shoes (and pedals if required);
5. Please bring your own water bottle and drink, and your favourite post training snack;
6. Please bring a towel
7. Showers and toilets are available.
8. Pre and post testing warm-ups and cool-downs are essential and the responsibility of the athlete.

Analysis

As part of Tests 4 and 5 Blood analysis, from a finger prick blood sample (2 drops), will be performed using a BM Accusport Blood Lactate portable machine on site at CQU HHP Exercise Laboratory. There will be several finger prick blood samples taken during a testing session.

Expired Gases collected during testing will be analysed by the CPXD Medgraphics Gas Analysis System on site at CQU HPP Exercise laboratory. Vertical jump and 10 second power tests will be similar to Phase 1 and Phase 2 testing.

A written report will be sent to you, your parents and your coach with implications of test results clearly interpreted. A verbal explanation of the results will also be provided together with information as to how the results relate to your training and performance. The researcher will discuss all results with you.

You are asked to keep your ***diet and school training the same prior to each test***. These measures will ensure that you are fresh for each test and that your diet does not influence the test results.

Risks

You may be required to complete heavy training periods during the period of this study. As you may be unaccustomed to such physical efforts during training you may experience slight muscle soreness. The risks shall be minimal as you will be closely monitored during each of your training sessions. You will have

been pre-screened, and your parents / guardian interviewed, to ensure that you do not have any existing medical conditions that may indicate that you should not undertake exercise and participate in this study. If any health risk factors are found that may affect your health or contra-indicate exercise participation, then you will be referred to a medical doctor to obtain approval to participate in the study.

APPENDIX D: TESTING PROTOCOLS

STATURE (STANDING HEIGHT)

Equipment

- Wall Mounted Stadiometer or Portable Stadiometer
- Level Floor

Measurement Procedure

- The subject's height must be taken in bare feet, standing erect with both heels touching and arms by the sides.

- The heels, buttocks, upper part of the back and the head should be in contact with the wall.

- The measurer should position the subject's head in the Frankfort plane. This position was achieved when the line from the orbitale to the tragion formed a right angle with the vertical axis of the body. The stretch technique is used where the individual was instructed to "look straight ahead and take in a deep breath" while the researcher gently lifts the subject's head to apply stretch.

- The measurer should then bring the stadiometer down until it sits firmly on the top of the subject's head. The measurement should be taken to the nearest 0.1 cm.

BODY MASS

Equipment

- A & D Electronic Scales

Measurement Procedure

- Turn the scales on at the **"on\off"** button.
- Wait for the scales to reset themselves to the 0.00 kg mode.
- The subject should stand without support, with their weight distributed evenly over the centre of the scales.
- Weight is recorded to the nearest 0.01 kg.

40 M SPRINT

Equipment

- Stop Watch

Measurement Procedure

- After sufficient warm up, the subject starts when ready, from behind the starting line of an accurately measured straight flat course of 40m.
- Timing gates are placed at 0, 20 and 40m. The subject is instructed to start when ready and run straight through the gates WITHOUT pulling up before the 40m gate.
- Athletes need only to complete this test twice.

VERTICAL JUMP TEST

Equipment

- Vertec

Measurement Procedure

- The *Vertec* is to be assembled on a flat, non-slip surface away from any walls or other physical objects.
- The vanes of the *Vertec* should be aligned so that they are on the opposite side to the ground supports. Ensure that all the vanes of the *Vertec* are vertically aligned using the reach stick supplied.
- The height of the *Vertec* should ensure that the subject can touch the bottom vanes (<20), but will not jump over the *Vertec* upon performing a maximal jump (N.B. This may occur in individuals who possess a vertical jump > 1m).
- After adequate warm-up, the subject should stand underneath the vanes of the *Vertec*, and extend their dominant arm above their head, touching the highest vane of the *Vertec* possible whilst standing. Testers should ensure that feet are flat on the ground, and that the subjects knees and arms are not bent. The highest number vane shifted is to be recorded as reach height.

- The subject then performs a maximal standing vertical jump using countermovement and arm swing. No step-in or shuffling is allowed unless specified within the specific protocol. The subject should touch the highest vane at the peak of the vertical jump. The number of this vane is to be recorded as peak jump height.

- Calculate maximum vertical jump by subtracting reach height from the subjects peak jump height. The difference is the subject's vertical jump and is measured in cm.

20 m MULTISTAGE FITNESS TEST

Equipment

- Calibrated Multistage tape/CD

Measurement Procedure

- After sufficient warm up, subjects line up at one end of the 20m shuttle course.

- Instruct subjects to follow the progressively increasing running pace, signaled by 'beep' sounds emitted from the tape, over the 20m course for as long as possible.

- At every 'beep' of the tape subjects should have reached one of the end lines of the course having placed one foot either on or behind the 20m line. If subjects arrive at the end of a shuttle before the beep sounds, they should turn around and wait for beep before resuming.

- The test is completed when subjects fail to maintain the pace (i.e. cannot reach within two strides of the line) for two successive beeps.

- To arrive at the 'converted score', the raw score is treated as follows. As all levels do not have the same number of shuttles , therefore this calculation is necessary in any case where the number of shuttles per level is greater than or less than 10. The following is an indication of the number of shuttles per level:

Level	# of Shuttles
5	9
6	10
7	10
8	11
9	11
10	11
11	12
12	12
13	13
14	13
15	13

Example: raw score = 12(8)
converted score = 12(7)

(8 achieved shuttles/12 possible shuttles = .667)

CYCLING 10 SECOND POWER TEST

Equipment

- Cycle ergometer

Measurement Procedure

The 10 s power test is conducted to determine the peak power output, time to reach peak power, average power over 10 s and peak pedal cadence. The individual is required to cycle as hard as possible for 10 s. The test is conducted on a cycle ergometer fitted with a power measuring device. The desired gears are set and they remain the same for the entire test.

- Height, weight and age of the athlete, temperature, relative humidity and barometric pressure are established.

- After a sufficient warm-up the athlete places their preferred foot at 30° above the horizontal and are instructed that maximum power is gained if they stay out of the saddle as long as possible and place their hands on the drops. They are told that the test requires a maximal effort.

- The test is started by giving the athlete a countdown of 5, 4, 3, 2, 1 'GO'.

- The test is stopped by giving the athlete a countdown of 3, 2, 1, STOP.

- The most important parameters to note are:
    - Peak Power (W)
    - Time to peak power (s)
    - Average Power (W)
    - Power to Weight ratio ($W.kg^{-1}$)
    - Peak Pedal Cadence (rpm)
    - Total Work (kJ)

- Ensure that the athlete has an adequate cool down prior to getting off the ergometer or repeating the effort.

APPENDIX E: PSYCHOLOGICAL QUESTIONNAIRES

PSDQ Instrument

All information supplied will be kept strictly confidential.

Name: _____ **Date of Birth:** ____/____/_____

Male / Female (circle one) **School:** _____

PLEASE READ THESE INSTRUCTIONS FIRST

This is not a test - there are no right or wrong answers. This is a chance to look at yourself. **It is not a test.** There are no right answers and everyone will have different answers. Be sure that your answers show how you feel about yourself. **PLEASE DO NOT TALK ABOUT YOUR ANSWERS WITH ANYONE ELSE.** We will keep your answers private and not show them to anyone.

The purpose of this study is to see how people describe themselves physically. In the following pages you will be asked to think about yourself physically; For example, how good looking you are, how strong you are, how good you are at sports, whether you exercise regularly, whether you are physically coordinated, whether you get sick very often and so forth. Answer each sentence quickly as you feel now. Please do not leave any sentence blank.

When you are ready to begin, please read each sentence and decide your answer. There are six possible answers for each question – "True", "False", and four answers in between. There are six boxes next to each sentence, one for each of the answers. The answers are written at the top of the boxes. Choose your answer to a sentence and put a tick in the box under the answer you choose. **DO NOT** say your answer out loud or talk about it with anyone else

1	2	3	4	5	6
False	Mostly False	More false than true	More true than false	Mostly true	True

Please do not leave any statements blank. If unsure, please ASK FOR HELP.

Please **circle the number** which is the **most correct** statement about you.

		FALSE			TRUE		
1	When I get sick I feel so bad that I cannot even get out of bed	1	2	3	4	5	6
2	I feel confident when doing coordinated movements	1	2	3	4	5	6
3	Several times a week I exercise or play hard enough to breathe hard (to huff and puff)	1	2	3	4	5	6
4	I am too fat	1	2	3	4	5	6
5	Other people think I am good at sports	1	2	3	4	5	6
6	I am satisfied with the kind of person I am physically	1	2	3	4	5	6
7	I am attractive for my age	1	2	3	4	5	6
8	I am a physically strong person	1	2	3	4	5	6
9	I am quite good at bending, twisting, and turning my body	1	2	3	4	5	6
10	I can run a long way without stopping	1	2	3	4	5	6
11	Overall, most things I do turn out well	1	2	3	4	5	6
12	I usually catch whatever illness (flu, virus, cold, etc.) is going around	1	2	3	4	5	6
13	Controlling movements of my body comes easily to me	1	2	3	4	5	6
14	I often do exercise or activities that makes me breathe hard	1	2	3	4	5	6
15	My waist is too large	1	2	3	4	5	6
16	I am good at most sports	1	2	3	4	5	6
17	Physically, I am happy with myself	1	2	3	4	5	6
18	I have a nice looking face	1	2	3	4	5	6
19	I have a lot of power in my body	1	2	3	4	5	6
20	My body is flexible	1	2	3	4	5	6
21	I would do well in a test of physical endurance and stamina	1	2	3	4	5	6
22	I don`t have much to be proud of	1	2	3	4	5	6

23	I am sick so often that I cannot do all the things I want to do	1	2	3	4	5	6
24	I am good at coordinated movements	1	2	3	4	5	6
25	I get exercise or activity three or four times a week that makes me huff and puff and lasts at least 30 minutes	1	2	3	4	5	6
26	I have too much fat on my body	1	2	3	4	5	6
27	Most sports are easy for me	1	2	3	4	5	6
28	I feel good about the way I look and what I can do physically	1	2	3	4	5	6
29	I am better looking than most of my friends	1	2	3	4	5	6
30	I am stronger than most people my age	1	2	3	4	5	6
31	My body is stiff and inflexible	1	2	3	4	5	6
32	I could jog 5 kilometres without stopping	1	2	3	4	5	6
33	I feel that my life is not very useful	1	2	3	4	5	6
34	I hardly ever get sick or ill	1	2	3	4	5	6
35	I can perform movements smoothly in most physical activities	1	2	3	4	5	6
36	I do physically active things (like jogging, dancing, bicycling, aerobics, gym, or swimming) at least three times a week	1	2	3	4	5	6
37	I am overweight	1	2	3	4	5	6
38	I have good sports skills	1	2	3	4	5	6

Please **circle the number** which is the **most correct** statement about you.

		FALSE			TRUE		
39	Physically I feel good about myself	1	2	3	4	5	6
40	I am ugly	1	2	3	4	5	6
41	I am weak and have no muscles	1	2	3	4	5	6
42	My body parts bend and move in most directions well	1	2	3	4	5	6
43	I think I could run a long way without getting tired	1	2	3	4	5	6
44	Overall, I am no good	1	2	3	4	5	6
45	I get sick a lot	1	2	3	4	5	6
46	I find my body handles coordinated movements with ease	1	2	3	4	5	6
47	I do lots of sports, dance, gym, or other physical activities	1	2	3	4	5	6
48	My stomach is too big	1	2	3	4	5	6
49	I am better at sports than most of my friends	1	2	3	4	5	6
50	I feel good about who I am and what I can do physically	1	2	3	4	5	6
51	I am good looking	1	2	3	4	5	6
52	I would do well in a test of strength	1	2	3	4	5	6
53	I think I am flexible enough for most sports	1	2	3	4	5	6
54	I can be physically active for a long period of time without getting tired	1	2	3	4	5	6
55	Most things I do, I do well	1	2	3	4	5	6
56	When I get sick it takes me a long time to get better	1	2	3	4	5	6
57	I am graceful and coordinated when I do sports and activities	1	2	3	4	5	6
58	I do sports, exercise, dance or other physical activities almost every day	1	2	3	4	5	6
59	Other people think that I am fat	1	2	3	4	5	6

60	I play sports well	1	2	3	4	5	6
61	I feel good about who I am physically	1	2	3	4	5	6
62	Nobody thinks that I am good looking	1	2	3	4	5	6
63	I am good at lifting heavy objects	1	2	3	4	5	6
64	I think I would perform well on a test measuring flexibility	1	2	3	4	5	6
65	I am good at endurance activities like distance running, aerobics, bicycling, swimming, or cross-country skiing	1	2	3	4	5	6
66	Overall, I have a lot to be proud of	1	2	3	4	5	6
67	I have to go to the doctor because of illness more than most people my age	1	2	3	4	5	6
68	Overall, I am a failure	1	2	3	4	5	6
69	I usually stay healthy even when my friends get sick	1	2	3	4	5	6
70	Nothing I do ever seems to turn out right	1	2	3	4	5	6

SPORT SITUATION REACTION SURVEY

Instructions

This questionnaire describes several positive and negative events in sport. Please try to vividly imagine yourself in each situation. If such an event happened to you, what would have caused it? While events may have many causes, we want you to pick only one – the single most likely cause if this event happened to you. Please write this cause in the blank provided. Then, we will ask you to answer some questions about the cause and about the event. To summarise, we want you to:

1. Read each event and vividly imagine it happening to YOU.
2. Decide what you feel would be the single most likely cause of the event if it happened to you.
3. Write the most likely cause in the blank provided.
4. Answer five questions about the cause.
5. Answer two questions about the event.
6. Go to the next event.

Treat each event independently, trying to vividly imagine yourself involved in that situation. Then, answer the questions as they apply to how you would feel. Please note that you can use any part of the rating scale when answering a question. The labels at each end of the scale are only for your guidance. Make sure that your answers accurately reflect how YOU would feel.

PLEASE TURN OVER AND BEGIN

1. YOUR TEAM-MATES CLAIM THAT YOU ARE A VERY GOOD PERFORMER.

a) Write down the single most likely cause: _____

b) Is the cause of your team-mates claiming you are a good performer something about you, or something about other people or circumstances? (Circle one number)

Totally due to other people or circumstances						Totally due to me
1	2	3	4	5	6	7

c) In the future when your team-mates are talking about your performance in sport, will this cause be present again? (Circle one number)

Will never again be present						Will always be present
1	2	3	4	5	6	7

d) Is the cause something that just influences how your team-mates refer to your performance in sport, or does it also influence other areas of your life? (Circle one number)

Influences just this particular event						Influences all my life events
1	2	3	4	5	6	7

e) Is the cause something that is controllable by you or others, or is it uncontrollable? (Circle one number)

Controllable						Uncontrollable
1	2	3	4	5	6	7

f) Is the cause something that is intentional or unintentional? (Circle one number)

Intentional						Unintentional
1	2	3	4	5	6	7

g) How important would this event be if it happened to you? (Circle one number)

Not at all important						Extremely important
1	2	3	4	5	6	7

h) How clearly were you able to imagine this event happening to you? (Circle one number)

Not at all clearly						Very clearly
1	2	3	4	5	6	7

2. YOU ARE NOT SELECTED FOR THE STARTING TEAM IN AN IMPORTANT COMPETITION.

a) Write down the single most likely cause: _____

b) Is the cause of your not being selected for the starting team something about you, or something about other people or circumstances? (Circle one number)

Totally due to other people or circumstances — Totally due to me

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

c) In the future when a starting team is selected, will this cause be present again? (Circle one number)

Will never again be present — Will always be present

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

d) Is the cause something that just influences whether or not you get selected for the starting team, or does it also influence other areas of your life? (Circle one number)

Influences just this particular event — Influences all my life events

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

e) Is the cause something that is controllable by you or others, or is it uncontrollable? (Circle one number)

Controllable — Uncontrollable

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

f) Is the cause something that is intentional or unintentional? (Circle one number)

Intentional — Unintentional

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

g) How important would this event be if it happened to you? (Circle one number)

Not at all important — Extremely important

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

h) How clearly were you able to imagine this event happening to you? (Circle one number)

Not at all clearly — Very clearly

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

3. YOU PERFORM VERY WELL IN A COMPETITION.

a) Write down the single most likely cause: _____

b) Is the cause of your good performance something about you, or something about other people or circumstances? (Circle one number)

Totally due to other people or circumstances — Totally due to me

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

c) In the future when performing in a competition, will this cause be present again? (Circle one number)

Will never again be present — Will always be present

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

d) Is the cause something that just influences your performance in competitions, or does it also influence other areas of your life? (Circle one number)

Influences just this particular event — Influences all my life events

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

e) Is the cause something that is controllable by you or others, or is it uncontrollable? (Circle one number)

Controllable — Uncontrollable

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

f) Is the cause something that is intentional or unintentional? (Circle one number)

Intentional — Unintentional

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

g) How important would this event be if it happened to you? (Circle one number)

Not at all important — Extremely important

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

h) How clearly were you able to imagine this event happening to you? (Circle one number)

Not at all clearly — Very clearly

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

4. YOU HAVE GREAT DIFFICULTY WITHSTANDING A DEMANDING TRAINING SESSSION.

a) Write down the single most likely cause: _____

b) Is the cause of training being difficult for you to withstand something about you, or something about other people or circumstances? (Circle one number)

Totally due to other people or circumstances — Totally due to me

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

c) In the future when you are training, will this cause be present again? (Circle one number)

Will never again be present — Will always be present

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

d) Is the cause something that just influences how difficult training is for you to withstand, or does it also influence other areas of your life? (Circle one number)

Influences just this particular event — Influences all my life events

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

e) Is the cause something that is controllable by you or others, or is it uncontrollable? (Circle one number)

Controllable — Uncontrollable

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

f) Is the cause something that is intentional or unintentional? (Circle one number)

Intentional — Unintentional

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

g) How important would this event be if it happened to you? (Circle one number)

Not at all important — Extremely important

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

h) How clearly were you able to imagine this event happening to you? (Circle one number)

Not at all clearly — Very clearly

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

5. THE COACH CRITICISES YOUR PERFORMANCE.

a) Write down the single most likely cause: _____

b) Is the cause of the coach criticising you something about you, or something about other people or circumstances? (Circle one number)

Totally due to other people or circumstances — Totally due to me

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

c) In the future when the coach criticizes you, will this cause be present again? (Circle one number)

Will never again be present — Will always be present

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

d) Is the cause something that just influences your coaches comments, or does it also influence other areas of your life? (Circle one number)

Influences just this particular event — Influences all my life events

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

e) Is the cause something that is controllable by you or others, or is it uncontrollable? (Circle one number)

Controllable — Uncontrollable

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

f) Is the cause something that is intentional or unintentional? (Circle one number)

Intentional — Unintentional

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

g) How important would this event be if it happened to you? (Circle one number)

Not at all important — Extremely important

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

h) How clearly were you able to imagine this event happening to you? (Circle one number)

Not at all clearly — Very clearly

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

6. YOUR TEAM-MATES CLAIM THAT YOU ARE NOT A GOOD PERFORMER.

a) Write down the single most likely cause: _____

b) Is the cause of your team-mates claiming you are not a good performer due to something about you, or something about other people or circumstances? (Circle one number)

Totally due to other people or circumstances — Totally due to me

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

c) In the future when your team-mates are talking about your performance in sport, will this cause be present again? (Circle one number)

Will never again be present — Will always be present

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

d) Is the cause something that just influences how your team-mates refer to your performance in sport, or does it also influence other areas of your life? (Circle one number)

Influences just this particular event — Influences all my life events

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

e) Is the cause something that is controllable by you or others, or is it uncontrollable? (Circle one number)

Controllable — Uncontrollable

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

f) Is the cause something that is intentional or unintentional? (Circle one number)

Intentional — Unintentional

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

g) How important would this event be if it happened to you? (Circle one number)

Not at all important — Extremely important

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

h) How clearly were you able to imagine this event happening to you? (Circle one number)

Not at all clearly — Very clearly

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

7. YOU ARE SELECTED FOR THE STARTING TEAM IN AN IMPORTANT COMPETITION.

a) Write down the single most likely cause: _____

b) Is the cause of your being selected for the starting team something about you, or something about other people or circumstances? (Circle one number)

Totally due to other people or circumstances — Totally due to me

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

c) In the future when a starting team is selected, will this cause be present again? (Circle one number)

Will never again be present — Will always be present

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

d) Is the cause something that just influences whether or not you get selected for the starting team, or does it also influence other areas of your life? (Circle one number)

Influences just this particular event — Influences all my life events

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

e) Is the cause something that is controllable by you or others, or is it uncontrollable? (Circle one number)

Controllable — Uncontrollable

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

f) Is the cause something that is intentional or unintentional? (Circle one number)

Intentional — Unintentional

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

g) How important would this event be if it happened to you? (Circle one number)

Not at all important — Extremely important

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

h) How clearly were you able to imagine this event happening to you? (Circle one number)

Not at all clearly — Very clearly

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

8. **YOU PERFORM VERY POORLY IN A COMPETITION.**

a) Write down the single most likely cause: _____

b) Is the cause of your poor performance something about you, or something about other people or circumstances? (Circle one number)

Totally due to other people or circumstances — Totally due to me

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

c) In the future when performing in a competition, will this cause be present again? (Circle one number)

Will never again be present — Will always be present

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

d) Is the cause something that just influences your performance in competitions, or does it also influence other areas of your life? (Circle one number)

Influences just this particular event — Influences all my life events

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

e) Is the cause something that is controllable by you or others, or is it uncontrollable? (Circle one number)

Controllable — Uncontrollable

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

f) Is the cause something that is intentional or unintentional? (Circle one number)

Intentional — Unintentional

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

g) How important would this event be if it happened to you? (Circle one number)

Not at all important — Extremely important

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

h) How clearly were you able to imagine this event happening to you? (Circle one number)

Not at all clearly — Very clearly

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

9. **THE COACH COMPLIMENTS YOUR PERFORMANCE.**

a) Write down the single most likely cause: _____

b) Is the cause of the coach complimenting you something about you, or something about other people or circumstances? (Circle one number)

Totally due to other people or circumstances — Totally due to me

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

c) In the future when the coach compliments you, will this cause be present again? (Circle one number)

Will never again be present — Will always be present

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

d) Is the cause something that just influences your coach's comments, or does it also influence other areas of your life? (Circle one number)

Influences just this particular event — Influences all my life events

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

e) Is the cause something that is controllable by you or others, or is it uncontrollable? (Circle one number)

Controllable — Uncontrollable

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

f) Is the cause something that is intentional or unintentional? (Circle one number)

Intentional — Unintentional

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

g) How important would this event be if it happened to you? (Circle one number)

Not at all important — Extremely important

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

h) How clearly were you able to imagine this event happening to you? (Circle one number)

Not at all clearly — Very clearly

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

10. YOU HAVE NO DIFFICULTY WITHSTANDING A DEMANDING TRAINING SESSION.

a) Write down the single most likely cause: _____

b) Is the cause of training being easy for you to withstand something about you, or something about other people or circumstances? (Circle one number)

Totally due to other people or circumstances — Totally due to me

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

c) In the future when you are training, will this cause be present again? (Circle one number)

Will never again be present — Will always be present

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

d) Is the cause something that just influences how easy training is for you to withstand, or does it also influence other areas of your life? (Circle one number)

Influences just this particular event — Influences all my life events

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

e) Is the cause something that is controllable by you or others, or is it uncontrollable? (Circle one number)

Controllable — Uncontrollable

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

f) Is the cause something that is intentional or unintentional? (Circle one number)

Intentional — Unintentional

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

g) How important would this event be if it happened to you? (Circle one number)

Not at all important — Extremely important

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

h) How clearly were you able to imagine this event happening to you? (Circle one number)

Not at all clearly — Very clearly

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

SPORT COMMITMENT QUESTIONNAIRE

Please **circle the number** which is the **most correct** statement about you.

Sports Commitment

1 = nothing at all dedicated/hard/determined

2 = a little dedicated/hard/determined

3 = sort of dedicated/hard/determined

4 = dedicated/hard/determined

5 = very dedicated/hard/determined

How dedicated are you to this talent identification program?	1	2	3	4	5
How hard would it be for you to quit the program?	1	2	3	4	5
How determined are you to keep training in this program?	1	2	3	4	5

1 = nothing at all

2 = a few things

3 = some things

4 = many things

5 = a lot of things

What would you be willing to do to stay in this training program?	1	2	3	4	5

Sport Enjoyment

1 = not at all

2 = a little

3 = sort of

4 = pretty much

5 = very much

Do you enjoy playing in (program) this season?	1	2	3	4	5
Are you happy playing in (program) this season?	1	2	3	4	5
Do you have fun playing in (program) this season?	1	2	3	4	5
Do you like playing in (program) this season?	1	2	3	4	5

Involvement Alternatives

1 = not at all

2 = a little

3 = sort of

4 = pretty much

5 = very much

How interesting do you think this activity would be?	1	2	3	4	5
How much fun do you think this activity would be?	1	2	3	4	5
How much would you like to do this activity, instead of playing (program)?	1	2	3	4	5
How difficult was it to choose playing in (program) over this activity?	1	2	3	4	5

Personal Investments

1 = none

2 = a little

3 = some

4 = pretty much

5 = very much

How much of your time have you put into playing in (program) this season?	1	2	3	4	5
How much effort have you put into playing in (program) this season?	1	2	3	4	5
How much of your own money have you put into playing in (program) this season for things like entrance fees or equipment?	1	2	3	4	5

Social Constraints

1 = not at all how I feel

2 = a little how I feel

3 = sort of how I feel

4 = pretty much how I feel

5 = very much how I feel

I feel I have to play in (program) so that I can be with my friends.	1	2	3	4	5
I feel I have to play (program) to please my friends.	1	2	3	4	5
I feel I have to stay in (program) because my parents have done so much.	1	2	3	4	5
I feel I have to play in (program) to please my mum.	1	2	3	4	5
I feel I have to play in (program) to please my dad.	1	2	3	4	5
I feel I have to play in (program) to please my head coach.	1	2	3	4	5