CHAPTER TWO

REVIEW OF RELATED LITERATURE AND STATISTICAL METHODS

2.1) INTRODUCTION

In this chapter a more in depth look will be taken into firstly the concept of talent identification and how it developed over the years, and then secondly the different methods that are used, and thirdly and finally the two methods that are of interest to this study.

It is important however, that we first take a look at a few terms that will be referred to in the course of this study. According to the definition that Du Randt (1993) supplies, it can be seen that ***talent*** can be defined as *"... the aptitude manifesting itself in a certain direction, exceeding an average standard and being not yet fully developed"* (Pretorius, 1996). According to Blooms (1985) talent is defined as an *"unusually high level of demonstrated ability, achievement or skill in some special field of study or interest..."* (Myburgh, 1998).

One merely needs to read an excerpt out of Brown (2001) to see that talent related to sport is a slightly more vague term. He states that *"If sports talent is that desirable and that important, what exactly is it?"* He then goes on to quote two dictionary definitions that define talent as *"a special, natural ability"* and *"a capacity for achievement or success,"* stating that his problem with these definitions is that they do not define talent as it relates to sport (Brown, 2001).

According to Brown (2001), when he researched the dictionary for the definitions of the concept of an athlete, he found that *Webster* described an athlete as *"a trained competitor in a sport."* An athletic person, however, is merely *"physically active and strong."* According to Blooms (1985) the conclusion is made that what any person in the world can learn, almost all people can learn-if provided with the appropriate prior and current conditions of learning.

However, there are approximately one or two percent of individuals who seem to learn in such unusually capable ways, that they are the exception to the apparent rule (Myburgh, 1998). Therefore, when the term talent is used in this study, it can safely assumed that it is that ability, be it in whichever field or practice, that is (far) above the normal or average, that which stands out and makes a powerful statement about the possessor's ability in their chosen arena.

Myburgh (1998), in her study on the identification and development of swimming talent, refers to the concept of ***identification*** as *..."being used synonymously with selection, and concerns the act, process or method whereby those characteristics which have been identified as components of swimming talent are observed and recorded in a objective, measured and recorded in an objective and verifiable manner"*

For the purposes of this study then, we can take the above definition and apply it to the field of rugby, completing the statement as follows: identification concerns the act ... whereby those characteristics which have been identified as components of rugby talent are observed, measured and recorded in an objective and verifiable manner.

When combining the above two terms, it can seen that ***talent identification*** according to Woodman (1985) involves *"...the screening of young athletes to determine those most likely to succeed in sport and directing them towards the sports for which they are most suited."*

When taking all the above definitions into account, talent identification can be defined as: identifying those individuals who posses a quality of execution or ability to perform, that is (far) above the normal or average, that stands out and makes a powerful statement about the individual's ability, with the intention of future development and nurturing of this talent, to the benefit of the individual as well as the country.

Before a further look at the literature regarding talent identification is taken, perhaps the following question should be answered: why test or identify talent?

According to Bosco & Gustafson (1983) *"... the reasons for testing can be divided into nine discrete categories: 1) classification of students; 2) diagnosis of student needs and weaknesses; 3) evaluation of instruction; 4) evaluation of program; 5) marking; 6) motivation; 7) instruction; 8) prediction and 9) research."*

The above is interesting, when relating it to the athlete or sports participant. We see that there are numerous advantages such as classification and diagnosis of needs and weaknesses and even motivation. What is interesting is that Bosco & Gustafson (1983) are of the opinion that testing plays an important role in prediction and research. Although the above reasons for testing seem to be predominantly advantageous, certain arguments for and against talent identification and prediction will be discussed in more detail later in this chapter.

In the context of the South African scenario, it needs to be remembered that due to the fact that South Africa was isolated from world sport for more than two decades, this state of affairs almost certainly led to South Africa getting left behind in the field of scientific methods used to identify talent. Talent identification was predominantly based on results from competition and the subjective judgement of coaches. A few sports do actually practice talent identification and development, but even here most of the methods are unscientific, with sporadic attention being paid to this concern (Van der Merwe, 1997).

It is therefore painfully clear that this is far from the ideal. It simply is not enough to follow unscientific methods and expect to perform well and remain competitive. Traditionally South Africans have had a competitive nature, where winning is the only result that matters. This in itself is not a problem, until we compete against a country with the same attitude, but with more advanced methods.

In South Africa, due to the pleasant climate indigenous to our country, sport plays a major role not only in terms of participation, even on an informal level, but also on a supporters level, where certain sports types enjoy an almost religious like following.

One of the sports types that has a large and committed following is rugby, a sport in which we have a particularly proud history and ability. Upon investigation of the literature to evaluate the type of research that has been done in the area of rugby, we see that scientific methods have been primarily used to formulate fitness programs and profiles (Hazeldine & McNab, 1991; Turnbull et al., 1995).

These fitness profiles were used to categorize players as talented or less talented. When entering the terrain of talent identification involving youth rugby players it is found that scientific identification was, until recently, relatively unknown (Hare, 1999). According to Hare (1999) however, in recent times researchers (Pienaar & Spamer, 1995; Pretorius, 1996; Hare, 1997; Van der Merwe, 1997) have compiled scientific test batteries according to which youth rugby players can be identified for further development.

The purpose of this study is to assist in the above, i.e.: to expand or broaden the base in South Africa whereby testing and research regarding talent identification in South Africa can be done. The reason why this study can be of particular value is due to the fact that it is comparing two methods or methods of talent identification that are commonly in use. The question is always present, namely, does one method of talent identification work better than the other method? In this study, that question will be addressed and hopefully answered.

2.2) BACKGROUND

For the latter part of the 20th century (and for the humble beginnings of the 21st century) it has become very clear that research into the field of talent identification has increased, with more and more researchers focussing on this terrain. Firstly, a general survey of talent identification worldwide will be presented, and secondly a discussion regarding the specific methods for talent identification in sport will be considered, where their relative advantages and disadvantages will be reviewed.

From the discussion of these methods, the conceptual model of Régnier (1987), which was used as framework for this study, will be evaluated. The relative functions of this method will be critically evaluated and there will also be indicated where this method conforms to the requirements of this study.

When the literature regarding this subject is reviewed, one finds various and varying points of views and ideas. Not all people agree to the need or function of talent identification. There are those who are in support of this practice. Singer *et al.* (1993) are of the opinion that all methods of talent identification eventually aim to predict future achievements of sportspersons, based on present abilities. Heilbrun (1966) supports the above point of view, namely that *"talent identification actually evaluates that which exists in actuality, not in possibility."*

As mentioned earlier, you also find the detractors of this practice, with talent identification at a young age receiving much criticism. The general consensus is that talent identification at a young age is not necessary, and can even be counter productive. Some researchers are of the opinion that a young sportsperson does not always reveal or possess all the variables that are necessary for later optimal achievement (Spamer, 1999).

Another author, Jim Brown, while not fully a detractor himself, quotes those in his book, *Sports Talent: How to Identify and Develop Outstanding Athletes,* who are sceptical of the process. Brown (2001) quotes Robert Singer, when he states that *"Everybody wants to predict athletic success based on present achievement or physical makeup…but predicting success is much more difficult than most people think. There are too many variables, even if certain athletes have a combination of genes that favours long-range talent".*

Singer et al. (1993) then goes on to say *"A person's genetic makeup can be expressed in many different ways, depending on environmental and situational opportunities. Variables such as motivation, coachability and opportunity can't be predicted.*

If one wants to say that you are much more favoured than I am to be a world-class champion due to genetic composition at birth, I can't argue the point. You can determine that one eight-year-old gymnast is more advanced than another but to project that talent 10 years forward and say that the child will be a world-class athlete is impossible" (Brown, 2001). Singer makes his point based on genetic factors versus so-called environmental, maturation or even psychosocial variables. This point is discussed at a later juncture in this chapter.

According to Spamer (1999), it is quite possible that, due to the processes involved in talent identification, potential top achievers may be disadvantaged or even eliminated as a result of slow growth, ripening, and development. Many coaches and sport administrators are of the opinion that all young talent should be accommodated and assisted to maturation, rather than to eliminate a number of the less talented.

As stated in the introduction, the play element should be encouraged and incorporated, and in so doing leave a good experience regarding sport, rather than one that is negative. Accommodation and the responsible accompaniment of youngsters has the advantage that children who do not possess sufficient talent, can be diverted to other fields in an ethical and educationally responsible way.

What must be remembered, this being a point supported by certain researchers, is that in no way may anyone remove the freedom of choice from a child to partake in a sport that the child may choose to partake in. These researchers are of the opinion that the implementation of talent identification programs may do just that.

The flip side of the coin however, is that talent identification has numerous supporters. Talent identification at a young age is supported by the literature studied, as it also holds certain advantages. The talented child receives the correct coaching, and this has economic advantages for the parents and for the country concerned. This fact can be argued that this is highly beneficial.

Not only is the child then coached in the area that he or she likes best and has a higher aptitude for, but they are also coached correctly, with the likelihood of that child achieving success in the direction that they have chosen.

Children are also referred to types of sport for which they show the best aptitude physically and psychologically. This can once again be seen as beneficial because of the time aspect involved. Time is not wasted following an arbitrary "hit and miss" approach, with all the efforts being focussed on that which the child is talented in, with the likelihood of success being very high.

Woodman (1985) echoes this statement by implicating that *"...This leads to good results being obtained and in the pleasure of exercising and participation in general being experienced."* The search for potential champions at an early age is therefore becoming an increasing practice in high performance in sport, especially if it is generally accepted that young players want to achieve success in specific types of sport (Hare, 1999).

Early identification of talent may also result in a better performance, as techniques which developed in young, talented sportspersons at an early age, will enable them to reach a higher performance level by the time when they participate in high-level competitions (Woodman, 1985). The question also begs to be asked: could this lead to them reaching high-level competition at a younger age? The possibility is that unidentified talent, or those who are identified at a later stage take a longer time to reach the high level they aspire to.

Therefore, the added advantage is that the talented youngster who is identified at an earlier stage may reach high-level sport sooner, with the benefits, be they economic or otherwise, glaringly obvious. The responsibility of the administrators or the coaches will then also lie with channelling the youngster in the right direction and preventing the burnout associated with extended participation in competition, especially at a young age.

It has been found that talent identification at an early age also has several disadvantages. It has been reported that between 22% and 35% of children between the ages of thirteen and fifteen years do not participate in sport any longer (Hare, 1999). It has been stated by St-Aubin & Sidney (1996) that they are of the opinion that a possible reason for this may be that participants feel that they are no longer competitive enough to successfully participate in sports.

There are probably many reasons for this, least of which being that after being classified into the talented or less talented category, that they may feel the extra pressure of the classification in the former (talented) category, feeling that they need to perform at a top level constantly, having to follow a results based approach based on success. This could lead to exhaustion and remove the fun or enjoyment element from the game.

The converse is true that if they find themselves classified in the latter category (less talented) they may wonder what the need is to continue competing, as the proverbial "numbers are against them." No one would be able to meaningfully compete in a sport that they love, knowing that they have been classified as less talented, and in so doing not been given a good enough chance of success.

Another possible problem is that the prediction functions are not always dependable, and that potential sportspersons do not always perform as expected, which means that talented children are lost for sport (Hare, 1999). Should this occur, it would be a tragic consequence. The search for more and more dependable predictive functions and models is ongoing, and is one of the primary motivators behind this study.

2.2.1) TALENT IDENTIFICATION - INBORN TALENT AND TRAINING

One of the most practical definitions for talent identification is that of Woodman (1985). According to him, talent identification is *"the screening of young athletes to determine those most likely to succeed in sport and directing them towards the sport to which they are most suited."*

Salmela & Régnier (1983) make a convincing argument when they say that one should distinguish between talent selection and talent detection in this regard. The difference between the two terms lies in the aspect of time. Talent selection has to do with a prediction of performance in the short term in accordance with the sportsperson's performance in light of certain variables at that stage.

In essence, you are choosing from what is available and present at the stage of selection. The possibility for misjudgements are higher, as we all know the factors that can play a role in the performance of an individual at a specific state in time.

Talent detection refers to prediction over a longer period where the sportsperson possesses the necessary talent and usually follows a development programme. It seems that talent detection is the more accurate of the two approaches, as it evaluates that which is present over a specific period, and takes differing circumstances into consideration.

It is clear therefore, that talent detection can be carried out on either a short-term or a long-term basis. Schneider (1993) garners support when he states that he is of the opinion that it is not only the identification process that is important, but that the success of the sports person also be determined by the development programme to be followed afterwards.

It is no use to identify talent that exists, and then not develop it to it's fullest potential. It is irresponsible to let talent that has been identified go to waste by not placing it in some kind of developmental program where the talented individual can eventually achieve the highest honour available to them.

An article in a prominent Sunday newspaper was published in which a prominent and respected Australian rugby union coach stated that South Africa would become the world's leading sporting and rugby nations the moment we identify our untapped potential. He stated however, that merely identifying potential means nothing unless it is developed properly. This sentiment is echoed around the world. If the rest of the world

can see this, then it is about time that South Africans realise this too.

Sufficient evidence abounds in various terrains in world sport that young people perform differently to one another. Howe et al. (1998) states that it is generally accepted that this difference can be attributed to the presence or absence of natural talent, abilities, and training. It is only natural that certain youngsters have more access to training facilities and methods than others. And some, we can assume, are more blessed with natural talent than others.

The question arises: what role does each of these factors play in the level of success that these youngsters achieve and to what extent? Another question that we can ask is what kind of influence do these factors have on one another?

Once again we find divided views on this. Some researchers are of the opinion that talent is hereditary and that it plays a role in performance, whereas others are of the opinion that training is the primary determinant of success (Hare, 1999).

Howe et al. (1998) are of the viewpoint that talent is important for performance in sport and that it comprises the following characteristics:

- Firstly, it originates from genetic structures and is partly inherited;
- The effect in performance is not so visible initially, but some of the early signs of talent are perceptible, and can be used by coaches;
- Because talent can be identified early, a basis can be formed in order to carry out identification scientifically or by means of observation;
- Only a small number of people possess this talent (Hare, 1999).

This is a divisive factor. The evidence that talent is genetic is obvious daily. One merely needs to look at the performances of talented youngsters, and invariably one will find a certain level of success in sport that was achieved by the youngster's parents.

On the other hand, however, one sometimes finds that certain children are successful in sport whether their parents were successful or not. One also needs to examine the environmental and social factors exerting their roles on the talented youngsters. Some were just more exposed to certain activities as youngsters than others.

Feldman (1988) agrees with the point-of-view that talent is inborn and cannot be acquired. Benbow & Lubinski (1993) support the principle that talent is inborn: *"talent is explicitly biological"*. Although there is support for the idea that talent is genetic, this is not necessarily a guarantee of achievement. It is also mentioned that children who have a specific talent, which is genetic, reveal this talent at an early age. Thus, in literature there is sufficient proof that talent has an inborn, genetic component that plays a definite role in achievement (Spamer, 1999).

Researchers such as Ericsson & Charness (1995) point out that no real predictions at an early age have yet been found to be a guarantee for later performance. They are of the opinion that success of performance in sport is primarily determined by training and exercise. They also profess that the specific hereditary, physiological character traits may positively benefit performance and achievement if these traits are of an extremely practical nature.

They used an example that is commonly found where certain athletes have predominantly slow contracting muscle fibres that are hereditary in nature. In the field we are dealing with, it is common knowledge that athletes with this kind of muscle fibre component are usually more suited to long distance running and endurance events. What has also been found however, as the above researchers found, that if you train for speed over short distances, that this will affect your achievements, as it did his, positively.

Therefore, according to Ericsson & Charness (1995), exercise is the primary determinant of success. The statements of researchers such as Elbert et al. (1995) and Schlaug et al., (1995) concur with Ericsson & Charness (1995), in which they *..."found that the changes that took place in the brain structure of talented players, should be*

ascribed to the effect of exercise and not so much to genetics".

As stated before, the standpoint needs to be taken that genetics combined with training and exercise need to be considered as primary determinants of talent in young children. The environments in which some children find themselves are of such a nature that they can play or practice freely and develop certain skills that may be apparent in other children, but less developed.

Therefore, due to the nature of the above, one cannot but concur that both factors, i.e.: genetics and exercise, play a very definite role in the identification and development of talent in the young child.

When the literature is further reviewed, further statements of great interest to the discussion of sports talent in youngsters are made. It is apparent that researchers are of the opinion that children can only be talented if they are still regarded as such over a long period of time. They go on further to say that an added requirement in this scenario is that these children should not have received any specialised training. Spamer (1999) goes on to say that extra or specialised training is to the advantage of the talented sportsperson.

Spamer (1999) refers to a longitudinal study done by Schneider (1993) on German tennis players in which it was found that achievement attained in the initial stages of participation is no guarantee for achievement at the early adult stage. This then proves that the duration of exercise or training that talented players are exposed to is also a determinant of success.

Where the researchers have a point when they state that a child can only be classified as talented should they still be talented years later with no extra or specialised training, it is not at all the best option to be followed. Raw talent is good, and may assist the individual in achieving initial success. Unfortunately, however, raw talent will not take you to the top.

In this day and age of specialised coaching and training techniques, those who are exposed to such training methods have an infinitely better advantage over those who do not have such exposure. It can be argued that it is irresponsible to not develop talented youngsters further, to assist them not only in improving on their natural talent, but also guiding them along the way towards sporting success.

When the findings of Sloboda & Howe (1991) are evaluated, another obvious factor in the discussion on sports talent is unearthed. These researchers emphasise the role that parents play in the development of talented sports persons. Sloboda & Howe (1991) made the point that parents have a role to play in their children's development of talent by the practice of ongoing encouragement and support. Howe et al. (1998) refer especially to the role of psychological aspects.

Spamer (1999) mentions the following determinants that play a part in the achievement of talented young sportspeople: attention and concentration, interest, motivation, self-confidence, personality and enthusiasm. It can be seen that the role that parents have to play in the above factors is great.

It must be remembered however, that parents are there to give constructive, positive support and guidance. All too often parents are found to be obsessive in their encouragement, to the point that they push their children to the limits of their endurance and abilities. This is not the desired outcome, and one that needs to be avoided at all costs.

Therefore, to sum up the divergent points of views on the topic of inborn talent, training and success in sport you find the following: it seems apparent that talent may have it's origins in genetic structures and heredity. This in itself however, is not enough. Practice and exercise are prerequisites for the development of these genetic structures and inherited talent.

Identification of these sports people is possible, and actually the ideal, as this can help to classify and develop these people. As stated on numerous occasions, identified talent needs to be nurtured if it is to reach it's potential, for the sake of the individual, firstly, the parents secondly and finally the country. National pride and the pride of the child is involved, something which cannot be taken lightly.

Unfortunately, the best things in life are rare, and hard to come by. It works the same way with sports talent. While there may be many who are capable, only a small handful are excellent. This needs to be remembered by those identifying and administering this talent. A final thought on this topic is that talent is sports specific, which means that it is related to specific sports types. Once again, this leaves those administering the sports the added advantage of taking good care of those identified as talented, if only for future success and competition.

What will follow now is a discussion of the various models that have been developed for talent identification in sport.

2.2.2) MODELS IN TALENT IDENTIFICATION

Before considering specific research models utilised for identifying talent, one should first analyse the methods by which the various models were composed. Singer et al. (1993) highlighted two approaches followed by researchers, namely the so-called devertical ("top down") approach and the evertical ("bottom-up") approach. The devertical method advocates the use of orthodox scientific methods (Spamer, 1999). Empirical data is gathered by using established scientific methods. Especially the methods which have been used by researchers (Singer et al., 1993).

Two methods of research are generally used by researchers (Singer et al., 1993). The first method is referred to as *single variable studies*. The disadvantage of this method is that only one variable is used in comparing achievers and non-achievers. In the field of talent identification, where numerous factors play a role and where you cannot merely focus on one factor, this method is highly limited.

The second method, namely *multi-variable studies*, eliminates the above problem found in single variable studies, as various variables are tested by means of statistical methods, and the underlying relationships between variables can be determined. This is a more realistic approach, and one where all the factors involved in talent identification can be exhaustively examined and even compared in terms of importance.

A well-known example of this type of study is where two experimental groups are selected, one group of which has performed well, and another group that has performed less well. The two groups are measured according to morphological, physical, and morphological, physical, and motor, psychological, and game-specific variables.

Consequently, in the above manner, variables are identified and utilized by means of which talented persons can be selected. In his report, Spamer (1999) mentions examples of such studies, which include the study done by Pienaar et al. (1998).

Later in this chapter, a more in-depth view of multi-variable models will be discussed, with particular reference to the two methods that are of interest to us in this study. As stated before, the two methods being compared in this study are the methods of logistical regression and discriminant analysis.

The so-called evertical approach aims to find out from top performers which aspects caused top performance and achievement. This is normally done by means of interviews, protocol analysis, and recall of achievements (questionnaire). Spamer (1999) states that *"according to this approach, top achievers are organized and structured categorically into problem or task types, most likely in a hierarchical or heterarchical perceptual and retrieval processing system, and on the basis of the particular goals and sub-goals each individual associates with those categories or types".*

Evaluating the knowledge base of the top performer or achiever is therefore an acceptable method to determine why some achieve success and others do not. According to Singer et al. (1993), the disadvantage of the evertical approach is that, as

soon as too many variables are analyzed simultaneously, the results may be questionable.

According to the writers, this approach has more value when applied to the process of talent development rather than the process of talent identification. It was the quest by researchers for a combination of the two approaches that led to the development of the so-called conceptual model of Règnier (1987) for talent identification (Spamer, 1999).

This model will referred to again later, as it forms the basis of the model on which this study is based. Before discussing the model of Règnier, other specific models for talent identification in sport, as designed by researchers, will subsequently be reviewed.

The Model of Harre (1982)

This German model can be described in the following way: the supposition is made that a young sportsperson can be classified as talented only by way of exercise. The role of parents and the social environment or ambience is important in the identification of talent. Harre (1982) emphasized a few important processes of his model.

The first process comprises two phases. The first phase is where all the children that have good, general ability are identified. The second phase is where the children are classified according to their abilities that they possess. The process that follows entails the identification according to factors that play a critical role in optimal achievement in their specific sports types.

The third process requires that each talent be regularly measured and evaluated on a regular basis, as the child increases in biological age. This part of the process requires that the child be evaluated, not only according to physical variables. Aspects such as psychological factors, attitude towards school, extra-mural activity involvement, and personality must be used as additional determinants. Harre's model is considered one of the most complete ones on talent identification. The only disadvantage of this model is that it cannot really be applied in a team sport setup.

The model of Havlicek et al. (1982)

This Czechoslovakian model is similar to Harre's model, and makes proposals regarding principles for talent identification. One of the most important principles is that sportspersons should be prepared sports specifically, i.e.: for a specific type of sport. To enable this principle, it is required that talented children be identified in physical education classes, and subsequently that they receive specialist training.

Early specialization in a certain sports type is not recommended, however. Selection criteria should be strongly based on genetic influences. Sport is multi-dimensional and all the variables need to be considered. The largest possible target population should be used, and this should take place within the greater context of talent development.

The model of Havlicek et al. (1982) emphasises the importance of hereditary factors and dependence on these for achievement. Heritage should not be over-emphasised however. The writers recommend a multi-dimensional approach however.

Gimbel's model (1976)

This German model views talent identification from three different angles: (1) physiological and morphological variables, (2) the ability to be coached and, (3) the motivation of the child. He distinguishes between the internal (genetic) factors and external (environmental) factors. These play a role in talent identification and further development.

He is of the opinion that a talented sportsperson who has been identified and who is between the ages of 8 and 12 years will need training before optimal performance will be achieved. According to him, it is important that youngsters with talent or potential be identified between the ages of 8 and 9. In his model, he also addresses the reasons as to why initially identified youngsters hardly ever reach the top (Gimbel, 1976).

Firstly, he states, the batteries of tests used for identification purposes are not valid, dependable or objective. In the second place, he also states that it is not possible to predict accurate achievement from the battery tests, as there are biological differences

within the same age groups. A third reason is that he feels that the contribution of psychological variables does not receive sufficient attention (Gimbel, 1976).

Gimbel's model can therefore be described as follows: it is a model in which morphological, physical, and psychological factors are essential and must be present for achievement or success in sport; furthermore, children need to be tested according to these variables and then referred to specific development programmes according to their results.

Subsequently, the children need to be regularly monitored for progress over the next 12 to 24 months. Lastly, a prediction about possible success is made for each child after the development program has been completed. The advantage of this model is that late developers are allowed sufficient time to develop and mature, and to even catch up to the others.

The model of Bompa (1985)

Bompa (1985) from Eastern Europe holds the following views regarding the advantages of talent identification: less time is needed to reach the top level, coaches work with talented learners, more athletes get the opportunity to reach international levels of competition, and sportspersons become more self-confident when identified.

According to Bompa (1985), three types of factors determine achievement in sport. They are:

- motor capacity (perceptual-motor skills);
- physiological capacity; and
- morphological variables.

Psychological variables are not referred to at all. The test results are then compared with existing norms of elite sportspersons, and talented people are identified accordingly. With reference to the various models presented, it appears that most of them follow the same basic principles and points of departure. This does not safeguard against certain problems, differences and weaknesses that they contain.

These can be summarised as follows:

- Combinations of variables lead to the attaining of peak achievement and success. These combinations differ from individual to individual however. Even so, the same results are achieved. It is therefore dangerous to accept that in the event that an individual possesses a number of variables, he/she will achieve success. Feldman (1986) points out that gymnasts who are short in length have an advantage over taller participants, but that the latter have other (specific) advantages such as height, diving and vaults. Bartmus et al. (1986) found these same results among tennis players. At this juncture it should be mentioned, however, that each type of sport does have certain basic requirements that can be considered primary requirements for top performance in sport. Salmela & Régnier (1983) proved that gymnasts younger than 12 years needed speed and power for the attaining of good results.

- A suggestion is that the emphasis on the demand for research in this field should be shifted to the combination of talent identification and talent development.

- Allowance should be made for the interaction between heritage and ambience. According to Malina & Bouchard (1991), the real interaction between the two components has not yet been properly or fully researched. It is known, however, that each individually, or both interacting together do influence achievement. It has been proven that the performance of marathon athletes can be predicted reasonably accurately in accordance with the intensity and quality of their training programmes (the ambience factors). A study by Blooms (1985) among tennis players and swimmers emphasized the effect of parental support on performance (ambience). Studies by Malina & Boucherd (1991) on twins clearly stressed the effects of inheritance on performance. Malina (1984) summarised her research on the effects of inheritance on motor function as follows: "evidence indicates a moderate hereditability for many motor

tasks with an unknown environmental effect."

- Longitudinal studies are necessary for identifying talent in order to be able to make objective deductions and draw objective conclusions. The different variables selected should be monitored regularly over a 3 to 10 year period. Variables with a low hereditary component normally tend to show signs of instability during longitudinal studies, because external factors exert such a strong influence upon them.

- Each sports type needs to determine it's own specific requirements, and the criteria should be evaluated from these requirements. The criteria must be multi-disciplinary and consider that variables change with an increase in age and exercise (Singer et al., 1993).

2.2.2.1) Conceptual model for talent identification

The Régnier model (1987)

When referring to the above descriptions of models and the subsequent discussion of their weaknesses, it becomes clear that with each model mentioned, the emphasis falls on individual sports types, as opposed to team sports types. Régnier (1987) constructed his own well-known conceptual model …"basing his model on the problems, shortcomings and suggestions made by researchers concerning the methodology of models of research on talent identification".

His model is very popular and is frequently used by researchers as a framework for their own work on talent identification. According to Spamer (1999), his model has been used successfully by researchers such as Jancarik & Salmela (1987) in gymnastics, Régnier (1987) in basketball and Pienaar & Spamer (1997) in rugby.

The major advantage of Régnier's model is that it can be successfully applied in the context of team sports. In order to meet the requirements of team sports, the researcher had to make use of a combination of variables, instead of individual variables, in his test

battery, e.g. a combination of dribbling and shooting goals in hockey, instead of separating the two variables.

According to the conceptual model, there are two essential phases. Phase one is where a thorough task analysis of the sports type is carried out in order to determine which variables play a part in ensuring success. In other words an analysis is done on the game-specific or sports specific requirements. Secondly, a further analysis is done on specific components, such as morphological, perceptual-motor, psychological and ambience factors.

This analysis is normally carried out by means of existing literature (test batteries), and the opinions of experts. Havlicek et al. (1982) are of the opinion that as many variables as possible should be involved during this phase. Both of the above phases, i.e. the identification of sports-specific (game-specific) requirements and the identification of determinants of performance will subsequently be discussed.

2.2.2.1 A) Identification of sport-specific requirements

In order to be able to develop a trustworthy model for identification, it is essential that all the possible variables that may play a role in performance be identified. The criteria in a prediction function consist of certain objectives that need to be met. The success of the sportspersons is determined by the extent to which they meet and comply with the prescribed sport-specific requirements (Hare, 1999).

This approach seems to be obvious and very simple, as is the case with certain types of sport. This is indeed true for some single-dimensional sports, such as swimming or running, where only one objective need be met. In this case, the prediction function is one dimensional in terms of time, distance or height (Hare, 1999).

In multi-dimensional sports, the situation gets more complex because several variables have to be carried out simultaneously, in order to determine a sportsman's success (Du Randt & Headley, 1993). In order to be able to determine what these variables are, a

thorough situation analysis of the requirements of the type of sport needs to be done. In certain cases this can be done through observation and the opinion of experts. Mainly two methods are used for this purpose, namely the so-called divertical (top-down, "bo-na-onder") approach, and the evertical (bottom-up, "onder-na-bo") approach (Singer et al., 1993).

The devertical method makes use of orthodox scientific methods. The situation-analysis is based on how the type of sport is currently practised, and how success can be obtained by means of a hypothetical conceptual model; for example, in order to be able to run fast, one needs speed (Hare, 1999).

Comparing certain variables with one another, where one variable, the variable that needs to be described, is the dependent variable (ability to run fast) and the other the independent variable (speed), usually does this. This will be discussed in more detail later in this chapter.

The evertical approach aims at finding out from top performers which aspects caused top performance. This is done by means of interviews, protocol analysis, and recalling performance (questionnaire) (Hare, 1999).

Singer et al. (1993) is of the opinion that, as soon as too many variables have to be analysed, results are questionable. After the essential determinants of performance had been determined, the identification of specific determinants of performance should be done, by means of specific tests combined in a prediction function. The identification of these determinants of performance will subsequently be discussed.

2.2.2.1 B) Identification of determinants of performance

In order to draw up a dependable test battery, a second task analysis needs to be done. This analysis is done to determine which underlying functions are essential for the sportsperson's performance. These underlying variables comprise mainly morphological, psychological, motor, and environmental factors. This task analysis is

done with the aid of existing literature and of experts on this topic, in order to compose a list of determinants of performance. In this case, devertical and evertical approaches can also be followed (Hare, 1999).

It is also advantageous if the predictors are of a genetic nature, as the chances of its realization will be better, because it can be developed (Du Randt & Headley, 1993). With reference to the development of a dependable identification model (Salmela & Régnier, 1983), the authors make use of the so-called "sliding populations" ("glypopulasie") principle (Hare, 1999).

This means that instead of monitoring the same population group from juvenescence to adulthood, the process of testing is carried out during various age-phases and on various population groups. A specific or unique test battery is designed for each age group. This identification model or test battery aims to select, from a specific pool population, those sportspersons who possess the possibility to reach the elite level of the next age group, known as the "target population" (Hare, 1999).

It is important during the selection of the pool population to involve as many persons as possible, in order to ensure that late developers with talent are also accommodated. It is also important that sportspersons who are part of the "pool population" should not afterwards form part of the target population. It is characteristic of the above model that some of the talented persons who performed well, were more obedient, dependent, and studious (Hare, 1999).

Certain researchers have expressed the opinion that a characteristic of this model that should be taken into account is the high dropout rate of initially identified so-called talented persons (Csikszentmihayi & Robinson, 1986). Jerome et al. (1987) found it characteristic of these dropouts that they experienced an identity crisis, become sexually mature and undergo other physiological characteristics at the same time.

From the discussion of the conceptual model of Régnier (1987), it can be said that it provides for most of the principles which research on talent identification has to adhere

to. It also describes in detail how each step has to be carried out. In addition, it emphasizes the importance of the multi-disciplinary approach. It also describes a thorough statistical process, which keeps in mind the interaction of various morphological, physiological, psychological and environmental factors as well as sport-specific requirements (Hare, 1999).

So, as can be seen from the above description of the conceptual model of Régnier (1987), it is probably the model best suited for the needs of this study at the present stage.

To conclude, one can set the following guidelines from the above discussion:

- talent identification is a continual process. This means that it occurs during various age phases and that it must be coupled to development. Norm scales for development should exist;

- a model of talent identification should:
  -supplement but not replace the coach;
  -make provision for late developers;
  -make the group that is initially selected as large as possible; and
  -have a multi-disciplinary approach. This means that the Physical Education teacher has a role to play as does the medical practitioner, the sport scientist, etc. It also comprises various components, e.g. physical and motor, anthropometrical, psychological, and game-specific;

- the components essential for top performance in each type of sport have to be analysed. An example is in rugby where handling, running, catching and passing kicking will be important components, and in netball where catching and passing, response time, speed, etc. are important components.

- biological and environmental factors must be considered. In young children, psychological factors may possibly be less important than anthropometrical

factors. The culture and background in which a child grows up may inhibit or facilitate talent identification;

- criteria for selection should strongly support the genetic components. This refers to components such as speed, balance, coordination, suppleness, and strength;

- rate of development should be constantly monitored. The rate at which improvement occurs is an important indicator of talent (Spamer, 1996); and

- a test battery should comply with the following:

- It should be simple and practical.
- It should make use of simple apparatus.
- It should need a limited number of personnel.
- Tests must be easy to administer.
- Test batteries must be composed in accordance with scientific findings.

Phases of talent identification

The Russian and Australian models of talent identification are generally known these days. The process is divided into three phases, namely:

Phase 1

This comprises mass evaluation (population) for the age group 8 to 10. Classification functions (abbreviated test batteries) are normally used to select the best talented persons. Selection is not strict, and border cases are included rather than excluded. This potentially talented group then follow a specific development programme in order to improve their talents.

Phase 2

This phase follows 18 to 24 months after phase 1 (age 11 to 12 years). During this phase, the talented group follow a development programme. Monitoring of improvement occurs regularly (monthly, half-yearly, or yearly). Full test batteries are used, not only

prediction functions.

Phase 3

During this phase, final talent identification takes place (± 13 to 14 years). The selected groups then receive further specialist coaching (Pienaar & Spamer, 1996).

In summary

For the coach involved in talent identification, it is important to understand how to talent is determined:

- firstly, all test persons are tested and subsequently evaluated in accordance with the results of talented persons. The coach also makes use of the prediction function in which everybody is tested and sportspersons rated in a ranking order from talented to less talented. In order to be able to determine the latter, the coach can send the raw data to the writers for processing, or may apply the formulas themselves as explained later;
- after a talented group has been identified, they should be exposed to a development programme;
- talented people must be regularly monitored by means of a complete test battery;
- being talented seems to be age-specific. This means that a ten-year old talented person will not necessarily perform well at an age of 18 years. More research needs to be done on this;
- do not totally ignore children who seem to have less talent. They may rise above the rest at a later age because they do have the talent, but may have an initial handicap due to late development; and
- as the development process progresses (skills programme), children must constantly be evaluated against norm scales in order to monitor tendencies such

as insufficient power or speed (Pienaar & Spamer, 1996).

2.2.3) TALENT IDENTIFICATION IN SOUTH AFRICA

Prior 1933 studies concerning talent identification in South Africa received little attention. Some studies to identify talented individuals were conducted by Daehne (1983) in athletics and Pienaar (1987) in gymnastics. The re-admission of South Africa to the international sporting arena has given South African sports governing bodies, administrators, sportspersons and researchers a new perspective regarding the demands of international participation (Spamer, 1999).

It was clear that South Africa had lost ground in the field of talent identification, as the isolation years had made us the pariah of the modern world. While the rest of the world continued to compete and develop new methods, we did not have much access and credibility, and hence did not advance as far the others.

On the scientific terrain, Du Randt (1993) made an important contribution to research in South Africa in her study of a perspective concerning talent identification on international and national levels. This assignment was carried out on behalf of the department of national education and had as main themes the identification of talent, physiological, psycho-social and anthropometrical variables, talent identification in the old Communistic and Western countries as well as suggestions and recommendations concerning research on the identification of talent (Spamer, 1999).

Some of the research referred to in this study has been confirmed by Du Randt (1993). In the light of the fact that research on the identification of talent is relatively unknown in South Africa, she has succeeded in laying down basic guidelines according to which a model for talent identification in South Africa can be drawn up.

There is also a brief overview of priorities for further research. The section on the identification of talent in South Africa, with some research results in this field that have been ongoing since 1993, will then be investigated (Spamer, 1999).

We are fortunate that South Africa woke up to the fact soon enough that research in this field needed to be conducted, firstly by analysing what the rest of the world was doing, but also developing our own methods that can be applied to the unique situations in which we find ourselves in this country. It is possible that South Africa can become one of the world's leaders regarding talent identification, and that the backlog that we started with can soon be caught up.

The guidelines according to which talent identification can be done were described by Du Randt & Headley (1993). Only the main issues, as supplied by them, are given.

- The identification of talent must be a continuous process because test results are only valid for 2-4 years after which time new norms are necessary

- National and regional programmes which stress general fitness should be encouraged

- Research models must also emphasize the following: in addition to the coach it must be taken into consideration that requirements according to age should be determined; provision must be made for late developers to catch up; as many individuals as possible should be involved and have a multi-disciplinary approach

- Test batteries for initial selection of talented individuals should be simple and practical, easily administered and yet always scientifically founded, should be simple and practical, be easy to administer, yet must always be scientifically based.

- Coaches and national bodies of sport should be trained and be made a part of talent identification.

- The conceptual model as suggested by Régnier (1987) is recommended, but the Russian model can be used with good results.

The study by Du Randt (1993) also made suggestions as to how sports scientists should pay attention to and approach further research in the future. A talent identification model should be developed for each type of sport. Quasi-longitudinal studies based on Régnier's sliding population principle, should be executed.

Norms for talented individuals within the South African population should be laid down and the effects of growth and development on hereditary must be calculated. In addition, a scientifically valid and dependable test battery for talent identification needs to be created.

Since the study by Du Randt (1993) published the South African government, during 1995 and in conjunction with the National Sports Council, confirmed that the formation of a national sports policy is a high priority. Several national and provincial programmes have since been started in order to obtain data. The training of researchers also received high priority, in the form of overseas training. Since then, a few scientific studies have been published.

There have been some valuable contributions however, with a few prominent researchers becoming specialist in their areas of interest. Included in the list are the names of Pienaar and Spamer.

Pienaar & Spamer (1995, 1996, 1997) and Pienaar et al. (1998) have made valuable contributions, especially in the field of rugby, to identify talented young players (Spamer, 1999). Their research showed that 10-year old rugby players, who had been identified as talented, were included in the Craven week primary school team with great success three years later. The total course of the identification process from a statistical processing viewpoint was described in detail by the researchers (Pienaar at al., 1998).

Pretorius (1996) also researched juvenile rugby players and described various prediction functions for different players' positions, to be used very effectively by coaches. Van der Merwe (1997) researched the effect of a rugby specific development programme of 11-year old identified talented rugby players. His conclusion was that

talented people can, indeed, be identified by a prediction function, and that they performed much better than non-talented people during a development programme.

Hare (1997) drew up a prediction function for 16-year old rugby players, in which he assessed not only anthropometric, physical, and motor and game-specific skills, but also psychological variables that can play a role in top performance.

Badenhorst (1998) did research on 15-year old soccer players and compiled a talent identification battery which can be applied in practice, with excellent effect. Recently completed studies include a longitudinal study on rugby by Hare (1999), and even a study on talent identification in hockey.

Although during the past five years, definite progress has been made in research on talent identification, this remains an unexplored field in South Africa. Tertiary institutions in sports institutes should take the initiative of stimulating more research in this field. Closer liaison with provincial and national sports bodies in order to identify needs should also be a priority.

2.2.3.1) CONCLUSION

From the literature, it appears that, especially during the last decade, much research has been done on talent identification. Many of the results of these studies led to talented juvenile sportspersons being identified, which afterwards led to top performance. As far as the situation in South Africa is concerned, scientific studies on the topic are relatively few.

Although this matter is currently receiving attention nationwide, a special effort will have to be made to have more scientific research done. In this way, it will be ensured that talented juvenile sportspersons be identified in each type of sport, enabling them to follow specialist development programmes.

From the above references to literature, it is clear that scientific studies in talent identification, and specifically in South Africa, have to adhere to certain basic principles. This chapter is concluded with the laying down of several guidelines for the process of talent identification that may be used by researchers in South Africa.

These guidelines should not be seen as the alpha and omega of talent identification, but may be used by researchers as a starting point.

1. Research should be focussed on both individual and team sports. It appears that, at present, in South Africa, only rugby, soccer, hockey, gymnastics, and some athletic items actually have research results to show.

2. It should be endeavoured, by means of research, to create test batteries for various age groups in all types of sport. From the literature, it appears that intervals of 3 years may be effective, e.g. 10, 13, and 16-year olds.

3. Talent identification is the initial phase, and talented people need to be subsequently introduced to a development programme. Such development programme should run for a period of 3 to 10 years, as it takes time to reach top performance. It is essential that, during the first three years, attention must be paid primarily to the development of general motor abilities, and that actual sport-specific coaching should take place only in the last 3-5 years. If longitudinal studies do not seem to be possible, quasi-longitudinal studies should be used.

4. Test batteries should be developed for identification at various ages (3 year intervals). For such testing, all possible sport-specific, anthropometric, physical and motor, and psychological tests should be included. These tests are aimed at determining which components are present in top performers.

5. The actual empirical process must be refined as follows:

   - as a first step, two groups are identified, i.e. talented and less talented

participants, who are subjected to a maximum number of sport-related tests. (Pienaar et al., 1998; Dixon, 1990). By the use of step-by-step discriminant analysis, as referred to in the literature, tests are selected, which will comprise the test battery. The population in question is then tested in accordance with these tests. This discriminant analysis aims at selecting tests that discriminate maximally between the talented and non-talented groups.

- After the population, or a large random sample have been tested as described in the sub-paragraph above, a canonical analysis should be done, using the first canonical principle, in accordance with which all persons involved in the test must be positioned in a ranking order.

- The top group (talented group) must be further subjected to a development programme. Care should be taken that groups are not too small, in order to make provision for late developers and dropouts.

6. Regular monitoring of performance is essential. As soon as sufficient research has been done, a scale of norms will exist, by means of which performance can be measured

Finally, the coach, in terms of having a scientific background and knowledge regarding battery tests, the parents, in terms of giving moral support and showing interest in the progress of their children and the community, in terms of providing facilities and financial support, will always play a role in top performance by talented people. And will therefore form an essential part of talent identification.

2.3) STATISTICAL METHODS

When it comes to data analysis, there are mainly two methods whereby research models were composed. According to Singer et al. (1993) the two approaches or methods used to compose models are referred to as the so-called devertical ("top

down") approach and the evertical ("bottom-up") approach.

There are numerous methods of research used worldwide, but two of the more commonly used or popular methods are called single variable studies and multi-variable studies. The first method, single variable studies, has the disadvantage that it is capable of using one variable when comparing achievers and non-achievers. In the field of talent identification, where numerous factors play a role and where you cannot merely focus on one factor, this method is highly limited.

The second method, namely multivariable studies, eliminates the above problem found in single variable studies, as various variables are tested by means of statistical methods, and the underlying relationships between variables can be determined. This is a more realistic approach, and one where all the factors involved in talent identification can be exhaustively examined and even compared in terms of importance.

A well-known example of this type of study is where two experimental groups are selected, one group of which has performed well, and another group that has performed less well. The two groups are measured according to morphological, physical, and morphological, physical, and motor, psychological, and game-specific variables.

The two models of sports talent identification being evaluated by this study are both multivariate models. This therefore warrants a further investigation into the types of multivariate techniques that are available to researchers, and an explanation of the factors involved.

2.3.1) Types of multivariable techniques

Multivariable techniques can be broadly divided into two main groups, namely dependence methods and independence methods. All dependence methods are characterized by a distinction between dependent variables and independent variables. Dependent variables are those that are characterized or explained by the independent variable (Diamantopoulos & Schlegelmilch, 1997).

Diamantopoulos & Schlegelmilch (1997) then go on to explain that to identify the multivariate technique to use, you need to determine whether your data permits you to distinguish between dependent and independent variables. In this case, the answer is yes. Therefore, the models under discussion are both dependence variable models.

An illustration should suffice at this point. The data is such that there can be a distinguished between dependent and independent variables. The dependent variable is explained by the independent variables. Therefore, in the case of this study, for argument's sake, the dependent variable is sports talent (or lack of it) which is described by the independent variable(s) i.e.: speed, agility etc.

Then clarification is needed regarding the dependence methods. The first area of clarification needed is the number and measurement level of the dependent variables. If you are dealing with just one dependent variable and this one variable is measured on a metric scale, you most likely require a multiple regression analysis. If, in contrast, your one dependent variable is non-metric/binary, you should have a look at multiple discriminant analysis. For both kinds of analysis, your independent variables should be metric (Diamantopoulos & Schlegelmilch, 1997).

2.3.2 Logistical regression

As seen from above, when your dependent variable is measured on a metric (numeric) scale, multiple regression analysis will need to be done. For this study, logistical regression is used. According to Kleinbaum (1994) *…"the logistic function, on which the model is based, provides estimates that must lie in the range between zero and one".*

The closer a result gets to statistical significance, the smaller the P-value gets. Therefore, if you have a $p < 0.05$, you have a significance at a 5% level, or in other words the hypothesis of no relationship (or no difference) is erroneously rejected only 5% of the time. This is a common form of reporting that has been seen over the years in the South African context.

As stated previously, the aim of this study is a comparison of the predictive ability of the two methods currently under discussion i.e.: logistical regression and discriminant analysis. According to the method of logistical regression, using the data that has been captured, the subjects will be classified as talented or less talented by making use of only one dichotomous dependent variable (i.e.: a variable having two distinct values).

Therefore, using the information regarding the subjects in the form of independent variables, each category's (talented vs. non-talented) data will need to be imputed respectively. The limitation of this method is that, unlike the method to follow, only one dependent variable can be measured at a time and in so doing requiring the researcher to test both groups separately should groups be the focus of comparison.

The basis and bulk of this information is derived out of Diamantopoulos & Schlegelmilch (1997) out of their book *Taking the Fear out of Data Analysis,* with adaptations done so as to make it clear to the reader where the application for this study is done.

Multiple regression analysis *(i.e.: logistical regression)* is a method used to analyse the relationship between one dependent variable and a number of independent variables. Both the dependent and the independent variables need to be metric, i.e. measured at interval or ratio level (independent variables can also be in the form of 'dummies' i.e.: indicating whether a phenomenon occurs or not) and therefore being numeric in nature.

The aim is to predict the presence of talent, by means of batteries of tests that were executed. What the reader must bear in mind, however, is that the groups are known and previously identified as being talented or not (see chapter 1 for more details). This study focuses on the accuracy of the predictive function of each of the models i.e.: do they distinguish known groups into their respective groups or not?

For the sake of this discussion, it can be assumed that the talented group is under investigation at this point (whereas the less talented group will also be reviewed according to the same process). As stated before, certain batteries of tests were utilised for this study, so as to accumulate scores needed for the predictive functions of these

models.

The next step would be to input each of the scores (the so-called raw data that have been statistically evaluated) that were achieved into the model. Ordinarily, when dealing with an unknown group, it can usually be assumed that each of the variables will affect whether the group is talented or not. The tests performed were exhaustive, investigating each of the previously identified categories of talent (for more information, consult chapter one and three). In total, there were between twenty and thirty tests performed.

Multiple regression analysis or *logistical regression* is therefore, in this context, the ideal analysis technique for this task. It not only enables the prediction of the dependent variable but also provides an assessment of the relative impact of each of the independent variables; moreover, it would indicate the *combined* ability of the independent variables in explaining the variation in the dependent variable.

The fact that the impact of each independent variable is measured, is, in practice of great help to the coach, researcher or anyone dealing with talent identification. When the identifier knows what tests best predict talent, a time saving aspect can therefore become an advantage to this model, albeit not initially.

Therefore, in the case of this study, the relative impact of each of the independent variables with relation to the dependent variable was determined and analyzed. If the impact was of little or no effect, it was discarded and the next variable was then imputed and analyzed until all the variables had been through the whole process. The best predictors were then selected according to their impact, and noted as being better selectors. The results of this can be seen in chapter 4.

For the sake of this discussion an example of the notation of the logistic transformation has been included below. The probability that a subject falls into one group (say MSP) as a function of the scores obtained on 4 tests, is given by:

$$P(X) = \frac{\exp(A + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4)}{1+ \exp (A + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4)}$$

When the above formula is evaluated, the following can be stated:

The terms **A** and function **exp (Y)** means **e** to the power **Y**, where **e** is the constant **2.7182818.** The terms **A** and **B_1 to B_4** are the unknown parameters that need to be determined. The **X_1 to X_4** known parameters that are substituted into the equation. Therefore, the **X_1 to X_4** parameters can be the scores that have been attained in the tests.

The details of this method are complicated. It is however important that the reader has a firm understanding of the basic principles that apply to this predictive function method. In summary, the following about this method can be said:

The dependent variable is what is being investigated (in this case it is the presence of talent or not-in this case known as the groups have already been classified). The independent variables are the factors that affect the dependent variable and have a certain level of impact on the dependent variable. Both the dependent and independent variable need to be metric, or in other words numeric.

These are substituted into the above method so as to derive certain results, so as to see whether the method predicts accurately that which is already known. The variables or factors can also then analysed so as to determine their impact. The whole idea here is that the result is already known, but that the prediction accuracy of the method is being tested to see how accurately it predicts success or the presence of talent. If the method is found to be accurate, it can be used with confidence to predict success in future data.

2.3.3 Discriminant analysis

Multiple discriminant analysis (in short-discriminant analysis) is used to analyse differences between groups in terms of several variables simultaneously. It is conceptually very similar to multiple regression analysis, the difference being that the dependent variable is now non-metric/binary (i.e. a nominal variable defining group membership) (Diamantopoulos & Schlegelmilch, 1997).

Discriminant analysis therefore allows for the analysis of differences between groups in terms of several independent variables simultaneously. The added advantage of this method is that comparisons can be drawn between groups. It even goes further so that identification of the best independent variables is possible, ranking them in terms of importance or significance.

This prediction method has an advantage in that you can analyze many variables simultaneously as well as differences between groups and even go as far as ranking variables according to importance or significance.

For example, if you would like to find out whether talented and less-talented athletes (a dichotomous variable) to differ in terms of, for argument's sake abilities in speed, running and catching and measurement in triceps skin fold, and any number of other factors discriminant analysis would be the technique to use.

The results would tell you whether talented and less talented score differently on these variables, and also identify which variable is the best, second best, third best, etc., in terms of discriminating power. In addition, the results could be used for prediction purposes, i.e. to classify people, for whom you do not know whether they are talented or less talented into one of these categories based on knowledge of their abilities in speed, running and catching and measurement in triceps skin fold, and any number of other factors for which you have made provision.

In most applications, the dependent variable in discriminant analysis is dichotomous (for example, talented versus non talented; flyhalves versus scrumhalves), but the technique is also applicable when a multichotomous dependent variable is involved (for example, flyhalves versus scrumhalves versus fullback).

As stated earlier in commentary on this method, the possibilities abound. When raw scores are obtained, the raw scores can be imputed into this method, with a classification being made regarding whether this subject(s) is talented or not. The results are quick and easy to obtain.

Comparisons can also made intra-group where a complete rugby team may be compared to one another in terms of strength and scores obtained in various tests. This will enable the coach or the researcher/scientist to make comparisons of different players in different positions according to relative abilities.

While it seems obvious that, in theory this may be the better method, one cannot argue that the previous method has numerous advantages of its own that can be highly desirable in practice. As researchers and in fact a country that is always seeking better ways of doing things, the previous method is deserving of investigation as this study is aiming to accomplish.

Therefore, unlike the previous method, this method can, in effect provide a broader view of two opposing groups and even rank certain factors (or independent variables) as being more important or significant than the next. The possibilities regarding this method abound.

It must be mentioned that a stepwise discriminant analysis is firstly used to identify the best discriminating factors (SAS/STAT User's Guide, 1989). This has an advantage in that it provides a more focussed look at these individual factors and that it allows the researcher to discount those so-called unnecessary variables or factors. In so doing, a more accurate result can be obtained, with all the unnecessary, and potentially complicating factors excluded.