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THE EFFECT OF VARIABLE ENVIRONMENTAL FACTORS ON SPORT PERFORMANCE

by

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I dedicate this study to my family

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DECLARATION

I, the undersigned, hereby declare that the work contained in this dissertation is my own original work and that I have not previously submitted it in its entirety or in part at any university for a degree.

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03/12/2013

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ABSTRACT

Available literature revealed a gap in the body of knowledge regarding the effect of environmental and related factors on the performance of elite under 17 judokas in South Africa in order to address the lack of available research. Scholars increasingly researched the social importance attached to the performance of athletes and the competitive environment, including the role of social agents and simulated training. The aim of this study translates into objectives, namely: i) to describe the sport competition environment through an extensive literature study, ii) to determine the effect of environmental and selected physical factors (sleep and nutrition) on the performance of elite judokas in South Africa in the under 17 age category with a self-designed questionnaire, iii) to determine psychosocial effects on judo performance with the Sport Competition Anxiety Test (SCAT) and the Sports Mental Toughness Questionnaire (SMTQ), iv) to determine the effect of environmental factors, selected physical factors and psychosocial factors on the performance of elite under 17 judokas with a focus group, v) to determine the effect of environmental, psychosocial and selected physical factors on the performance of elite judokas from the perspective of judo coaches by way of interviews, and vi) to conduct a comparative analysis based on various variables such as gender, locality, frequency of competition participation and access to resources. Both qualitative and quantitative data were gathered, constituting an exploratory research design. Questionnaires (SCAT and SMTQ) and qualitative data was gathered by way of interviews with judo coaches (n=8) and a focus group with judokas (n=8). In total sixty five (n=65) judokas participated in this study. A purposive sample of coaches and elite judokas were recruited as research participants. Results indicate that judokas have relatively moderate mental toughness (M=41.66) and that mentally tougher judokas experience relatively less anxiety whilst competing (r=-.48, n=60, p<.01). An increase in anxiety is correlated with a decline in performance and medal winning judokas were relatively more confident than non-medal winners. All research participants were negatively affected by not having adequate exposure to environmental simulated training conditions, with temperature as a main factor impacting on performance.

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Key words: Environmental factors; Psychosocial factors; Physical factors; Judo; Judokas

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CHAPTER 1

INTRODUCTION, PROBLEM STATEMENT, AIM, OBJECTIVES, DESIGN AND SCOPE

1.1 Introduction

> *"Our civilization has always recognized exceptional individuals, whose performance in sports, the arts, and science is vastly superior to that of the rest of the population"*
> (Anders Ericsson, Krampe & Tesch-Romer, 1993: 363).

In order to understand the exceptional sport performance of certain individuals, it has to be remembered that observed behaviour is not only dependent upon genetic structure and inheritance. It is rather the interaction between genes and different environmental factors that could enhance and facilitate high performance in sport (Anders Ericsson et al., 1993). Examples of such performances would be Michael Schumacher's seven world championship titles in Formula 1 motor racing and Michael Phelps' 22 Olympic medals for swimming.

Davids and Baker (2007) proposed a number of factors associated with environmental contstraints on sport performance. Some of these are:

- Quality and quantity of training. Elite athletes engage in more hours of sport-specific training than non-elite athletes.
- Coaches are often completely responsible for the practice environment. Elite athletes are often superior to their counterparts due to the fact that coaches engage in meticulous planning of the structure and content of their training programs and environments.
- Parental support has been indicated to be vital in nurturing talented children and providing them with optimal development opportunities.
- The importance that a nation places on the performance of their athletes in whichever sport they embrace, has a profound impact on their performance. Culture is therefore

often seen as a factor that may influence the performance of athletes at a greater level than genetic inheretence.

Due to their interrelatedness, psychosocial factors, physical factors (such as sleep and nutrition) and environmental factors influencing sport performance cannot be considered independent of one another, hence this study attempted to determine the effect of these sets of variables on the performance of elite under 17 judokas in South Africa. Physical factors that were selected for investigation were sleep and nutrition. Both of these physical factors emerged as important topics during the pilot study with judokas, especially as a lack of sleep was associated with perceptions of higher anxiety and lower alertness and reaction levels. Nutrition was associated with cutting weight which is a common practice is sports where weight categories are present.

Judo is an elite sport that requires the execution of skills in an open competition environment and is influenced by physical environmental factors. Judo is the fusion of an ancient combat art, modern sports training, and a philosophy of continuous improvement (Ohlenkamp, 2006: 16). It is an Olympic Sport, is practiced by most age groups and according to Ohlenkamp (2006) has more than 200 National Olympic Committees globally, making judo one of the most widespread Olympic sports in history. Judo was first included in the 1964 Olympic Games in Tokyo, Japan (Ohlenkamp, 2006) and is a sport that teaches moral and ethical values, discipline, mental strength and focus, as well as physical skills (Kano, 1994).

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1.2 Problem statement, aim and objectives

In South Africa, scientific information regarding environmental factors that influence sport performance is not readily available. For this reason, there is a knowledge gap that needs to be filled. In order to address this gap, this study aims to determine key environmental and psychosocial factors that might influence the performance of elite under 17 judokas.

The aim of this exploratory study translates to the following objectives:

- Describe the sport competition environment with an extensive literature study.

- Determine the effect of environmental and selected physical factors on the performance of elite judokas in South Africa in the under 17 age category with a self-designed questionnaire.
- Determine psychosocial effects on judo performance with the Sport Competition Anxiety Test (SCAT) and the Sports Mental Toughness Questionnaire (SMTQ).
- Determine the effect of environmental factors, selected physical factors and psychosocial factors on the performance of elite under 17 judokas with a focus group.
- Determine by way of interviews with judo coaches, the environmental, physical and psychosocial factors that judo coaches deem to have the greatest impact on judo performance at competitions, as well as the simulation methods that they use in order to prepare their judokas for anticipated competition conditions.
- Conduct a comparative analysis based on various variables such as gender, locality, frequency of competition participation and access to resources.

1.3 Research design and methodology

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An exploratory research design entails integrating qualitative and quantitative data (Cresswell & Plano Clark, 2007). In this research, qualitative data was gathered from interviews and a focus group conducted with judo coaches and judokas respectively. Quantitative data was gathered from questionnaires submitted to judokas in the target group. Further explanation of the research design for this study follows in Chapter 4 (4.2, p. 70).

1.4 Sample

The population of under 17 judokas who participated in the SA Open 2012 was 139. In total, 65 judokas (47% of the population) completed the questionnaire. In the focus group conducted with judokas, eight were present. All judokas in the focus group were selected on the basis that they were SA Open gold medal winners. Interviews were conducted with eight judo coaches, all of whom had coaching experience at club, regional, national and international level. More detail in this regard is provided in Chapter 4 (4.7, p. 74).

1.5 Delimitations

This study focussed solely on Group 4 (under 17) judokas who participated at the South African Open Judo Championships in 2012. The reason for this focus was due to the fact that this is the youngest age category in judo that can participate in a world championship event, the Cadet World Judo Championship.

1.6 Limitations

The number of respondents was influenced by the limited contact time between the researcher and judokas. This was largely due to the fact that the majority of judokas were dependent on transport and often left the venue directly after the tournament. Hence they did not have sufficient time available to complete the questionnaires and hand them in directly afterwards. Another possible explanation may also be that judokas do not realise the potential value that this research could add to their training programmes and their performance at major judo events. Despite the fact that the purpose of the research and the potential advantages thereof was explained clearly, the fact that very little research exists on judokas in South Africa may have contributed to the fact that judokas do not fully appreciate the potential advantages that the results of such research may hold for future training methods and preparation prior to major judo events. Due to the limited amount of contact time between the researcher and judokas, only a focus group was conducted.

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1.7 Key concepts

Environmental factors: Factors in the environment that may influence the performance of athletes, such as air quality and altitude. Refer to Chapter 2 (p. 7) for a detailed discussion.

Psychosocial factors: Psychological factors (such as anxiety and mental toughness) and social factors (such as social agents and culture) that may inhibit or enhance performance. Refer to Chapter 3 (p. 28) for a detailed discussion.

Physical factors: In this study sleep and nutrition were selected and discussed as physical factors that may influence the performance of elite judokas.

1.8 Significance and envisaged output

A literature search on South African judokas revealed that no study of this nature could be found. Hence, this study is expected to fill the existing knowledge void and contribute to a greater understanding of the effect that environmental, psychosocial and physical factors have on the performance of elite South African judokas. The results may assist judo coaches in adapting their training sessions and planning their training programmes accordingly in order to create optimal performance environments in future. This may result in more successful competition performance of their judokas both at national and international level. In addition, this study could allow for:

- A paper to be presented at the 2013/2014 SASReCon conference.
- The publishing of a research article in a subsidised peer reviewed research journal.
- Contribution to the existing body of knowledge regarding the effect of environmental, psychosocial and physical factors affecting sport performance.

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1.9 Structure

Following the introduction of the problem, aim, objectives and methodology of this dissertation in Chapter 1, a description of the remaining chapters is provided.

Chapter 2 provides a comprehensive literature review of environmental factors that may influence sport performance. The discussion of each of the identified environmental factors includes a general discussion regarding the potential influence on sport performance, followed by a discussion of the potential influences on the performance of judokas. In conclusion, a relationship is established between the effect of environmental factors and psychosocial and physical factors influencing sport performance that is described in Chapter 3.

Chapter 3 proceeds with a literature study on a variety of psychosocial factors that may influence sport performance. Selected physical factors (sleep and nutrition) are also included in the literature review as potential performance inhibitors or enhancers. This chapter also describes the potential effect of psychosocial and physical factors on sport performance in general, as well as the potential effects on judo performance.

The research methodology is explained in Chapter 4 and the results of the data from this study are described in Chapter 5 and interpreted in relation to the dissertation. Chapter 6 provides a conclusion and recommendations for coaches and judokas, as well as for future studies.

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CHAPTER 2

ENVIRONMENTAL FACTORS INFLUENCING SPORT PERFORMANCE

2.1 Introduction

Most methods used by teachers and coaches to facilitate their students' skill learning experiences require the matching or adaptation to environmental demands (Gentile, 1972). This is specifically the case for adaptive motor patterns. Adaptive motor patterns in sport are body movements directed at changing or maintaining the body's position in space with reference to external objects, manipulating the external object with reference to the body, or both (Gentile, 1972). According to Perry (2005), all sports take place in either open or closed environments, which refers to the type of skill set that athletes should be able to execute as well as the environment to be expected. Perry (2005) describes closed environments such as those in archery, golf and swimming as characterised by the fact they require a clearly defined skill set in order to achieve success. This implies that the environment does not constantly change during sport performance.

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However, in open environment sports, the opponent or environment is ever changing, such as the unknown strategies and skills to be executed by the opponent. In essence, movement patterns performed under stationary environmental conditions are closed (for example archery) and movements performed under conditions where regulatory events are constantly changing their position in space are open (for example during a rugby match or surfing competition) (Chapman, Needham, Allison, Lay & Edwards, 2008).

Gentile (1972) developed a taxonomy on skill acquisition in open motor skill environments. A number of progressive steps are proposed, namely: i) "getting the idea of the movement" that involves organising motor skill patterns in order to find solutions for specific problems that emerge following need-reduction interaction with the external environment, i.e. determining a goal; ii) "regulatory stimulus subset" which refers to the fact that the motor skill pattern selected in response to the problem/challenge presented, is determined, restricted and controlled by the environmental characteristics that are inherently related to the goal; and

iii) “selective attention” referring to the fact that an individual must respond to the environmental regulations, and only once these regulations have been, can an appropriate motor skill pattern can be selected to respond accurately. According to Gentile (1972), the temporal and spatial characteristics of open motor skill environments are controlled by the variable regulatory conditions of the environment.

Another consideration with regard to the sport environment is the external environment, referring to objective environmental factors that divert an athlete’s attention away from the intended target. The external environment includes factors such as weather changes, crowd noise, background noise and spectator movement (Brewer, 2009).

The changing environmental factors (according to the characteristics of an open motor skill performance situation) are indoor air quality, temperature and other similar factors, such as the processing of responses from an opponent or the changing of an element in the environment to which an athlete must react. Environmental considerations lead to the conclusion that elite sport participation is influenced in varying degrees by many factors that coaches and athletes may often be unaware of. For example, some soccer teams have complained about hostile comments made by the Turkish Football Club Galatasaray’s fans when playing at their home stadium, making it difficult for them to focus and perform optimally (Brewer, 2009).

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The above-mentioned literature makes the proposition of manipulating environmental conditions during training, especially during the preparation phases that precede elite sport competitions a viable proposition in order to improve the performance of elite athletes, and this should have a bearing on the results obtained. One method of preparing an athlete for projected conditions is referred to as competition simulation and has advantages for the performance of elite athletes (Bertollo, Saltarelli & Robazza, 2009). Simulation may include environmental simulation prior to competition in order for the athlete to be better prepared and familiar with expected conditions. While some simulation methods may prove relatively costly, environmental simulation in judo may be as simple as arranging individual contests during training with students acting as referees and parents and other students acting as spectators.

All sports that are focused on achieving Olympic success with their athletes should take serious note of the demands and effects of the environment in which athletes compete (Fletcher & Hanton, 2003). The external environment provides athletes with significant challenges in terms of focus and attention. Athletes' attention supply may fail to meet the burden of increased effort and demands (Kahneman, 1973), hence the fact that the increase in environmental demands may negatively impact on the performance of athletes.

2.2 Environmental factors influencing sport performance

In order to reach the achievement of peak sporting performance, many environmental factors need to be acted upon optimally. Environmental factors in and around the competition venue may also have a significant impact on performance (Borresen, 2008). Athletes able to adjust to environmental conditions quickly and effectively are more likely to achieve success in elite sport competitions (Schwellnus & Derman, 2010), as environmental conditions may provide distractions capable of negatively affecting performance at various levels. Therefore, thorough knowledge of the environmental conditions at upcoming sporting events is particularly important for optimising training as well as performance.

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Environmental factors that may influence sport performance during a competition could include climatic and weather conditions, altitude, new or unfamiliar venues and/or environments, high levels of air pollution and extreme temperatures (Peiser & Reilly, 2004). Effective simulation during training in preparation of athletes for major tournaments may provide a competitive advantage given that all other factors are relatively equal.

Athletes therefore not only compete against one another, but have to adapt to, manage and overcome environmental challenges. Environmental factors sometimes play a greater direct role in outdoor sport events due to direct exposure to weather-related elements such as sunshine, heat, wind, cold, visibility and rain. However it can be derived that when indoor events are not adequately prepared and elements effectively controlled, the effect could be just as detrimental to performance. This is due to the fact that indoor facilities may be more seriously polluted than large outdoor industrialised areas (United Nations Environmental Protection Agency, 2010). The focus of preparation for major sport events should be to physically and mentally condition athletes as optimally as possible, whilst simultaneously

simulating expected environmental conditions in order to create familiarity and ensure that athletes are physically and mentally prepared to compete. At competitions where physical and mental abilities are relatively equal, a more optimal level of preparation in terms of environmental factors (simulation), should provide athletes with added benefits in their performance, and ultimately victory.

As judo is an individual indoor sport, preparation and simulation for expected environmental stimuli in any given competition environment may provide judokas with the necessary skills to compete more successfully than their counterparts who have not engaged in competition simulation.

2.2.1 Indoor air quality

Indoor air refers to the air that is inhaled within buildings and sport halls and the quality of this air may have a significant impact on sport performance as sports buildings are often extremely crowded with participants and spectators (Xianting, Yong, Xiaoliang & Xiaojun, 2011).

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A chemical process within the body produces oxygen, which can be described as fuel for the muscles (Wells, Selvadurai & Tein, 2009). This process of oxygen production as well as the body's capacity to take in oxygen and efficiently transfer it throughout the body within the shortest time possible, is vital for all sports that do not require immediate and instantaneous performance (Angle, n.d.). A sport that would be described as requiring immediate and instantaneous performance is weightlifting, whereas in judo, the same qualities are required during a bout, although the judoka may have up to six bouts during a competition day. The capacity to inhale oxygen depends upon a number of factors, one of which is the availability of oxygen in the air which is influenced by air quality.

Indoor air pollution and urban air quality (which may influence indoor air quality where indoor venues are not well ventilated) were rated as two of the world's biggest pollution problems by Green Cross and the Blacksmith Institute (Ericson, Hanrahan & Kong, 2008). Exposure to air polution may give rise to symptoms that include coughing, chest pain, difficulty in breathing, headaches, eye irritation and a decrease in forced exhalation during

high intensity workouts which are all factors that are likely to negatively impact performance during training and competition (Florida-James, Donaldson & Stone, 2004). According to Laskowski (2011), the risk of asthma development is increased by indoor air pollution, which could have a major bearing on sport outcomes as irregular breathing patterns, and therefore a lack of adequate oxygen intake, will inhibit athletic performance considerably. Chronic illnesses such as cardiovascular disease, are long-term, and associated with uncertain outcomes, as well as often being very intrusive to individuals' everyday lives (Larsen, 2009). Temporary illnesses differ mainly in that they are not associated with the long-term outcomes of chronic illnesses.

While aerobic activity is one of the keys to a healthy lifestyle and healthy sport participation, air pollution and exercise can be an unhealthy combination. There is little doubt that the presence of air pollutants might be detrimental to athletic performance due to a marked increase in ventilatory rate and concomitant nasal and oral breathing (Lippi, Guidi & Maffuni, 2008).

According to Pierson, Covert, Koenig, Namekata and Kim (1986), controlled studies and observational studies on athletes indicate that air pollution will have adverse effects on athletic performance during training and in competition. This is mainly due to the higher intensity and volume of breathing when exercising, exposing athletes to a higher level of inhalation of possible harmful and toxic substances. Potential substances may include sulphur dioxide, and the increased inhalation of pollutants such as these significantly constrict blood vessels and decrease ventilator flow, making breathing considerably more difficult during exercise. This may influence performance negatively in indoor facilities where ventilation and air quality are not carefully monitored and controlled.

Air pollution is a contributing factor to respiratory illness and thus causes difficulty in breathing (United Nations Environment Protection Agency, 2010). This will necessarily have a detrimental effect on sport performance in general and therefore also on participation in judo tournaments. Air pollution, the use of toxic chemicals and pesticides, cigarette smoke, pollen and ozone layer depletion are also factors that negatively influence air quality and therefore sport performance. Exposure to air pollution can cause health problems when not exercising, but with the combination of air pollution and exercise, the potential health

problems are exacerbated. During aerobic activity athletes inhale more air and therefore air is inhaled more deeply into their lungs. Furthermore, when exercising, air is mostly taken in through the mouth, thus bypassing the nasal passages which normally filter airborne pollution particles (Laskowski, 2011). Low ventilation rates is one of the factors most commonly identified with negative respiratory health effects in indoor venues (Ajimotokan, Oloyede & Ismail, 2009) and therefore the number of windows and sufficient air flow through training and competition venues are vital for peak performance.

Piturro (2008) identified eight athletes who competed at the 2008 Beijing Olympic Games who were severely compromised in their performances due to levels of air pollution far exceeding safety guidelines. When focussing on world records established in outdoor events during the 2008 Beijing Olympic Games in comparison to those set at the 2004 Athens Olympic Games, it was clear that only six records were set in 2008, while 12 were set in 2004 (Piturro, 2008). Given that one of the major differences between the Olympics was air pollution, it may be concluded that high levels of air pollution may have adversely impacted the performance of elite athletes.

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The level of indoor air contaminants in gymnasiums is inevitably more severe than that of the outdoor environment, and indoor air quality is also directly influenced by outdoor air quality (Dacarro, Picco, Grisoli & Rodolfi, 2003). These researchers determined that the indoor pollution that athletes are exposed to is not sufficient to detrimentally influence their performance by enhancing breathing difficulties and limiting potential training intensity in venues with modern forced ventilation systems.

A method of judging the quality of air in an indoor sports hall is by determining the concentration of Carbon Dioxide (CO_2) in the air. Assessing CO_2 together with the number of people and room volume can assist in determining the ventilation rate in a venue (Travers, n.d.). A TSI Q-TRAK indoor air quality monitor can be used to assess the CO_2 level in an indoor venue (Travers, n.d.). Ma, Jian and Cao (2006) propose that a maximum level of CO_2 in an indoor sports hall during competition should range between 0.10% and 0.15%. This should be monitored consistently in order to ensure that athletes have optimally positive conditions to compete in. Careful monitoring of CO_2 levels and increasing ventilation to control CO_2 levels (Travers, n.d.) will increase the level of comfort of spectators and athletes,

as well as enabling athletes to perform at a higher intensity due to greater availability of oxygen (Ma, Jian & Cao, 2006).

Other factors that are identified as having a potential negative impact on performance are moisture or dirt in air-conditioning systems often caused by rain (Sieber & Stayner, 1996), formaldehyde (a colourless pungeont gas) (Garrett & Hooper, 1999), chemicals in cleaning products (Zock, Kogevinas, Sunyer, Almar, Muniozguren, Payo, Sanchez & Anto, 2001) and microbiological pollutants (Bornehag & Blomquist, 2001) such as dust. The aforementioned factors influence the air quality of indoor buildings and may have a significant impact on athletes' breathing and therefore their training intensity and health, thus inhibiting their performance both in training and in competition.

2.2.2 Altitude

In South Africa athletes are provided with an opportunity to train and compete at low, moderate and high altitude levels, with coastal venues being the lowest and inland being the highest. Lancaster and Smart (2012) define low altitude as lower than 1 500m above sea level, moderate altitude from 1 500m to 2 500m and high altitude from 2 500m to 5 300m. Altitude could potentially influence the final outcome of a competitive sports event as explained in the following section.

Balke, Nagle and Daniels (1965) showed that performance capabilities at 10 000 feet (approximately 3 000m) high altitude show no differences to low altitude performance, and oxygen debt capacity is not affected in disciplines requiring relatively short bursts of energy expenditure. Important, however, is that the duration of recovery was prolonged and after 10 days of continued training, the athletes showed slight improvement in performance, but did not achieve their prior lower altitude levels. More importantly, for judo, Balke et al. (1965) reported that maximum physical efforts of one minute or more showed manifest reductions of normal performance. A decrease in performance at high altitude is the direct result of a decrease in the ability to maintain high training intensity at high altitude (Lancaster & Smart, 2012). This is important as the normal time of judo bouts for the age group under study is up to four minutes in length. Lancaster and Smart (2012) further indicate that the greatest advantages in altitude training are derived from 9.5 hours of

training per day for a period of two weeks prior to competition at moderate altitude (2 500m to 3 500m above sea level).

Important to consider in terms of South Africa's geographical settings, is that there is evidence suggesting that living at high altitude levels in combination with training at low altitude levels produces great improvements in performance. In a study by Saunders, Telford and Pyne (2009) on seven elite middle-distance runners, athletes trained and lived at high altitude (approximately 2 800m above sea level) for a period of time, followed by a period of time where they trained and lived at moderate altitude (between 1 700m and 2 200m above sea level). This was done in preparation for a middle-distance race and Saunders et al. (2009) reported that all these athletes had an increase of up to 1.9% in performance during the race as compared to their original performance. Corresponding to these findings of research done on elite endurance athletes is research conducted by Obminski, Stupnicki, Borkowski, Lerczak and Blach (1996) on nine female judokas in the mountains of Spain. Judokas participated in a judo training camp at a moderately high altitude (2 100m to 2 300m above sea level) for a period of two weeks. Findings suggest that the response of the adrenal cortex to exercise stress was significantly reduced, thus indicating that training for judokas ranging from moderately high to high altitude for a period of time holds significant advantages for performance in training as well as in competition. The adrenal cortex is responsible for releasing the corticosteroid hormone cortisol that is essential for reducing stress levels and regulating blood glucose levels during training (Hackney, Battaglini & Evans, 2008).

The effects of altitude training should be monitored quite closely, as acclimatisation to high level altitudes holds particular advantages in terms of increased oxygen transportation, however training at altitude also limits exercise intensity, which may have detrimental effects in terms of competition performance. Being unable to maintain high intensity training may decrease aerobic fitness levels, which in turn may offset any positive physiological adaptations from altitude exposure (Levine, 2002). The highest levels of performance were found to follow moderate-altitude acclimatisation with low-altitude training (Levine & Stray-Gunderson, 1997).

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Altitude has a significant effect on athletes as their training altitude could impair or enhance their competition performance. In many sports this has a bearing on performance and demands extra attention in terms of training programmes. Altitude is indicated to influence judokas as they regularly travel to compete both at high altitude and at low altitude (Lafon, n.d.). This was confirmed by research done on judokas in Germany, where it was determined that altitude training holds significant advantages to judo and other combat sports (Lehmann & Heinisch, 2000). A study on the Guangdong judo team in China in 2002 indicated that alternating training between low altitude (1 000m above sea level) and moderate altitude (1 891m above sea level) improved athletes' flexibility and speed (Gong, Luo & Zhou, 2002).

Besides the fact that altitude considerations and training may influence the performance of an elite athlete, adjusting to weather changes, specifically in terms of temperature, may determine competition outcomes (Dankanich, 2012).

2.2.3 Temperature

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Historically, many major sporting events occur in environments that are considered as thermally stressful (Barwood, 2008). These events may take place in unfamiliar conditions (such as colder or warmer) than what athletes are adapted to in their regular training conditions. This has prompted sport scientists to focus their research on asking the question of how they can improve their athletes' performances in such circumstances (Quod, Martin & Laursen, 2006). Besides training in thermally stressful environments, the body's core temperature also rises during physical activity which may cause added challenges in terms of performance in such conditions (Maughan & Shirreffs, 2010). Dankanich (2012) explains that athletes from the USA travel to environments considered thermally stressful prior to participation in order to assess each athlete's ability to maintain a core body temperature of a maximum of 37 degrees Celcius. Should athletes not be able to do so, they are provided with a cooling vest in order to maintain a healthy core body temperature. This implies that it is beneficial to performance to measure and control an athlete's core body temperature.

Another proposed method to overcome extreme environmental temperatures is cooling athletes prior to exercise and competitions. In a study by Quod et al. (2006), it was found that pre-cooling athletes lead to significantly better performances. Siegel (2011) conducted

research on the effect of consuming slurry ice prior to participation in extremely hot conditions (30˚C and higher). Siegel (2011) reported that there is a significant improvement in performance when cooling the athlete internally, as this may lead to a decrease in brain temperature, as compared to traditional pre-cooling methods that focus on external cooling, such as immersion of the athlete in an ice bath. The traditional external cooling methods are considered impractical for sport settings, whereas the consumption of fluids ranging between 14˚C and 16˚C is considered a more practical solution to gaining the same advantages. Monitoring an athlete's core body temperature should assist in accurately applying this method, as each athlete may react differently (Dankanich, 2012). Siegel (2011) found that there is a combined advantage of both external and internal cooling prior to participation. This gives particular credence to the fact that high temperature (30˚C and higher) can inhibit overall sports performance. The available evidence discussed clearly indicates that temperature regulated venues may have a significantly positive influence on the performance of athletes, however, venues that are not temperature controlled may lead to significantly impaired athletic performance.

Lafon (n.d.) states that temperature influences judo performance and that the effects can be mitigated by training in similar conditions. Simulation methods for extreme temperature that have been successful for Olympic athletes, especially in the short term (4 to 6 weeks prior to a major event), are using a sauna and training in climatically controlled chambers. This is in order to prepare for specific climatic conditions as well as to simulate climatic conditions that are expected at the competition venue (Lehnert, 1994).

The potential detrimental effects of extreme temperatures are confirmed by various studies indicating that stressful environmental conditions create overall thermoregulatory strain, which not only inhibits performance, but leads to poorer muscle recovery (Duffield, King & Skein, 2009). With increased temperatures, athletes are more prone to fluid loss through sweat evaporation, and significant fluid loss may lead to detrimental effects on cardiovascular capacity and thermoregulatory functions, especially in endurance sport events. Judo is unique in that it requires high levels of explosive power over short periods, as bouts may last up to five minutes or more and athletes may compete in up to five bouts during a normal competition day (Ohlenkamp, 2006). This demands particular attention in terms of venue temperatures and fluid intake during a competition day.

Dehydration due to fluid loss through sweat may significantly impair the performance of athletes both during training and competition performance (Maughan & Shirreffs, 2010). Considerations regarding dehydration are especially relevant for judokas who have an increased risk due to the fact that the judo attire they wear is relatively heavy (a judo suit jacket weighs approximately 2kg) and results in higher core body temperatures and higher rates of sweat loss. In endurance sports, Peiser and Reilly (2004) reported that high temperatures (30˚C and higher) negatively affect the performance of marathon runners at the Olympic Games. It is suggested that a conducive temperature for judo competitions is 18˚C (Drouin, 1998) which negates most of the negative effects of high or low temperatures on judo. Judo requires a high level of endurance fitness due to the fact that judokas compete in a number of bouts in a given time period, which makes temperature regulation an important consideration in order to achieve a high level of performance. Temperature regulation is not only associated with the venue itself, but also to the regulation of core body temperature.

Riviera-Brown and De Felix-Davila (2012) conducted a study on adolescent judokas (n=24) to assess their hydration levels prior to, during, and after a training session in a high-heat-stress environment (approximately 29.5˚C). Results revealed that the majority of the judokas commenced training in a significantly dehydrated state and that the fluid intake during training was minimal. Symptoms of dehydration (such as a decrease in body mass) were still present the day following the training. The main reasons for the poor hydration habits of judokas were attributed to the fact that judokas engage in rapid weight loss strategies that include a combination of exercise, food restriction and dehydration-inducing methods (Artioli, Franchini, Nicastro, Sterkowicz, Solis & Junior, 2010), few fluid breaks allowed by coaches, and a lack of availability of bottled water and sports drinks.

2.2.4 Ambience

A model by Uhrich and Koenigstorfer (2009) was developed in order to create an optimal ambience for spectators and participants of sporting events alike. The model indicates that there are optimal conditions of sports participation in terms of the environment and the ambience that it creates. In this model ambience is defined as the emotional response to the entirety of stimuli in a particular environment. Swart (1994) conducted a study on 44 male and female first team members who participated in a variety of individual and team sports.

The results of the study reported that members in individual team sports had lower levels of competitive stress when participating in a competitive ambience than members in team sports.

The proposed effects of ambience indicate that noise and crowd support (the support of spectators for any given athlete at a tournament), lighting, venue and habits of the people involved in the event are important topics that contribute to a clear picture of what the term embodies, hence the discussion of these terms follows.

2.2.5 Noise

For the purposes of this study, a description of noise is adopted from Kavishwar (2011). The author describes noise as a derivative of the Latin word 'nausea', that implies unwanted sound that may lead to adverse effects on hearing and performance in sport, i.e. anything that interferes with the message being heard clearly (Williamson, 2008).

2.2.5.1 Background (white) noise

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One type of noise that requires particular attention is white noise. White noise is produced by combining sounds of all different frequencies together. An example of equipment that may produce white noise is a fan. White noise is often used in order to mask other noises, especially voices of people. This is especially relevant to judo as judokas have to be able to hear coaches and referees simultaneously, despite a number of other sound interferences such as announcements and spectator noise.

A study by Molander and Bäckman (1990) conducted on a number of highly skilled miniature golf players assessed what the effect would be of different types of background sounds on motor performance, arousal, and memory for shots played. Motor performance is influenced by physiological factors such as strength, speed and endurance, biomechanical factors such as technique and psychological factors (Potgieter, 2006).

Potgieter (2006) defines arousal as the energising of the mind and body that leads to a condition of alertness. Memory refers to the psychological ability of the miniature golf players to recall and execute their skills accurately under the different conditions in this study,

according to what they have learned in the past and based on their memories. The study assessed these skills when playing a recording of traffic sounds, and also when playing a radio broadcasting of a soccer game in the background. The study very importantly reported that younger players in the study (average 27 years old) performed equally well under both conditions, however, as the age of the players under study increased (average 53 years), their performance during the radio broadcasting decreased. The results suggest that there may be an age-related impairment in selective attention situations and when the task does not demand for the irrelevant noise stimuli to be searched. This implies that domain-specific expertise in older people is reduced in situations of high arousal or during periods of increased cognitive demands (Molander & Bäckman, 1990).

The demands placed on participants in miniature golf are in many instances similar when compared to judo, as it is an individual sport that places high cognitive demands on participants in terms of technique (correct execution of required skills), concentration (attentional focus required for the task at hand), and focus and routines in an environment where noise is acceptable and expected. Therefore, the results of the above-mentioned study have significant implications for judo. Maintaining attentional focus on the task at hand regardless of other distracting sounds is referred to as the cocktail party phenomenon (Haykin & Chen, 2005). The cocktail party phenomenon can be described as a psycho-acoustic phenomenon that describes a human's ability to recognise and attend to one source of auditory input in any given noisy environment, where hearing interference is caused by competing speech sounds or a number of other noises that are assumed to be independent of each other (Cherry, 1953). A judoka requires the ability to be able to focus on either his/her coach or the referee during any given judo contest.

It is likely that competitors, especially children with low attentive levels, i.e. inattentive children, will experience benefits from constant exposure to moderate amounts of auditive noise and white noise (Soderlund, Sikstrom, Loftesnes & Sonuga-Barke, 2010). These researchers found that children with high levels of attention, i.e. attentive children, experienced detrimental effects and therefore the opposite to inattentive children when exposed to moderate amounts of noise. An exact explanation as to why these differences occur is not clearly available, although a recently developed computational model proposes that a combination of two factors explains the differences in concentration with various

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background noises. It also relates to the concept of how noise enhances attention and performance in general through stochastic resonance. Stochastic resonance refers to when a weak signal is presented below the hearing threshold and then becomes detectable when white noise is added to the signal. This variability essentially pushes the weak signal above the detection threshold and has been indicated to enhance visual perception and cognitive ability (Soderlund et al., 2010). The second factor is proposed to exist as a result of individual differences in dopamine. Dopamine is the critical neurotransmitter that modulates the neural cell's responses to the environment and determines the probability that it will react at the presentation of a given stimulus (Servan-Schreiber, Printz & Cohen, 1990). In this model it is proposed that children with low attentive levels require higher amounts of noise stimulation in order to increase the likelihood of tonic dopamine release, which in low amounts is associated with failure to sustain attention (Bilder, Volavka, Lachman & Grace, 2004).

The aforementioned information is particularly interesting as many children are referred by psychologists to martial arts (Kennedy, 1997) such as judo in order to improve their concentration levels and this may have a significant impact on their concentration levels, especially during training. In a study done on a number of karate practitioners ranging from 11 to 45 years old (Ferguson, Carbonneau & Chambliss, 1994), three groups were exposed to emotionally positive music, emotionally negative music and white noise respectively. This study found that karate practitioners exposed to white noise performed worse in a preselected drill as compared to both the other groups, with karate practitioners also indicating that music had a relaxing effect which white noise did not have. Due to the fact that white noise is associated with a failure to sustain attention, the conclusion can be made that white noise inhibited their reaction time during the respective drills.

Besides noise causing hearing difficulties, it may also lead to stress (United Nations Environment Protection Agency, 2010). In a study conducted by Schultz, Ramsey and Grefenstette (1990) on a flight simulator, which particularly attempted to determine the effect of noise across training and target environments, it was reported that the closer the noise levels in the training environment are to the noise levels in the target environment, the better the performance of participants. However, in the case where it is not possible to have similar environments, the results indicate that it is better to have too little regularity in the training model than too much, in order to adequately prepare the trainees for as many as possible

environmental circumstances and eventualities (Schultz et al., 1990). Similarly, these researchers found that it is better to have a training model with overly general initial conditions than overly restricted initial conditions.

2.2.5.2 Music

Another type of sound that is present in athletes' daily lives at training or at the gym is music. It is proposed that music at certain frequencies and certain rhythms is beneficial to runners' performance during competition and training, increasing both their training intensity and velocity (Schneider, Askew & Abel, 2010). Research has found that each athlete has their own preferred type of music that enables them to perform at a higher level. It is possible that athletes in different sports listen to different types of music and therefore it is essential that all judokas find the style of music that relates most to success in their performances.

Research on 10 Turkish individuals between 20 and 30 years of age indicates that performance is considerably better when training in tune with the beat of music, rather than background music that does not have a particular beat/rhythm (Koć & Curtseit, 2009). The findings published by these researchers indicate that training with music that has an appropriate rhythm for the required demands of the exercise may increase endurance capacity, explosive power and grip strength, all skills required for judo participation. Furthermore, exercise adherence in the long term may also be enhanced through training with rhythmic music. In certain training situations, music may also be used to enhance the challenge of training when attempting to increase the amount of distractions during performances that require full focus of attention on single elements (McCann, 2012).

2.2.5.3 Noise from spectators

Noise levels are focussed and amplified in indoor sports, which particularly affect athlete performance positively in the case where the support is for that athlete, such as for home ground events. In the case of visiting teams, high noise levels have been indicated to disrupt their communication and individual differences of each athlete may also cause for impaired performance (McAndrew, 1993). Another study by Kristiansen (2010) describes how Penn State's football stadium seat allocation has been rearranged to enhance the acoustics within the stadium. The stadium owners found that, by placing their loudest supporters in certain

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areas of the stadium, the visiting team supporters will experience up to 50% higher levels of noise creating conditions where the visiting team's quarterback can at times only be heard from as close as 40cm. This is especially relevant when executing skills that require visual and auditory feedback, such as catching a ball. Significant impairment in the communication and performance of visiting teams was visible (Kristiansen, 2010), although this was not only limited to visiting teams, but home teams as well. In judo there is crowd noise as well as the instructions of coaches that judokas have to contend with, and they need to be able to differentiate as effectively as possible between these types of noise. These instructions are vital to hear and react to for optimal performance. In judo, spectators are allowed to support judokas for the full duration of the contest, whilst coaches are only allowed to speak during clear pauses in the contest when judokas are instructed to reset to the middle of the contest area.

Crowd noise not only leads to the breakdown of communication within visiting and local teams, but could also have a significant impact on refereeing decisions, possibly due to intimidation. This is a vital consideration with judo as there are guidelines for scoring, although the awarding of scores is still left to subjective judgement. Research shows that home crowd advantage has little or no impact on scoring where objective judgement is required, however, the opposite is applicable to subjective judgements (Unkelbach & Memmert, 2010). This research found that referees were inclined to penalise visiting athletes more severely when home crowd noise was significantly present.

Judo has strict rules regarding coaches, limiting their instructions only towards their judokas. That is, they are not permitted to refer to the referees or the opponents of their judokas and are not allowed to shout any scores during competition bouts. It is, however, not always possible to control crowd behaviour, especially verbal abuse directed at players and officials. This could significantly influence the judgment of referees. It is possible that crowd noise may have an adverse effect in that communication between coaches and their judokas could break down in very noisy conditions, resulting in miscommunication, misunderstandings and errors in performance.

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2.2.5.4 Noise from opponents

In a study conducted on tennis players (Sinnett & Kingstone, 2010), it was also found that the grunting sound that many tennis players make as soon as they strike the ball interferes with their opponent's concentration and execution of the return shot. Whilst it is still uncertain exactly what causes the interference, it is more likely to be either the auditory stimulus (the grunt) that masks the sound of the ball being struck by the racket, or it distracts an opponent's attention from the sound of the ball. Maria Sharapova is a successful international tennis player who uses the grunt excessively during her matches. Women's Tennis Association (WTA) chief executive Stacey Allaster stated that the WTA needed to lower the noise levels of grunting in tennis in order to improve playing conditions for future generations (Robson, 2012)

Whilst tennis stands in contrast to judo for the fact that judo allows for a high noise level during competitions and tennis does not, it is also likely that similar effects exist in judo. Many Asian judokas, for example, are taught to give a loud shout when the judo bout is started which may intimidate the opponent and act as psychological cue to start the contest. They are also taught to give a shout when attempting a throw. The theory surrounding this technique has long suggested that shouting when attempting a throw often influences the referee's decision to award a higher score than the throw actually deserves.

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2.3 Visibility

According to Knudson and Kluka (1997), a number of factors influence vision in sport and directly influence performance. The first factor relates to the ideal vantage point for athletes when viewing motion. The **vantage point** of an observer strongly influences the perception of an event and the subsequent performance, and is in right angles to the line of sight.

Anticipation refers to the athletes' ability to focus on relevant cues and visual stimuli and gather appropriate information in order to react more accurately and quickly. Athletes untrained in this ability will not be able to fixate their vision and gain the necessary information to react timely to corresponding cues. **Visual search** is necessary for anticipation

to be more accurate. Visual search refers to the amount of eye movement when searching for information. Athletes who are not well trained in this skill will move their visual search back and forth between different cues and not be able to fixate their vision on certain elements.

Together with fixating vision on the correct stimuli and cues, the time available and the athletes' ability to focus their vision effectively within this space of time (speed) is vital for enhanced sport performance. Athletes who can process visual information within the shortest possible time should perform better than those who require more time to process visual stimuli. In essence, this can be referred to as **reaction time**, which is the time that proceeds between the onset of a stimulus and the commencement of a movement response (Magill, 1998). Magill (1998) further indicates that the reaction time for a visual stimulus is approximately 250ms.

Eroglu and Senel (2002) reported that male wrestlers had a reaction time to visual stimuli of 206.09ms. A study by Alessandro (2009) on experienced black belt judokas (n=9) and beginner white belt judokas (n=11) indicated that experienced judokas use less exhaustive search strategies that involve fewer fixations of longer duration than beginner judokas. Experienced judokas made a greater number of transitions when presented with attack and defense scenarios than their beginner counterparts. The reason for the afore-mentioned was due to the fact that experienced judokas focussed more effectively on the central regions of the body and use peripheral vision to focus for monitoring their opponents' limb movements. Experienced judokas focus on the chest of their opponents and are able to perceive the movement of their arms and legs, whilst inexperienced judokas switch their vision to moving limbs constantly, i.e. they are not as capable of perceiving vision peripherally. Peripheral vision in a non-static task demanding sport in which the visual information is constantly in motion such as in judo, requires a greater emphasis on peripheral awareness than visual acuity (Alessandro, 2009; Erickson, 2007). Focus on the central regions of the body allows judokas to focus on the areas where grip fighting takes place. Grip fighting is the skill that judokas use to control the fighting area (Alessandro, 2009), and the most important visual skills in dynamic sports such as judo are peripheral vision combined with accurate depth perception.

Finally, **visual errors** refers to an athlete's ability to accept that there will be visual errors from time to time and that the response to these errors should be swift in order to ensure that

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control and performance are recovered within the shortest possible time. Initially, in a judo contest there are a number of cues that will give the judoka invaluable information regarding the fighting style of their opponent before contact is made, such as stance and direction of movement. Once contact is made the judoka must be able to focus on the movement patterns of the opponent and be ready and able to react accordingly in order to avoid being thrown, and for the judoka to be able to throw his/her opponent. Visually well trained judokas will be able to focus their vision effectively and be able to adjust swiftly when visual errors occur.

A number of colours such as orange, green, yellow, blue and ultraviolet form wavelengths that are critical for all athletic activities (Laby & Kirschen, 2007). The necessity of light lies in the fact that light is the basis of all aspects of vision, such as acuity, depth perception and contrast sensitivity. Laby and Kirschen (2007) further indicate that contrast sensitivity is arguably the most important visual function that athletes in any sport rely on to make assessments and react accordingly. Contrast sensitivity refers to the visual ability of an athlete to detect an object against its background and is a vital skill necessary for almost all sports (Laby & Kirschen, 2007). In judo it has been indicated that a workload of 60 per cent enhances optimal visual perception maximally (Drid, Majstorović & Drapšin, 2010) and hence contrast sensitivity. However, a workload that increases above 60 per cent leads to a significant decrease in visual perception. Furthermore, lighting may lead to sleeping problems, which may be detrimental to recovery from training (Samuels & Alexander, 2013).

Although it is often proposed that poor lighting and visibility negatively affect sport performance, very little research is available to substantiate this. From the available research, one can derive that sufficient lighting is necessary for high visibility and should contribute to optimal sport performance. This is due to the high demands on human vision resulting from the fast movements that occur in sports. Fixation on certain important elements in sport participation is another concept that relates to the necessity of high visibility and accurate skill execution (Knudson & Kluka, 1997). Sufficient lighting implies that there is sufficient light to be able to clearly see all objects in the tournament venue. Due to the fact that light affects visual acuity, depth perception and contrast sensitivity, the speed of this perception will impact on reaction time. Hence if lighting is not sufficient, athletes will react more inaccurately and slowly.

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Perceiving unexpected objects in their visual field may distract athletes to the extent that they react to unexpected stimuli and lose focus on relevant stimuli. Therefore, vision is a vital source of information for sport performance (Perry, 2005). From ancient times, the aspect of vision has been an important consideration in judo performance (Matsumoto & Ikai, 1969). According to Perry (2005), a sport such as judo can be classified as an open environment sport as it is dynamic and changing and therefore the environment contributes to the challenges of the competitive scenario. It is thus vital that the athlete is capable of focussing his/her sight on only relevant stimuli and select only meaningful cues in order to perform optimally. Such visual stimuli in a judo contest include mainly being able to focus on the opponent and their movement patterns.

2.4 Summary

Available literature enabled the researcher to indentify the sport environment as consisting of two interrelated components, namely the internal environment, and the external environment. In this chapter, the external environment is discussed thoroughly through an in-depth literature study, and identifies a number of external environment elements that emerged as the most significant factors relating to sport performance. These factors include air quality, altitude, temperature, ambience, noise, and visibility. It is evident from the literature that these factors do not impact on performance independently, but rather act as an interrelated set of variables. Temperature is identified as one of the major factors related to the internal environment.

Furthermore, sports are classified within two categories based on the type of variables that athletes are exposed to during competition, namely open and closed environments. Judo is identified as an open environment sport, based on the fact that a number of factors that judokas are exposed to during participation constantly change.

Having considered the external environment, it is evident that the factors identified hold significant considerations for coaches in terms of preparing athletes for major sport events.

Due to the sport environment consisting of two interrelated components, it is necessary to consider the second element of the environment that influences sport participation

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significantly, namely the “internal environment” (Brewer, 2009). The internal environment includes mostly subjective factors that include an athlete’s own thoughts, feelings and various physical factors. Factors may include emotions, concentration and self-talk (Brewer, 2009), hence the discussion of a number of these factors in Chapter 3.

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CHAPTER 3

PSYCHOSOCIAL AND SELECTED PHYSICAL FACTORS

3.1 Introduction

Sport psychology refers to the application of psychological principles to improve sports performance through teaching athletes, coaches and parents of athletes healthy and effective methods of building mental toughness and coping with the pressures of competition (Viljoen, 2011). High performance athletes gain tremendous advantages in performance by enhancing these skills (Creasy, 2005). Components of mental toughness include managing competitive stress, controlling concentration and improving confidence. Enhancing these skills may positively impact on social skills such as communication and the promotion of team harmony (Williams, 2006). Team harmony or team cohesion is firstly dependent upon establishing a common vision for the team (Williams, 2006). Other factors relating to enhancing team cohesion are establishing a positive feedback environment that will enhance learning as well as clearly establishing role clarity and accountability, and enabling interaction amongst team members outside of the sporting environment, that is social interaction.

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High performance athletes have reported a number of psychological characteristics associated with peak performance. These psychological characteristics include a loss of fear prior to and during participation (relaxed mindset), not thinking of performance/emptiness (athletes often report a sense of emptiness characterised by a complete loss of ego when experiencing peak performance), total immersion in the activity and narrow focus of attention, effortless performance (the perception that skills can be performed in a completely relaxed environment without pressure), having complete control and a feeling of an integrated universe and time-space disorientation (characterised by the perception of the slowing down or speeding up of time during performance, simultaneously with feeling completely in control of the situation) (McInman & Grove, 1991; Ravizza, 1977). Orlick's (1996) Wheel of Excellence describes many of the aforementioned psychological characteristics as elements/components of mental readiness, which the author views as a priority in order to produce peak performance at competitions.

A study conducted by Orlick and Partington (1988) revealed that mental readiness was a significant factor in determining which athletes were able to perform at their best under the pressures and stresses of the Olympic Games. Subsequent studies such as one by Chen, Chang, Hung, Chen and Hung (2010) on the effect of mental practise have indicated similar findings regarding mental readiness and performance, in that a lack of mental readiness leads to poorer performance amongst elite table tennis players. It can be assumed that events of similar stature and demands to the Olympic Games, such as World Championships, elicit similar reactions and emotions.

Van Rossum and Gagné (1994) determined that coaches of various sports including judo and track and field, regarded the same three factors as the most important predictors of success in their respective sports, namely physical fitness, mental fitness and genetic endowment. Physical fitness is a term describing all the physical qualities such as cardio-respiratory fitness, muscle strength, movement speed, agility, coordination and balance (Ruiz, Ortega, Gutierrez, Meusel, Sjostrom & Castillo, 2006). Mental fitness "includes goal setting, critical thinking, creative thinking, learning and memory, expressing ideas clearly, and developing a positive mental attitude that includes: optimism, mental flexibility, self-esteem and confidence, and a willingness to risk" (Cusack, Thompson & Rogers, 2003: 396). Genetic endowment refers to an athlete's genotype (combined influence of many genes), epigenic factors and non-hereditary environmental variation (Lucia, Moran, Zihong & Ruiz, 2010).

Jarvis (1999) identified motivation, self-efficacy, arousal, aggression and anxiety, as well as social relationships with parents, peers and coaches as the most important psychosocial factors influencing sport. In support of Jarvis' findings, Williams and Krane (2001) reported that the evident factors influencing expert sport performance are self-confidence and higher levels of sustained concentration. The authors also reported that successful athletes at elite level generally experience lower levels of anxiety prior to and during competition, think more positively about their performances and their skills, and have the necessary skills to channel their anxiety in a way that enhances their performance. Successful athletes also have a tendency to recuperate more quickly and more effectively after a failed attempt at a competition, indicitave of their enhanced level of mental readiness.

It has been reported that American Olympic teams in Atlanta during 1996 performed better when mental training was included in the preparation for the Games. The athletes in these

teams perceived themselves to be more adequately prepared for unexpected events as well as for external factors such as unexpected exposure to the media. In contrast, teams that underperformed complained that they were not mentally prepared for the event and they did not know how to react to unexpected events or to the excitement of spectators, supporters, officials, fellow athletes and their friends and family, intrusive media coverage, and the hype of the Olympic Games (Gould, Guinan, Greenleaf, Medbery & Peterson, 1999).

Mental toughness includes controlling emotions, maintaining focus and concentration, having a high degree of self-confidence and displaying full commitment towards the task(s) at hand (Crust, 2010). A number of mental factors that form part of mental toughness influence an athlete's ability to perform successfully at the highest echelon of sport. These factors have been identified and are described in greater detail next.

3.2 Arousal and anxiety

Arousal and anxiety are often used interchangeably in order to describe the emotional state of athletes directly prior to competitions, however, a differential approach is needed to illuminate these psychological states. Recent research indicates that arousal and anxiety are clearly distinct psychological constructs (Weinberg & Gould, 2011).

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3.2.1 Anxiety

Anxiety is described as a negative emotional state characterised by nervousness, worry and apprehension when an essential value is threatened and is associated with activation or arousal of the body (Weinberg & Gould, 2011; Balague, 2005). Anxiety is associated with the inappropriate activation of fight-flight behaviour (Binboga, Senol, Catikkas, Bayazit & Tok, 2012). Values associated with anxiety can then be physical (e.g. strength), psychological (e.g. unknown opponents) or interpersonal (e.g. relationship with coach and team mates). The higher the level of anxiety in competition, the greater the negative apprehension towards whichever element arouses the apprehension. This negative apprehension increases the intensity of behaviour and physical activiation (arousal) of the athlete, which could lead to negative fluctuations in performance (Jarvis, 1999).

3.2.1.1 Trait and state anxiety

Two types of competitive anxiety exist that may influence sports performance, namely state and trait anxiety (Zeng, Leung & Liu, 2008). Some athletes are more prone to being anxious than others, which may be genetic in origin, or may be socially acquired by learning from adults during childhood. This view is prominent in social learning theory (Jarvis, 1999) and is characteristic of trait anxiety. Trait anxiety is "an acquired behavioural tendency or disposition that influences behaviour" (Weinberg & Gould, 2011: 79) and due to the fact that it is part of the personality, individuals will respond to situations they subjectively perceive as threatening with state anxiety reactions that are inappropriate to the actual danger of a situation when it is viewed ojectively (Weinberg & Gould, 2011). Trait anxiety consists of three components according to the Sport Anxiety Scale (Smith & Smoll, 1990). They are somatic trait anxiety (such as the extent to which one perceives heightened physical symptoms such as stomach tension), worry trait anxiety (the extent to which one worries or experiences self-doubt), and concentration disruption (the extent to which one loses concentration during a competition).

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Judoka A may have identical levels of physical skills to judoka B. However, due to personality differences (judoka A is naturally low in trait anxiousness, whilst judoka B is high in trait anxiety), judoka A performs much better when entering major international events than judoka B. Judoka A perceives major international events as less threatening than judoka B, hence the fact that he is more successful. Mitić, Mitrović, Bratić and Nurkić (2011) reported that judokas in general were less anxious than non-athletes, and that top judokas were less anxious than "recreational" judokas, contributing to their greater success in the sport.

State anxiety is the anxiety caused by competing in an evaluative environment and is therefore the result of the competition and not personality factors (Weinberg & Gould, 2003). State anxiety is an immediate reaction or emotional state characterised by fear, negative apprehension and tension in combination with an increased level of physiological arousal (Weinberg & Gould, 2011).

3.2.1.2 Somatic and cognitive anxiety

The degree to which an individual worries (has negative thoughts) is referred to as cognitive state anxiety (Weinberg & Gould, 2011), whereas changes in perceived physiological activation from situation to situation refers to somatic state anxiety. Somatic anxiety refers more to the subjective percepetion of the level of physiological activation than the actual level thereof. In contrast to cognitive anxiety, somatic anxiety refers not to worry, but to the physiological aspects of arousal such as muscle tension and stomach discomfort often present with athletes prior to participation in competitive events (Gould, Greenleaf & Krane, 2002).

Zeng et al. (2008) found that athletes high in cognitive state anxiety reported higher levels of somatic state anxiety, which resulted in low self-confidence and accordingly poorer performance than their counterparts with comparatively low cognitive and somatic state anxiety and higher self-confidence. These researchers also reported that athletes with high levels of trait anxiety in training situations had high levels of cognitive and somatic state anxiety during competition. In contrast, athletes with high levels of sport-confidence had relatively lower levels of state cognitive and somatic anxiety and consquently found competition less daunting and produced higher levels of performance. Furthermore, these researchers established that there were four accurate predictors of sport performance in terms of anxiety, namely: i) somatic state anxiety is an accurate predictor of state self-confidence, ii) somatic state anxiety is an accurate predictor of state sport-confidence, iii) cognitive state anxiety is an accurate predictor of state sport-confidence, and iv) cognitive state anxiety is an accurate predictor of state self-confidence.

A judoka's level of state anxiety will vary from moment to moment during a contest, from starting off in a tactical contest to achieve grip superiority (slight nervousness and awareness of a pumping heart), to defending a lead at the end of a close contest (heart racing and high level of nervousness). A study by Kul, Görücü, Özal, Yaman, Çetinkaya, Genç and Demirhan (2012) on wrestlers at national and international level (n=50), reported that wrestlers at international level were more adept at controlling their levels of state anxiety as compared to those at club and provincial level. This is largely attributed to higher levels of experience in the sport and competition environment associated with international participation. In another study Kuuseok and Ratassepp (2001) reported that judokas (n=59) had higher levels of state

anxiety prior to competition (pre-competitive state anxiety) when they were young and lacked experience. Furthermore, higher pre-competitive state anxiety was highly correlated with unstable temperament (high trait anxiety). García, Toro and Ortega (2008) measured the difference of state anxiety (cognitive and somatic) between under 14 judokas (n=49) and under 16 judokas (n=48) with the Competitive State Anxiety Inventory-2 (Martens, Vealey & Burton, 1990) at the Spainish National Judo Championships. Results indicated that there was a significant difference in the state anxiety between age categories, with the under 14 judokas displaying higher levels of anxiety than the under 16 judokas. This was attributed to the fact that older judokas had participated in national tournaments before (experience), and that they had more effective adapative processes and skills to pre-competitive anxiety, which varies between individuals.

Filaire, Sagnol, Ferrand, Maso and Lac (2001) assessed the relationship between physiological responses and psychological responses of male judokas (n=12), approximately 22 years of age, prior to a regional judo tournament and an interregional judo tournament. The results of the study indicated that cognitive and somatic anxiety were higher at the interregional tournament than at the regional tournament. A significant correlation was reported between somatic and cognitive anxiety and cortisol. Cortisol is a hormone produced by the adrenal glands and is especially released when physical stress is placed on the body (Summers, 2011).

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3.2.2 Arousal

Arousal in sport is a combination of physiological and psychological activation directed at a competition situation and the intensity of behaviour at a particular moment, and varies on a continuum from a deep sleep to intense excitement (Binboga et al., 2012; Weinberg & Gould, 2011).

Just prior to competing at a major international tournament such as the world championship, a judoka may experience a high level of arousal, displaying symptoms such as an increased heart rate, higher respiration rate and sweating, all factors associated with a high level of mental and physical activation.

3.2.2.1 Relationship between arousal, anxiety and performance

Hardy, Beattie and Woodman (2007) reported that cognitive anxiety influences performance negatively when physiological arousal is high. In cases where cognitive anxiety is high and physiological arousal is elevated, it leads to a catastrophic drop in performance, referred to as the catasrophe model. It can therefore be assumed that cognitive anxiety has a positive effect on performance when physiological arousal is low (Hardy et al., 2007). This is the physiological and cognitive state that all athletes should strive to achieve in order to produce the best possible results.

3.2.2.2 Performance-arousal models

A number of models exist that have attempted to describe the relationship between anxiety, arousal and achieving peak level sport performance (Weinberg & Gould, 2011; Jarvis, 1999). The models are drive theory, inverted-U hypothesis, individualised zones of optimal functioning, multidimensional anxiety theory, catastrophe model and reversal theory (Weinberg & Gould, 2011).

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3.2.2.3 Drive theory

This theory proposes that the relationship between arousal and performance is linear and therefore as an athlete's arousal/state anxiety increases, so too does his/her performance (Spence & Spence, 1966). This theory is no longer relevant as it does not explain the occurrences whereby elite athletes fail to perform at an optimal level in situations where there is more pressure on them to do so.

3.2.2.4 Inverted-U Hypothesis

The inverted-U hypothesis states that increased arousal enhances performance gradually until performance reaches its peak. Arousal that exceeds this level results in a gradual decline in performance and vice versa (Krane, 1992). The general principles of the inverted-U Hypothesis are accepted, however, a number of elements of the hypothesis are debatable, such

as the shape of the U, the proposal that optimal arousal (and therefore optimal performance) always happens exactly at the midpoint of the curve (Weinberg & Gould, 2011) and the fact that arousal and anxiety are viewed as interchangable.

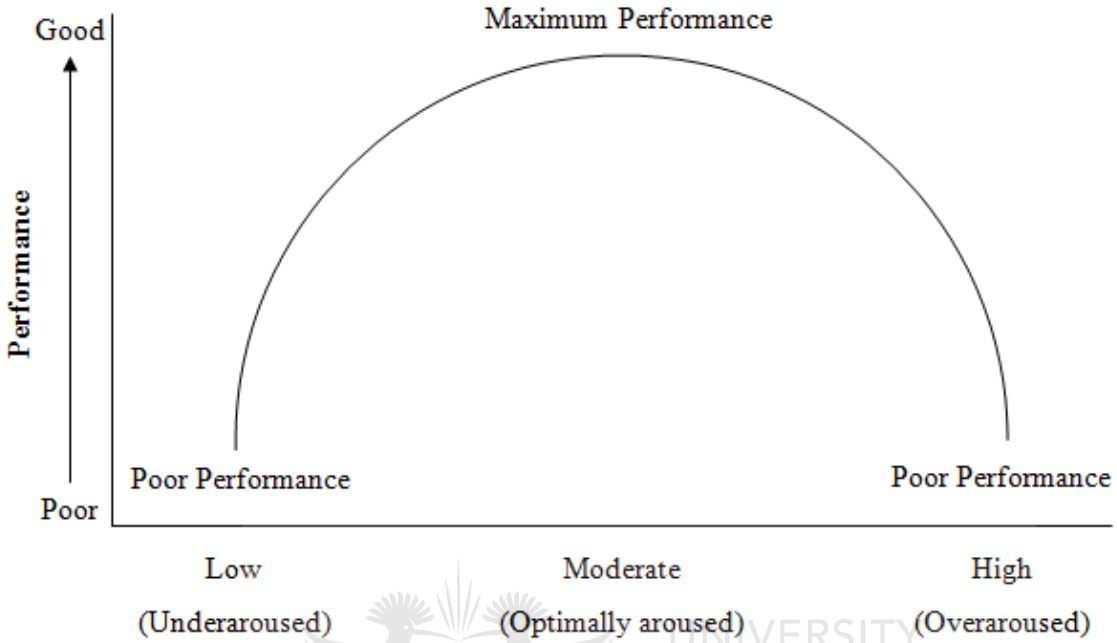

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Figure 1: Inverted-U hypothesis (Source: Muntz, Costello & Korabik, 1975).

3.2.2.5 Individualised zones of optimal functioning (IZOF)

The third model is the Individualised Zone of Optimal Functioning (IZOF) model, which proposes that arousal is sport specific and that each athlete has his/her own optimal level of arousal. It is proposed that endurance sport athletes have a low level of optimal arousal whilst sports such as weightlifting and wrestling will have a high level of optimal arousal (Hanin, 2007). The model differs from the inverted-U hypothesis in that it proposes that there is an optimal state anxiety level where athletes perform at their best. Outside of this optimal zone, performance suffers. The model also allows for the inclusion of the effect that negative and positive emotions (for example anger and joy) may have on individuals (Weinberg & Gould, 2011). Some athletes may experience anger (a negative emotion) as beneficial to their performance, whilst others may find that negative emotions have a detrimental effect on their performance.

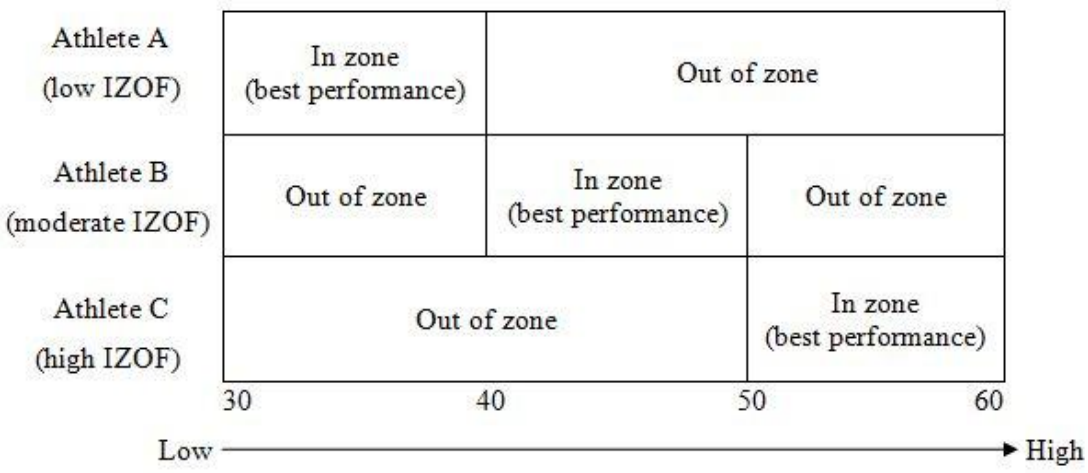

Figure 2: Individualised Zones of Optimal Functioning (Source: www.studyblue.com, n.d.)

3.2.2.6 Catastrophe model

The catastrophe model developed by Hardy (1990) proposes that there is a rapid and drastic decline in performance as soon as the optimal level of arousal is breached. In this model, challenges that athletes are presented with during which they experience low levels of worry or cognitive state anxiety, results in performance in the way of the inverted-U hypothesis. When athletes experience a high level of worry or cognitive state anxiety, the model proposes that performance will increase to an optimal level, whereafter there will be a dramatic (catastrophic) drop in performance. Recovery takes longer than proposed in the inverted-U hypothesis (Weinberg & Gould, 2011).

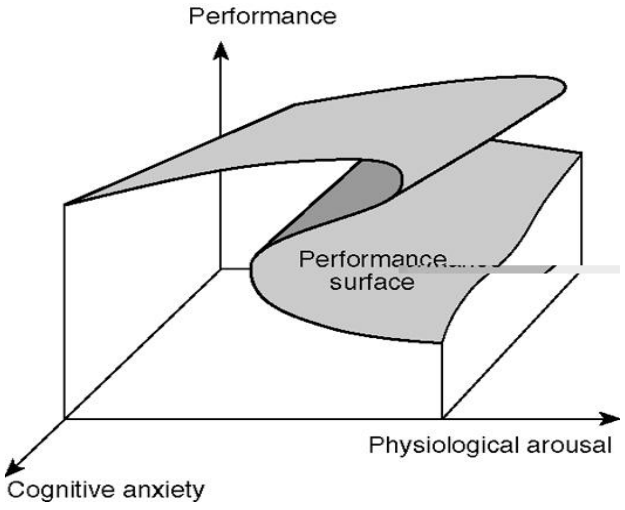

Figure 3: Catastrophe model (Source: Hardy, 1990).

3.2.2.7 Reversal theory

Reversal theory proposes that an athlete's performance depends not only on the actual level of arousal during participation, but rather the athlete's perception of the level of arousal experienced during participation (Kerr, 1997). According to this model athletes are capable of changing their perception of whether the arousal they are experiencing is positive or detrimental to their performance from moment to moment. Although Weinberg and Gould (2011) indicate that the reversal theory provides an interesting perspective on the fact that measured arousal is not always the determining factor of an athlete's performance, but rather the result of an athlete's subjective interpretation of the arousal, the theory has not been tested extensively and more scientific conclusions cannot be made as yet.

3.2.3 Coping with anxiety

Weinberg and Gould (2003) explained that some athletes who are more trait-anxious have developed coping strategies that allow them to compete successfully under extremely stressful circumstances despite their obvious weakness in this regard. Some of these imagery and attention strategies are described by Potgieter (2006) as follows:

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- Activation control (arousal regulation) which holds that all athletes have their prime level of personal activation that allows them to perform optimally. They need to be aware of how to regulate their level of activation in order to ensure that it does not elevate beyond prime or drop below prime.
- Imagery is generally based on the belief that an imagined event and a real event will have similar effects on the nervous system. Imagery takes place through cognitive visualisation and can therefore be used to learn or acquire new skills (mastery imagery) or to practise problem solving when situations are out of control or do not work out as initially planned (coping imagery).
- Attentional strategies are techniques and strategies that assist and allow the athlete to focus on the correct cues and maintain higher levels of concentration for longer periods of time.

Having the required strategies and methods to control arousal and anxiety are components that will influence the mental readiness of an athlete prior to and during competition. This has already been reported in the eighties (Orlick & Partington, 1988). Of the three major readiness factors assessed in Canadian Olympic athletes prior to the 1984 Los Angeles Olympic Games namely physical, mental and technical, the only statistically significant link to final Olympic ranking was found with regard to mental readiness. Mental readiness helps reduce stress and enhance performance during critical times, such as elite level sport events (Thompson & McCreary, 2006).

Greater insight into the effect that arousal and anxiety have on athletes and their performances may be gained by assessing athletes in terms of the big five personality traits (Sindik, 2011). According to Sindik (2011), this may provide valuable results in terms of the different positions that athletes play in team sports such as basketball. The main personality traits are defined by Sindik (2011) as: i) extraversion which is the volume and intensity of social interaction, activity level, need for external stimulation and the feature of joy, ii) agreeableness referring to the quality of interpersonal orientation towards others along a continuum from pity and compassion to adversary, antagonism in thoughts, emotions and actions, iii) conscientiousness which refers to task-oriented and goal-oriented behaviour and socially required impulse control, and iv) emotional stability and intellect, i.e. openness to experience.

Emotional intelligence comprises of a set of abilities that all top athletes should possess. These include the ability to perceive, evaluate and express emotions quickly and accurately, the ability to detect and generate emotions that facilitate the process of thought, the ability to understand emotions and display knowledge about emotions, and the ability to regulate emotions with the aim of promoting emotional and intellectual development (Mitić, Mitrović, Bratić & Nurkić, 2011). Emotional Intelligence is regarded as a major predictor of successful outcomes in individuals' interactions in everyday life and in sport psychology is regarded as a major predictor of athletic performance (Mitić et al., 2011). Mitić et al. (2011) conducted a study on recreational and elite judokas from a judo club in Serbia and determined that successful judokas displayed higher levels of emotional intelligence in stressful conditions, especially in terms of controlling emotions. Successful judokas also displayed less anxiousness and neuroticism than their less experienced counterparts.

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Two types of athlete orientation are indicated as accurate predictors of level of anxiety and performance, namely task orientation and ego orientation. Potgieter (2006) indicates that athletes high in task orientation value the mastery of tasks and skills highly, and this serves as their main motivation during participation and performance. These athletes derive satisfaction from the acquistion and development of their own skills. They are also more likely to seek challenges, use effective learning strategies and persist for longer, often even increasing their effort when they fail. In contrast, Potgieter (2006) explains that ego orientation refers to athletes who are primarily concerned with demonstrating superior skills and performance as compared to other athletes. Their focus is externally directed and these athletes, when confronted with very challenging conditions, often doubt their own skills and tend to avoid such situations due to fear of failure.

Gimeno, Buceta and Perez-Llantada (2007) indicated that significant advantages exist in terms of mental training for judokas. These advantages include enhancement of performance and prevention of injuries, as well as encouragement regarding and improvement of long-term training commitment. Athletes ranging from 13 to 18 years old improved their performances when having a keen sense of being task-oriented together with a sense of competence, rather than having an ego-oriented attitude towards competition. This approach with young athletes prevents an elevation in cognitive sport competition anxiety (Ommundsen & Pedersen, 1999). Mitić et al. (2011) found evidence supporting the fact that successful elite judokas are more task-oriented than less successful non-elite judokas.

Ego-oriented participants have a preoccupation with displaying superiority. They focus on victory rather than enhancing their own skills and have the perception that the ultimate success in sport is to beat the opponent with the least effort (Duda, 1993). In contrast, the essence of task orientation is to improve, gain new skills and harness a desire to learn and to meet the demands of the task.

In a study conducted by Chin, Khoo and Low (2012) on track and field athletes, research evidence supports the theory that older students (above the age of 12 years) are more task-oriented that younger students (under the age of 12 years). According to the authors, there are a number of possible explanations for this. One being that older students are capable of a better understanding of forward planning and basing their success in sport on hard work and

commitment, whereas younger students cannot always separate the concepts of performance and task execution.

3.2.3.1 Task and ego orientation

Task and ego orientation also have particular gender dynamics (Chin et al., 2012). In their study, Chin et al. (2012) confirmed previous findings that male athletes were more inclined to be ego-oriented than their female counterparts. This is due to the fact that male athletes judge their performances and abilities in terms of comparison with that of fellow competitors and the competition environment. Contrary to this, female athletes are more inclined to judge the success of their performances in terms of the execution of techniques and improvement of personal performances.

A couple of factors that contribute to increased anxiety prior to competition, namely being ego-oriented as well as having a high level of perfectionism, were identified in a study done on pre-competitive anxiety of high school runners. Some of these athletes changed their motivational focus to being ego-oriented just prior to competitions, which led to an increase in their anxiety levels (Hall, Kerr & Matthews, 1998). This was possibly due to the fact that there was high emphasis placed on the fact that achievement is rated by position (competitive environment), rather than skill and technique (learning environment). High school athletes with high levels of perceived ability and competence within their sports domain are more likely to achieve success (Duda & Nicholls, 1992). This is in accordance with the self-efficacy theory that states that self-confidence is domain-specific. This entails that an athlete may be confident in one domain, but will not necessarily be able to translate that self-confidence amongst multiple domains of life (Potgieter, 2006).

The self-efficacy theory states that individuals high in self-confidence and confidence in their abilities are more likely to perform better than their relatively less confident counterparts. The psychological factor that mostly influences self-efficacy is an individual's perception of his/her abilities compared to the required task at hand (Potgieter, 2006). Individuals with a high self-perception of physical ability will perform better than those who have a low self-perception of their physical ability.

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Due to the fact that anxiety has a major cognitive component, monitoring and self-awareness should include the athlete's thoughts or focus of attention. This is especially relevant for lengthy sport events or sport events that have regular breaks or pauses, such as set changes in tennis, or rest between bouts at a judo tournament (Balague, 2005).

According to Jarvis (1999), athletes who compete in sports that require high amounts of explosive power and are relatively short in duration, require high levels of arousal. This can be described as having a high level of arousal together with a high level of performance. Judo is a sport that has similar demands and therefore an optimal level of arousal will be characterised by higher levels of anxiety and higher levels of performance. As already identified, the athlete can achieve optimal levels of arousal and activation and control anxiety levels through the acquisition and application of appropriate mental strategies and techniques. Highly skilled athletes who can implement these strategies and techniques more effectively than their counterparts should be capable of outperforming their opponents who do not have these skills.

3.3 Defining concentration

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Two different dimensions of concentration are said to exist, namely the width of attentional focus and the direction of the athlete's attention (Nideffer & Sagal, 2006). Nideffer (n.d.) proposed four scales of attentional focus, namely i) broad-internal, used for strategic thinking, analysing and planning by comparing information stored in long-term memory with information from the environment, ii) broad-external, used to interpret and react to external stimuli automatically/instinctively, iii) narrow-internal, used to systematically organise an activity and rehearse information, and iv) narrow-external, used to execute a physical skill (e.g. kicking a ball) or an interpersonal skill (e.g. asking a question). Attentional control or sustained concentration is the result of athletes having the necessary skills, perceptual awareness, self-confidence and emotional control to execute a performance that matches or exceeds the demands of the competition (Perry, 2005). Athletes require preparation for the competition arena through the understanding of the sporting demands in order to achieve success in this regard.

According to Moran (1996), the mental skill of concentration can be referred to as attention, however Weinberg and Gould (2011) indicate that concentration consists of a number of constructs of which selective attention is one. Selective attention is referred to as the ability to focus on relevant environmental cues (Weinberg & Gould, 2011). Focus of attention on the correct internal and external cues during participation is dependent upon the execution and maintenance of effective concentration skills and techniques (Perry, 2005). Focus can be defined as the "ability to attend to internal and external cues in your attentional field" (Taylor, 2010). According to Perry (2005), athletes in all sports who maintain optimal levels of concentration for the longest period of time are most likely to achieve success.

Moran (1996) refers to the attentional system as consisting of three vital components, namely focused concentration, coordination of skilled behaviour, and arousal control. The author identified environmental stimuli that are likely to divert attention of athletes away from the intended direction. These are noise, weather and playing conditions, and visual distractions.

Noise is any sound that interferes with the clarity and accuracy of communication. Especially background noise may adversely affect concentration and inhibit performance (Andrews, 2010). In judo, crowd noise during competitive events is allowed, and the perception of this noise may influence a judoka's performance positively or negatively. Crowd noise is a potential distraction during sport performance (Weinberg & Gould, 2011) and it may interfere with clear communication between a judoka and his/her coach.

The perception of weather conditions and playing conditions as potential distractions during performance could affect the performance of athletes. Some athletes may perceive extreme heat negatively, lose concentration and perform poorly, whilst others may not (Maughan & Shirreffs, 2010). Refer to paragraph 2.2.3 Temperature (p. 15).

3.3.1 Constructs of concentration

Thurstone and Thurstone (1986) developed the Thurstone Test of Mental Alertness, a test for assessing general mental ability. The test defines and assesses the constructs of mental alertness as an individual's ability to perform numerical, simple arithmetic and number sequences (quantitative assessment) and an individual's ability to understand language, word

and letter pattern matching (linguistic assessement). Once athletes are capable of identifying their optimal performance state and compare that to the state they are in at any given time of performance, they will be aware of the need to gain control of their situation. This will assist them in directing their mental attention more effectively towards the task at hand (Ravizza, 2006). Higher levels of alertness are associated with greater work output and better performance in the workplace than those with lower alertness levels (Campbell & Dawson, 1990).

Awareness, a lower state of alertness, is thus the first step towards gaining control over a pressure situation during a sport competition. Once athletes are capable of becoming aware of their psychological state and control their thoughts and feelings, they will be able to perform more successfully (Weinberg & Gould, 2011).

Another concept related to awareness is mindfulness. Mindfulness can be described as "the awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to the unfolding of experience moment by moment" (Kabat-Zinn, 2003: 145). In a study conducted by Thompson, Kaufman, De Petrillo, Glass and Arnkoff (2011), a mindfulness based intervention strategy implemented for a period of one year on archers, golfers and long-distance runners (n=25) enhanced the mindfulness of the athletes as compared to athletes who did not participate in the intervention programme, however performance enhancement was not visible. The intervention programme consisted of attending workshops as part of Kaufman, Glass and Arnkoff's (2009) and De Petrillo, Kaufman, Glass and Arnkoff's (2009) Mindful Sport Performance Enhancement model. It was hypothesised that, based on the results of related studies, the athletes would be able to experience enhanced performance with an ongoing mindfulness-based intervention programme (Thompson et al., 2011).

Optimal performance is not only dependent upon awareness, but also on optimal focus of attention. Once the athlete is able to successfully focus on basic skills and proper execution of techniques regardless of the amount of pressure, optimal performance should be reached (Ravizza, 2006).

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Randori, a form of judo training that simulates competition fighting, requires that the judoka is capable of reacting to every move that his/her opponent makes, which in turn implies that the judoka is constantly in a state of high mental alertness (Kano, 1994). Considering that the judoka requires a high level of mental alertness during training in order to react to the opponent, it can be logically assumed that the judoka will require an even higher state of mental alertness when participating in competition bouts where there are so many more potential distractors and challenges present. Therefore, judokas who are capable of maintaining higher levels of mental alertness for the duration of competitive events should outperform their counterparts who are incapable of achieving similar mental alertness levels if all other factors are equal.

3.3.2 The role of concentration

Mahoney and Gabriel (1987) reported that elite collegiate athletes were more effective in maintaining their concentration levels during training and competition as compared to non-elite athletes of the same age. The research on concentration and sport as described earlier clearly indicates the importance of enhancing this mental skill in order to produce peak sport performance.

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Judo requires a presence in the here and now so that decisive action can be taken immediately, before the opportunity is lost, implicating a fast reaction and movement time. Complete concentration is necessary for safety and success up to a level where it becomes impossible to compete without total commitment (Ohlenkamp, 2006). Spilt-second decision-making is required in judo as the situation demands.

Attentional focus on the opponent during judo competition is essential, especially with intermittent breaks in attentional focus that are caused by the shift in focus to the referee and the advice of the coach. Due to the shift of direction of attention from the judoka's coach, to the referee and the opponent, it is clear that judo requires both narrow and broad external attentional focus.

Mahoney and Gabriel (1987) show that there is a significant difference in the concentration levels of athletes competing in sports that take place in open and closed environments. These

researchers reported that athletes competing in sports such as judo and wrestling, where there is unpredictability in the open environment stimuli, are more capable of maintaining focus and concentration than their athletic counterparts participating in closed environment sports such as weight lifting. Open skill environments place far greater cognitive and physiological demands on athletes, especially in terms of the complexity of decision-making skills (Farrow, Pyne & Gabbett, 2008).

3.4 Definining self-efficacy and self-confidence

Self-efficacy is an individual level psychological construct that refers to an individual's judgment or perception of his/her capabilities and efforts (Bandura, 1997). It can be considered as an important cognitive mediator of performance (Bandura, 2001). Self-efficacy encompasses a situation-specific form of self-confidence (Weinberg & Gould, 2003). Self-confidence is a more resilient mental skill/attribute, whilst self-efficacy may differ between domains and contexts (Vogt, n.d.).

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The Self-efficacy Theory, which is derived from the Social Learning Theory, provides an explanation for one common mechanism that people may use to exercise influence over their own motivation and behaviour (Bandura, 1997). The level of confidence that an individual perceives to possess in relation to his/her abilities to perform a task successfully, is referred to as self-efficacy (Bandura, 1997)

In a year-long study done on a patient with chronic obstructive pulmonary disease (COPD) Kasikci (2011) used an intervention strategy incorporating different elements that influence efficacy expectations. These elements include:

- Mastery experiences which is one of the most powerful approches for developing confidence and entails enhancing situational processing (complexity of the task) and cognitive processing (perception of one's ability) (Luthans, Luthans & Luthans, 2004).
- Modelling "provides inspiration and skills on how to succeed in the task at hand" (Kasicki, 2011: 2).
- Verbal or social persuasion which arises through social support and provides motivation to work harder to achieve success.

- Decreasing emotional/physical arousal may contribute to higher self-efficacy expectations and enhanced performance. The effects of the intervention strategy indicated that an increase in self-efficacy decreases COPD.

Low self-efficacy is a factor responsible for high levels of anxiety in athletes prior to competition (Jarvis, 1999). A study by Martin and Gill (1991) using the Sport Orientation Questionnaire indicated that win orientation and competitiveness were related to outcome self-efficacy. Results from their study also indicated that high scores of self-efficacy are directly linked to the achievement of performance and outcome goals. Although self-efficacy is not related to an improvement in decision speed and decision-making performance, it is directly related to overall physical performance (Hepler & Feltz, 2012; Hepler & Chase, 2008).

Stevens, Lane and Terry (2006) determined the mood profile of an elite male judoka competing in various Olympic qualification events. Psychological responses were recorded over a period of time, using the Eysenck Personality Questionnaire (EPQ), the MCOPE, the Brunel Mood Scale, self-set goals and self-efficacy for goal attainment. The strongest association was found between high self-efficacy and achievement of performance goals and outcome goals. It can thus be concluded that it is imperative for a judoka to have a strong belief in his/her own abilities and thus high self-efficacy in order to perform optimally at elite level.

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3.5 Achievement motivation

In the sport context, achievement motivation is "conceptualised as a function of the subjective meaning that a performer assigns to success or failure" (Harwood, Cumming & Fletcher, 2004: 319). Weinberg, Tenenbaum, Pinchas, Elbaz and Bar-Eli (1991: 174) reported that "One of the most popular motivational techniques for enhancing performance and productivity in business, education, and sport is goal setting". In contrast to the general acceptance that goal setting is an effective motivational tool and enhances performance, researchn by Burton and Weiss (2008) indicated that goal setting may only have a limited impact on the performance of athletes. More recently, however, Weinberg and Gould (2011) indicated that theories on achievement motivation indicate that athletes engaged in setting

mastery (task) oriented goals are more likely to achieve success at a high level of sport (elite sport) than athletes engaged in setting outcome goals.

According to Martin and Gill (1991), a performance orientation may increase the athlete's self-efficacy which is linked to higher sport confidence and is therefore responsible for better competition performance by athletes who have an outcome orientation in sport. Two competitive orientations exist in sport that may have an impact on an athlete's confidence. One of these orientations, namely outcome orientation, reflects a desire to win or achieve a position higher than competitors. The other, performance orientation, indicates a goal of performing well relative to one's own abilities and standards (Gill & Deeter, 1988; Vealey, 1988).

One of the achievement motivation theories is the competence motivation theory which is especially relevant to children and refers to the fact that the primary determinants of motivation are worthiness and competence. The theory holds that people will strive to feel worthy and competent and that athletes' perceptions of control, self-worth and competence will influence their affective emotional states (such as joy, anxiety, pride and shame), which in turn will either positively or negatively influence their performances (Weinberg & Gould, 2011).

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In South Africa there is considerable work to be done in the area of sport psychology as sport coaches in general lack the knowledge and insight required to identify the performance anxiety that especially young athletes experience when participating in sport (Le Roux, 2010).

3.6 Sociocultural factors

The majority of research into factors influencing optimal sport performance can be divided into two broad categories. The first category relates to variables that have a primary influence on performance such as genetic composition and predisosition, type and amount of training engaged in, and psychological factors. The second category refers to variables that have a secondary influence, indirect, but enduring influence on sport performance, such as sociocultural factors and contextual elements. Secondary variables have an influence on sports performance through the interrelatedness with other variables (Baker & Horton, 2004).

3.6.1 Ideology and cultural identity

Combat sports, at their core, are violent (Kim, Greenwell, Andrew, Lee & Mahoney, 2008). In society in general, and in South Africa, different cultures display patriarchal ideology, celebrating physical aggression and violence. Males in certain instances are expected to display masculine characteristics and engage in physical activities whilst similar behaviour is not condoned for females (Beinart, 1992).

Gender ideology is constructed within the socio-cultural environment and patriarchal ideology is entrenched in social institutions (e.g. school and household), as well as in the labour market and community (Sultana, 2010). Similar to Sultana's (2010) view, Pelak (2010) argued that there are still deeply held beliefs regarding a woman's position in the domestic realm. A woman is expected to be the primary caregiver of the household, family and children. This is especially relevant in South Africa today, as the patriarchy system of the more traditional households is still present. However, together with increasing social and economic empowerment, women are increasingly challenging the entrenched focus of patriarchy (Afisi, 2010).

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In terms of sport, this is especially relevant in the South African society due to the legacy of apartheid. During the apartheid years white male sports received government and economic priority, which resulted in the disproportionate allocation of resources and professionalisation (Burnett, 2004).

It has been reported that wrestling, which requires similar skills to judo, is seen by females (average age of 19.8 years) as more of a form of violent entertainment than a sport (Leng, Kang, Lim, Lit, Suhaimi & Umar, 2012). Gender biases are influential when children or youth are socialised into sport participation. This, according to Leng et al. (2012), encourages men to participate and discourages women to participate in similar sports. A similar trend has been noticed amongst spectators of Mixed Martial Arts (MMA). MMA is a combat sport that combines elements and skills of multiple martial arts and fighting sports such as judo, jiu-jutsu and boxing (Kim et al., 2008). According to a study conducted by Kim et al. (2008), male MMA spectators displayed higher motives for violence, and economic and sport interest for watching MMA than females did.

The sociocultural environment holds a unique challenge for athletes, especially when travelling abroad to countries with foreign methods and habits that are unfamiliar to the athlete. The greatest challenges that athletes experience when travelling abroad for a period of time, are overcoming language barriers, developing social relationships, sharing similar viewpoints and priorities, and accepting cultural differences. These cultural differences refer to factors such as eating habits, dietary requirements and lifestyle habits of foreign athletes (Sato & Burge-Hall, 2008).

The social environment, including venue, food, spectators, foreigners, hype surrounding the event, importance of the event, and ambience during competition played a major role in the successes of American teams at the Atlanta Olympic Games (Gould et al., 1999). Some athletes felt that they performed better due to the fact that they stayed outside the Olympic city and trained in environments similar to their regular training environments, whereas others felt isolated from the Olympic Games. The change in social environment and dealing with other athletes from many different cultures provided endless amounts of distractions, with the more successful teams being able to deal with these distractions more comprehensively and appropriately. The successful teams did not find these distractions as disconcerting as the less successful teams (Gould et al., 1999).

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Similarly, McAndrew (1993) reported that wrestlers participating in their home town tended to win many more bouts than away from home. This was attributed to home crowd support and being familiar with surroundings, procedures and people. Lafon (n.d.) also states that a change of social environment may significantly influence judo performance. The social environment consists of social relations, setting and venue, food, atmosphere, visitors (possibly foreigners) and lifestyle habits of local and foreign individuals. American athletes who performed above expectations at the Olympic Games also noted that they felt the spirit and excitement of the Games and also felt that they had arrived upon entering the Olympic village (Gould et al., 1999). Nevill and Holder (1999) propose that there are two reasons for home advantage in sport, namely that the home crowd is able to lift the performance of the home team, and that the home crowd is able to influence the decisions of referees and judges. The latter was shown to be the more dominant reason for home ground successes.

The reasons for referee decisions favouring the home crowd are due to the salient nature of crowd noise, the need to avoid home crowd displeasure by making decisions in favour of the home team, and the potential use of speculative forming (heuristic) strategies and tactics (Nevill, Balmer & Williams, 2002).

To the contrary, home crowd support does not always provide the obvious advantages that have been mentioned. Home crowds often increase self-focus and overcautiousness, leading to athletes focussing on not losing, rather than finding ways to achieve victory. Home crowds also often disrupt the automatic execution of skills that negatively influence the outcome of sport performance (Wallace, Baumeister & Vohs, 2005). These influences are usually brought about by verbal abuse and excessive noise-making when the visiting team is attempting to execute skills that require high levels of mental focus and concentration.

3.6.2 Significant others

In a sports context there are many interpersonal relationships that can impact on performance. Examples of these relationships include that of the coach and parent, the athlete and athlete, the coach and athlete and the athlete and parent (Jowett & Timson-Katchis, 2005). These interpersonal relationships are influenced by transitions in athletes' lives. A transition occurs when an event or non-event brings about a change in assumptions about oneself and the world, and therefore requires a corresponding change in one's behaviour and relationships (Schlossberg, 1981). Transitions may be brought about by experiencing a change in physical context, such as moving to another city or taking on a new social role. Other major transitions include getting married, or physiological changes associated with puberty (Pearson & Petitpas, 1990), factors which all have an impact on athlete relationships. On the other hand, recent research indicates that the involvement of people in sport is in the first place largely dependent and influenced by social dynamics, mainly gender, social class and ethnicity. These social dynamics impact on the participation and socialisation of athletes as they interact with others and constitute their own social world (Wheeler, 2012).

Role socialisation and role integration of athletes at a young age of participation are formed and directed by parents (or primary caregivers) as they are the social agents or main sponsors for their children (Stevenson, 1990). The propensity to participate in sports is formed during

childhood years and is largely influenced by family culture which creates a set of predispositions that is shaped by the families' context, and is transmitted via socialisation processes within the family context (Birchwood, Roberts & Pollock, 2008). During this teenager period athletes begin to associate with a competitive subculture in their sport, hence there is a process of transition from parent as main social agent to the coach as significant other, and social agent (Burnett, 2010). Following this period, a transition to adolescence leads to major transitions in talented athletes' lives and careers as the coach and peers become the major social agents influencing and facilitating their sporting experience (Raudsepp & Viira, 2000). Harris (1994) explains that, as students are being prepared for work during their final formal years of education, the process of time management in order to cope with increased social and psychological demands and high level training, is required. Students completing school and entering tertiary institutions often experience increased role conflict as there is an increased academic, social and sport demand (MacPhail, Gorely & Kirk, 2003). It is during this time, from age 16 to 23 years, that there is the most notable decrease in sports participation (Roberts & Brodie, 1992). The socialisation process of sports is especially in conflict with the professional socialisation process during this period of life, as athletes in contact sports have a relatively short professional sporting career (Burnett, 2010). Judo is also a contact sport, hence it can be logically concluded that similar challenges exist in judo.

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Different parenting strategies have been identified by Wheeler (2012) that are indicated as major influences on the socialisation of their children into sport. The first was introducing their children to the sport, i.e. parents with children in sport indicated themselves as the catalysts for their children to be involved in sport. The second was that parents allowed their children to sample different sports. Sampling is one of the core ingredients of children going on to become elite sports people (Berry, Abernethy & Côté, 2008), as well as continuation in sport recreationally (MacPhail et al., 2003). Sampling is associated with the development of social networks that bind individuals to sport, and of fundamental motor skills which are linked to self-perception and motivation depending on perceived level of competence (Côté, Horton, MacDonald & Wilkes, 2009). Another strategy parents indicated was the persuasion of their children to gain commitment to their selected sports. This is significant as mere introduction to sport is insufficient in fostering continued committed participation, however, regular voluntary participation is likely to lead to habitual and routine behaviour (Green, 2010; Stevenson, 1990). The fourth strategy was to maintain a level of voluntary participation, and a fifth strategy was ensuring that children were not participating in too

much sport. Cox (2002) supports the notion that participating in too much sport and especially high levels of competition can lead to drop-out and burnout amongst young people.

A combination of acceptance and belonging to a peer group as well as a relationship with a specific friend of the opposite sex appears to increase motivational attitude towards training and participating in competitions (Smith, Ullrich-French, Walker II & Hurley, 2006). Support for a **social view of motivation** in youth sport exists. Participants reported relatively high levels of perceived peer group acceptance and relatively low perceived peer group conflict. They indicated relatively high perceptions of friendship quality, performed with lower levels of competition anxiety and were more successful in general than their counterparts (Smith et al., 2006). Participants endorsed diverse types of **social motivational orientations**, including a social motivational approach as an additional explanation of female adolescents' sport interest and enjoyment (Allen, 2003). Such social motivational behaviours have been confirmed in young judokas participating in elite training programmes. This suggests that peer relationships, relationships with other competitors, and relationships with coaches and other senior/authority figures all play a major psychological role in terms of confidence during performance. Confidence in the coach and feelings of belonging and acceptance in the group may also enhance confidence in performance. These factors influence the performance of these athletes as well as their continuation in the sport (Le Bars, Gernigon & Ninot, 2009).

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3.6.3 Social support

A study conducted by Freeman and Rees (2008) on 123 British golfers assessed the importance of perceived versus received social support (emotional and financial support from family) on the performance of these golfers. Evidence suggests that there are major effects on sport performance when athletes receive social support (family is visibly involved in supporting the athlete on social and financial fronts), as compared to when they merely perceive social support (family is not visibly involved although athletes are told that they will receive support).

According to Lakey (2010), social support can be derived from three major subconstructs, namely:

- Social integration, which reflects the number of different types of relationships that recipients participate in (e.g. the coach, team mates, friends and family members).
- Enacted support, which reflects the specific helping actions as displayed and enacted by team mates, coaches, friends and family members, usually during a specific time frame.
- Perceived support, which refers to an individual's potential access to social support resources and the individual's subjective perception that friends, coaches, family members and team mates would be willing to support whenever required. Although Rees, Freeman, Bell and Bunney (2012) found that research on the impact of enacted support is often unclear, the effect of perceived support received much evidence for positive impact on the performance of athletes. Furthermore, Rees et al. (2012) reported that some athletes tend to perceive certain coaches as being supportive, whilst others do not. This may be due to personality traits such as openness and agreeableness, however it varies from athlete to athlete.

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Another authority role inherent in an unequal power relation that may influence the performance of athletes is that of the team captain. In youth sports it is often the case that athletes are appointed as team captains, however they are merely involved in organisational activities and not actual leadership positions, such as planning of training sessions and team meetings (Gould & Voelker, 2010). It is further reported that many athletes reported that they received no formal training in leadership and captaincy, despite being appointed as a leader (Voelker, Gould & Crawford, 2011; Gould & Voelker, 2010). This has important implications when progressing to high school leadership roles. In situations where decision-making is expected, selecting the correct candidates for high school captaincy roles is vital to team success as high school students are more egocentric and self-focused than adults (Keagan, 1982).

Gould and Voelker (2010) make important suggestions for coaches and team captains to engage in leadership training programmes together. In a study conducted on professional

sport by Day, Sin and Chen (2004) on the changes in performance of team leaders/captains over time in the National Hockey League (NHL) of the USA, results indicated that individuals in team captaincy roles showed consistently higher levels of individual performance when placed in such leadership roles. Teams also displayed collectively better performances when led by team captains. This was mainly attributed to the fact that team captains in the NHL are associated with fame and fortune and team members strive to associate with these values.

3.6.4 Parents/guardians

Higher levels of enjoyment, perceived competence, lower stress levels and high self-determined motivation have all been positively associated with positive perceptions of father-child and mother-child relationships in youth sport (Ullrich-French & Smith, 2006). Father-child relationships have been found to have an important bearing on enjoyment of participation in sport, perceived competence relating to higher self-efficacy and greater belief of the children in their own abilities and skills. It also translated into lower stress levels due to higher self-efficacy and enjoyment and self-determined motivation, relating to greater independence, enjoyment and self-efficacy. Mother-child relationships specifically influence self-determined motivation, which relates to higher self-efficacy, in turn enhancing the child's self-belief and enjoyment of participating with others.

Athletes not only show enhanced levels of motivation and improved performance due to their own evaluation of the importance of situations in sport, but are also largely dependent on the expectations their parents have for their children in training and competition (Collins & Barber, 2005). This is partly due to the fact that parents both provide and interpret sport-related experiences for their children. This research also reported that children of parents who have higher expectations of their sport participation, exhibited greater amounts of self-confidence. However, these same children exhibited greater amounts of cognitive anxiety when presented with competitions where their parents had great expectations related to their performances as compared to those children who do not experience parental pressure.

The athlete-coach-parent/guardian relationship triad has been investigated in order to determine the effect that the relationship between athletes and parents might have on the relationship between coaches and athletes. This study revealed that parents are defined in

their model as a psychologically significant network member and therefore provide a range of information, feedback, opportunities and emotional support. These factors all influenced the relationship between the athlete and coach on three levels, namely closeness, commitment and complementarity (Jowett & Timson-Katchis, 2005). The study concluded that parents often do not completely understand what roles to play in the careers of young athletes (their children). Parents could have a much bigger and much more positive influence should they understand the strong relationship that develops between a coach and athlete. The result of this lack of understanding is usually undue pressure on the athlete to perform, which often negatively impacts on performance.

Evidence presented by Kanters and Casper (2008) indicates that there is a considerable difference between child athletes' perceptions and parents' perceptions of what constitutes supportive behaviour and behaviour that places greater pressure on them to perform. The research by Kanters and Casper (2008) further confirms that a discrepancy between these perceptions of youth athletes and parents causes conflict that often leads to short-term participation in sports, but drop-out in the long term.

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3.6.5 Coach

Leadership is the art and science of influencing others through credibility, capability and commitment (Williams, 2006). The coach is often the authority figure whom a student will have outside of their household and for this reason plays an important role in the development of a student on social and emotional levels as discussed below.

Teaching and motivating are essential aspects of effective coaching, and these characteristics of coaching are holistically referred to as effective communication (Hardy, Burke & Crace, 2005). In order for the coach-athlete relationship to develop positively, communication is of the utmost importance. Factors that affect and determine the coach-athlete relationship and their quality of communication are discussed accordingly.

Effective coach-athlete relationships are seen as encompassing influences and perspectives that emphasise **positive growth** and development both personally and in a sporting role (Jowett & Timson-Katchis, 2005). Jowett and Timson-Katchis (2005) state that these positive

relationships are associated with values such as empathy, understanding, honesty, support, acceptance, friendliness, trustworthiness, respect and postive regard. Successful coach-athlete relationships also stem from effective communication that is clear, honest and direct (Hardy et al., 2005). This relationship in all sports, but particularly individual sports, is further enhanced by coach empathy, consistency and responsiveness to individual differences. In the assessment of gymnasts, Massimo (1973) reported that the most important factors for gymnasts in terms of their coaches were that coaches should use minimal verbiage, have a sense of humour, direct psychological techniques at gymnasts according to their individual needs, have technical competence and embrace the sociological make-up of the team.

The level of **expertise** of the coach as well as the **confidence** of the team in their coach are largely dependent on how the team views the coach's involvement in the sport. There is more confidence invested in the coaches and their knowledge of the sport if they are viewed as professional coaches rather than amateur coaches (Gould et al., 1999). In order to fully understand the athlete-coach relationship, Chelladurai (1999) proposed a multidimensional leadership behaviour model that focuses on training and instruction, social support, positive feedback, democratic behaviour and automatic behaviour. The model proposes that the effectiveness of leadership is influenced by the alignment of situational factors, the leader's qualities, leadership styles and the follower's qualities. The greater the degree of alignment, the greater the degree of effectiveness.

The opposite, which highlights **poor athlete-coach relationships**, is said to emphasise emotion (lack of consistency in the way the coach behaves), remoteness (tendency of the coach to provide less social support and communicate less with athletes), antagonism (characterised by negative feedback) and abuse that can take place on a mental and/or physical level (Jowett & Timson-Katchis, 2005). Findings in literature with regard to coaches are consistent in terms of the fact that young athletes have been shown to have higher levels of performance anxiety, characterised by a high fear of failure due to, in part, negative and punitive feedback from coaches, which contributes to a threatening athletic environment. Conversely, young athletes who perceive their coaches as supportive and positive in their **feedback**, experienced less performance anxiety and performed better in competitions (Smith, Smoll & Barnett, 1995). Smoll and Barnett (1995) based their coaching model on positive control and positive reinforcement, and found these values to be vital in promoting enjoyment

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and participation in sport with young athletes. Positive reinforcement is linked closely to encouragement, and also has a significant positive impact on youth sport participation, enjoyment and internal motivation.

Research by Amorose and Horn (2000) on 386 male and female Division I athletes in America revealed that both male and female athletes' levels of **intrinsic motivation (IM)** were related to the perceived behaviour of their coaches. Athletes with higher intrinsic motivation perceived their coach(es) as exhibiting a leadership style that emphasised training and instruction, and which was more inclined to democratic behaviour than autocratic behaviour. They experienced feedback from coaches as high in positive and informative, and low in negative, punishment-related and ignoring behaviour.

3.6.5.1 Factors influencing coach-athlete relationships in individual sports

Several important factors that influence the relationship between the coaches and their athletes in individual sports have been identified by Antonini Philippe and Seiler (2006). These are i) closeness, also known as social relationship; ii) communication and setting of goals/objectives/targets (co-orientation); iii) acceptance and respect of roles (complementarity). This research also revealed that athletes involved with individual sports often find a healthy relationship with the coach as vital for performance at elite level sport events. Hungarian Olympic coaches revealed that their most successful individuals sports, namely kayaking, swimming and wrestling emphasised coach-athlete relationships based more on the needs of each individual athlete than on the sport in general (Trzaskoma-Bicserdy, Bognar, Revesz & Geczi, 2007). A similar trend is relevant in judo as one judoka may require more feedback from the coach in terms of his/her performance than another. Coaches perceive that if they act confidently, their athletes model the same character (Weinberg & Gould, 2003). Baker and Horton (2004) confirmed in their findings that the quality and expertise of the coach as well as the quality of the instructional methods and communication style of the coach have a major effect on the level of performance of athletes.

Another important determinant of the success of elite athletes is their level of **conformity** (Vuckovic, Gadzic, Sekulic & Kukric, 2012). Conformity is defined as an individual's adjustment to attitudes, opinions and behaviour in relation to the standards of a certain group

(Vuckovic et al., 2012). In comparing the conformity of male and female elite athletes to club management and their coaches respectively, Vuckovic et al. (2012) reported that successful male and female athletes indicated a higher degree of conformity towards coaches than towards management. It is believed that coaches with a high level of expertise and knowledge deserve their athletes' conformity. Novice athletes displayed higher conformity towards club management and this was attributed to their lack of knowledge of role embarkation within the club structures. Important to note in the case of judo is that Vuckovic et al. (2012) reported that athletes in individual sports reported less conformity to coaches than athletes involved in team sports.

It has also been indicated that Olympic teams that perceived their coaches as displaying a higher level of **knowledge** of the environment, the sport and the expectations and demands that the teams were going to experience, received a higher level of acknowledgement from athletes. Their teams performed better and they had more rewarding experiences at the Games than those teams that perceived their coaches to be inexperienced and lacking knowledge of the demands of the Games. The teams that performed at a higher level perceived their Olympic experiences to be of higher value than those that lacked confidence in their coaches. The less experienced coaches did not deliver on all the planned training sessions that should have taken place during the tournament (Gould et al., 1999). Similarly, Gould at al. (1999) reported that coaches with a lack of relevant knowledge also lacked credibility and accordingly athletes displayed diminished levels of commitment and adherence to their training programmes.

Coaches with a higher level of **experience** (previous coaching at similar events) are relatively better prepared and this preparedness instills greater confidence in their teams. They create better training and competitive environments for their athletes at Olympic Games (Gould et al., 1999).

The **attitude** of coaches towards competitions and the behaviour that coaches exhibit towards their athletes have major implications regarding the psychological impact on athletes in training and competition scenarios. The coach has the ability with proper behaviour and a sound psychological approach to reduce performance anxiety in athletes considerably (Baker, Cote & Hawes, 2000).

Social identity theory is one of the most widely considered and accepted theories for group behaviour amongst individuals (Yuki, 2003). This theory suggests that individuals lose their sense of self within a group and effectively become members of a shared social category. This phenomenon is known as depersonalisation of self-representation. Belonging to a group and having your identity defined by your membership to that group may influence your interaction with athletes from other countries (and other perceived outsiders) as well as influencing behaviour at international tournaments. This may have an effect on sport performance, although it is unclear whether it is negative or positive.

Gould et al. (1999) reported that Olympic teams were more satisfied and performed more successfully when they had coaches from the same **culture**. These athletes found it relatively easier to relate to these coaches and they could communicate more effectively regarding personal issues.

Similarly research by Jowett and Frost (2007) has reported that black football players with white coaches would have related relatively easier to black coaches and that their level of emotional connection was more superficial than it would have been with someone of the same ethnicity and culture. South Africa is unique in that it comprises of diverse populations with cultural and ethnic divisions along racial and socio-economic lines. This presents South Africa with great challenges in terms of culture and ethnicity (Mattes, 2002).

Relatively little research is available that determines the effect of coaches from different ethnic and racial backgrounds on athletes that are of different cultures/ethnicities. This is important to understand as it will have implications regarding the way in which coaches and athletes interact with each other. Coaches will have to find appropriate methods of motivating athletes, whilst athletes and coaches will have to find common grounds in order to collaborate. Coaches, being in positions of leadership, will need to find ways of controlling their athletes as athletes from different cultures and ethnicities will inevitably require differential approaches from their coaches.

With regard to judo in South Africa and in the world, it has been classified as a non-racial, non-religious organisation that promotes the inclusion of all individuals and all nations (International Judo Federation, 2011). Judo therefore has a policy of inclusion, but this does

not imply that there are no racial, cultural and ethnic challenges within the organisation. In Judo South Africa, as with most other sports, coaches and athletes from different backgrounds are expected to collaborate and have a positive relationship. No documented research could be found for Judo South Africa's particular situation.

3.6.6 Peers, team members and outsiders

The importance of cohesion is well documented for all different types of groups that exist (Ohlert, 2012). It has been suggested as the core psychological factor for small groups, especially sports groups (Carron, Hausenblas & Eys, 2005). Team cohesion in sport can be defined as "a dynamic process that is reflected in the tendency for a group to stick together and remain united in the pursuit of its instrumental objectives and/or for the satisfaction of member affective needs" (Carron, Brawley & Widmeyer, 1998: 213). This definition of team cohesion implies that there are multidimensional aspects related to team performance that are described as task cohesion, the general orientation of athletes towards achieving the goals, and the objectives of the group/team that they form part (Jenkins & Alderman, 2011; Weinberg & Gould, 2011). It also refers to social cohesion which is an athlete's individual orientation toward developing and maintaining social relationships within the group/team (Jenkins & Alderman, 2011).

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Paiement and Bischoff (2007) conducted a study on tennis players and lacrosse teams in order to assess the importance of player integration and team cohesion on the performance of teams and individuals within the teams. The researchers explain their selection of these two sports as one being highly interdependent (lacrosse), and the other being a co-acting sport (tennis). The results of this study indicate that success and cohesion are highly correlated and that no significant effect exists in gender differences. The results further indicate that, whilst the performance of an athlete may not be directly influenced by the performance of team mates in co-acting sports, cohesion within the group may have a direct effect on performance. These findings are significant for judo as it is an individual sport that also has a team competition format, however, athletes are not dependent upon team mates for their individual performances in either formats.

Arroyo (1997) conducted a study on 112 collegiate wrestlers in order to assess the value of cohesion in a co-acting sport such as college wrestling. Cohesion was assessed in terms of its correlation with absolute success, relative success and satisfaction/enjoyment using the Group Environment Questionnaire (GEQ). Arroyo (1997) administered the GEQ to 12 teams at the beginning of the season, middle of the season and at the last regular season competition. Data indicated that a positive correlation exists between cohesion and satisfaction/enjoyment, and that there may be a positive correlation between performance and cohesion.

Youth soccer players were found to have more positive motivational outcomes when experiencing social relationships positively (Ullrich-French & Smith, 2006). These soccer players displayed higher levels of enjoyment and perceived competence as well as higher levels of self-determined motivation and lower levels of stress when experiencing high peer acceptance and friendship quality. Whilst soccer differs from judo in that it is a team sport, similarities can be drawn on a number of levels. Judokas train in groups/teams, which requires coherence between team members in the sense of following coach orders and training together; there are also similarities in gaining peer acceptance when travelling within a province as a club team, within the country as a provincial team and when travelling abroad as a national team.

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Amorose and Horn (2000) reported that athletes with a higher (perceived) level of belonging and purpose displayed higher levels of intrinsic motivation and performed more successfully. This was evident in the fact that athletes with scholarships for their sport had higher levels of intrinsic motivation than athletes who did not receive scholarships.

3.6.7 Gender

Sport has greatly contributed to a change in perspective on male and female equality in sport and in profession (Messner, 2011). Messner (2011) argues that there is a process of gender ideology formation/construction that has contributed to the participation of females in a traditionally male sport environment.

He proposed four distinct stages:

i) Hard essentialism which sees women and men from a categorical and essentialist view that formed the basis of a hegemonic gender ideology. This post World War II gender ideology was based on a white, heterosexual family and was partly constructed and naturalised within the sport domain.

ii) Binary Constructionism emerged in the 1970s from feminism and challenged the traditional beliefs of gender hierarchy and gender difference. This view stimulated counter-hegemonic discourse and focused on organising events around the category of women.

iii) Multiple Constructionism has its roots in the socialist feminist movement of the 1970s and the 1980s feminist movement of coloured women's critique of the traditional white, middle-class feminist Binary Constructionism. This view has developed from the 1990s to the present and promotes a radical anti-categorical and anti-essentialist view that includes homosexual interaction and attempts to promote a de-gendering theory.

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iv) Soft Essentialism is a gender ideology that is specifically proposed by Messner (2011), which claims that the female liberalisation movement has been valorised by the fact that individual choice in sport activities exist for females, but that the male view of participation has remained relatively neutral and that the same freedom of choice has not emerged in the male sporting environment.

In a study conducted by Clément-Guillotin and Fontayne (2011) on 64 French undergraduate students who evaluated themselves on the Bem Sex Role inventory in a competitive sport context, the researchers proposed that the competitive sport context would enhance responses on masculine items. The results of this study confirmed these expectations and indicated that, when confronted with a competitive sport context, responses are embedded and well anchored in gender schema.

Many sports exist that promote full-contact interaction and promote aggressive strategies to display superiorty over an opponent (Coakley, 2009). The violent behaviour in these sports are carefully governed and controlled by rules and regulations, but are seen as necessary to achieve victory. Coakley (2009) further states that, in society, this type of controlled violence in the so-called explosive and power sports reinforces expected male behaviour and therefore contributes to a male gender ideology that emphasises the importance of masculinity and physical prowess. In society and across cultures, however, no such gender ideology exists for females and aggressive and physically dominant behaviour is not realted to greater athletic abilility. There is, however, a gradual increase in female participants in these types of sports. Judo is a sport that promotes a combination of skill and controlled aggression in order to achieve victory.

An analysis of gender relations by Guérandel and Mennesson (2007) amongst high-level judokas using an interactionist paradigm, takes into account both the judokas' history and their context. Interactions between men and women during training sessions were observed and interviews conducted with the judokas. Results indicate that differentiated behaviours exist that are determined by gender both during the judo session and during the fight when the principle of pride is paramount. Behaviours constitute an out-of-frame communication that reinforces a gender hierarchy. This gender hierarchy is in accordance with the stereotypical view of sport as a masculine activity (Guérandel & Mennesson, 2007). However, prior to training, after training and during breaks in training sessions, male and female judokas dressed and interacted according to the gender stereotype. For example, males attempted to court females, whilst females were dressed in a feminine way when they arrived at judo. Moreover, the co-educational fight situation conflicts with the framework of engendered experience. This indicates that the competitors attempt to position themselves as men or women, whilst simultaneously being recognised as judokas. An analyses of co-educational fights revealed that the majority of judokas interpreted the situation through the gender framing experience.

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3.7 Selected physical aspects

3.7.1 Recovery

Athletic performance depends largely on the amount and quality of sleep that the athlete experiences during training and prior to competitive events. The biological rhythm involved in sleep is the sleep-wakefulness circadian cycle which helps the body clock to match with daylight and darkness, and therefore with sleep and wakefulness during the day and night respectively (Davenne, 2009).

According to Davenne (2009), athletic performances have rhythmic variations (biorhythms) that are driven by the body clock, which indicates that athletic performances are heavily dependent upon the level of vigilance (alertness and ability to perform mental tasks) that athletes experience. According to the available research and evidence, athletes will experience a decrease in reaction time and sustained attention both during the night and the early morning, making this a consideration when having to train and compete at different hours of the day.

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Research by Davenne (2009) on sleep and the sleep cycles indicates that there are a number of potentially vital sleep cycles that athletes experience which directly implies that athletic performance will suffer should athletes not experience enough sleep and high quality sleep. One of the sleep cycles that is associated with the release of growth hormone, is slow wave sleep. Growth hormone is associated with protein synthesis, muscle growth and repair and is essential for recovery following strenuous exercise. Growth hormone is produced and released by the pituitary gland.

Evidence relating to growth hormone has shown that increased activity levels during the day lead to a higher level of growth hormone in the blood during the following night. However, sleep deprivation leads to an opposite effect, resulting in a far lower concentration of growth hormone in the blood (Kato, Murakami, Sohmiya & Nishiki, 2002; Kanaley, Weltman, Veldhuis, Rogol, Hartman & Weltman, 1997).

Rapid eye movement sleep is another phase of sleep and it has been proposed that the mental process occurring at this time is memory consolidation. Stickgold and Walker (2007) reported that there are a number of studies suggesting evidence exists indicating that a loss of rapid eye movement sleep (REM) may lead to a negative effect on procedural memory and motor skills.

A study done by Dement (2005) to assess the effect of sleep time on athletic performance reported that athletes were asked to sleep as much as possible prior to participation. These athletes produced far better performances, displayed significantly better mood states and lower fatigue levels than their counterparts that experienced a night of sleep of habitual length. This suggests that sleep quantity and quality may be one of the most important factors in producing high level competition performance in athletes. Dement (2005) also reported that it was evident that most individuals are sleep deprived in one form or another, but that it is currently unknown how many extra hours of sleep one requires to eradicate this sleep debt.

Sleep is widely regarded as one of the main necessities of athletes for proper recovery from training. However, very little clarity exists as to the exact amount and type of sleep are required and what the effect of the different phases of sleep is on the body during this recovery period (Leeder, Glaister, Pizzoferro, Dawson & Pedlar, 2012).

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Only moderate sleep deprivation over four hours at the end of a night reduces high-power performance output of athletes considerably (Souissi, Souissi, Souissi, Chamari, Tabka, Doqui & Davenne, 2008). In contrast to the negative effects of a lack of adequate amounts of night sleep, athletes have experienced an increase of up to 20 per cent in motor speed without a loss of accuracy when sleeping adequately. A similar wake time provides no significant benefit (Walker, Brakefield, Morgan, Hobson & Stickgold, 2002). Motor speed is one of the vital aspects of improved performance of elite 17 year old judokas (Krstulovic, Zuvela & Katic, 2006).

A study conducted on 10 elite male sprinters found that sleep deprivation of 30 hours resulted in a decrease in the overall muscle glycogen levels of the athletes (Skein, Duffield, Edge, Short & Mundel, 2011). The decrease in muscle glycogen resulted in a loss of energy and subsequently a decrease in performance of an intermittent sprint exercise compared to when

the athletes experienced adequate amounts of sleep. Anaerobic power output has also been assessed when athletes were deprived of sleep at the beginning of the night as well as at the end of the night. In this study by Souissi et al. (2008), it was reported that athletes deprived of sleep at the beginning of the night showed no signs of a decrease in anaerobic performance. However, when athletes were sleep deprived by four hours at the end of the night, they showed a significant impairment in the performance of anaerobic power output.

Elite athletes tend to experience lower sleep quality than their age and gender non-athlete counterparts, yet these athletes still remain within the acceptable range of sleep quality (Leeder et al., 2012). This is potentially due to higher expectations on their performance resulting in higher levels of cognitive anxiety. Travelling across time zones that results in jet lag may signficantly influence sleep quality and quantity.

A study conducted by Erlacher, Ehrlenspiel, Adegbesan and El-Din (2011) on elite German athletes' sleeping patterns preceeding competitive events, revealed that athletes from both team and individual sports are likely to experience sleeping difficulties the night prior to the event (65 per cent of athletes). Although most athletes did not report any difficulties in participation or in their performance the following day, some of the athletes experienced increased daytime sleepiness and a bad mood on the day of the event following a sleep-deprived night. Among these athletes, it was found that the negative effects were much more prevalent amongst those competing in individual sports.

Psychologically, sleep deprivation has been indicated to contribute to higher levels of confusion, fatigue, vigor, and total mood disturbance as found in a study by Blumert, Crum, Ernsting, Volek, Hollander, Haff and Haff (2007) on male elite weightlifters at college level. A combination between sleep deprivation and exercise have been indicated as performance inhibitors in complex decision-making (Lucas, Anson, Palmer, Hellemans & Cotter, 2009).

3.7.2 Nutrition

Sports performance is not only based purely upon talent and training, but on the amount, type and balance of the athlete's diet (Hata, 2008). According to Hata (2008), athletes require thorough knowledge and understanding of the type of food and fluids that they need to take in

during training and competition, as well as the amounts required in order to perform optimally. An athlete capable of combining his/her talent with the most effective physical, psychological and nutritional programme will be more likely to achieve success.

It is vital that athletes engage in healthy nutritional habits both prior to and during competition situations (Radovanović & Todorov, 2010). Hata (2008) explains that lack of proper nutrition can lead to a sudden loss of energy and dehydration that could result in poor performance. In a study conducted by Radovanović and Todorov (2010), judokas who were required to make their respective weight categories in order to compete, participated in a nutritionally well balanced and controlled diet for an extended period of time, maintaining hydration levels and energy levels. The aim of this study was to avoid the often used rapid weight loss strategies that judokas follow that include dehydration and malnutrition which may inhibit performance. Findings indicate that a combination of a well balanced nutritional plan with goals of training may enhance the performance of judokas.

One of six sport types identified by Sundgot-Borgen (1993) as high-risk sports for the development of eating disorders, are sports where weight gain is necessary in order to derive maximum benefit from participation, such as judo and wrestling. This is often refered to as 'yo-yo dieting' by judokas, refering to the fact that they rapidly lose weight for tournaments and shortly afterwards regain the weight. Judo holds particular challenges and health-injury dangers to participants in that judokas often follow extremely aggressive and rapid weight-loss strategies. It is vital that athletes and coaches have the relevant knowledge in order to design appropriate weight-loss strategies for judo (Artioli et al., 2010). The weight-loss practises of judokas include skipping important meals, exercising in sweat kits which results in fluid loss and often dehydration, fluid restriction, going without food and fluid for a period of more than 24 hours, use of laxatives, use of diuretics, self-induced vomiting and the use of diet pills (Coles, 2001).

A study conducted by Filaire, Maso, Degoutte, Jouanel and Lac (2001) on elite judokas for a period of seven days which assessed their performance on a 30-second jumping test as well as a left arm strength test found significantly decreased levels of performance amongst judokas that were attempting to maintain or lose weight. They reported that these judokas restricted their carbohydrate and micronutrient intake in their diets, which resulted in negative

psychological reactions such as an increase in tension, anger, fatigue and confusion, as well as a decrease in vigour.

Another study by Degoutte, Jouanel, Beque, Colombier, Lac, Pequiqnot and Filaire (2006) that assessed 21 male elite judokas reported that judokas were inclined to consume a low carbohydrate diet whether attempting to lose weight or attempting to maintain their weight during the seven days prior to a judo tournament. This research reported that judokas attempting to lose weight showed signs of increased fatigue, increased tension and a significant decrease in vigour. The dietary restriction of the judokas attempting to lose weight directly related to poor performance at the tournament.

Importantly, research by Artioli et al. (2010) indicated that judokas who made their weight category successfully by losing up to five per cent of their body weight experienced no impairment in their performance following a four-hour recovery period during which they were able to replenish their bodies with both fluids and food.

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Zaggelidis, Kanioglou, Mavrovouniotis and Galazoulas (2008) assessed the use of supplements in judo and the effectiveness thereof. Supplements include non-pharmaceutical products such as herbal preparations and nutritional products. Other supplements fall into the categories of dietary supplements and nutritional ergogenic aids. Dietary supplements are mainly vitamins, minerals, amino acids, herbs, botanicals and metabolites and are added to the diet. Nutritional supplements are essential to meet the dietary needs of high performance athletes and ergogenic aids are products within this category aimed at enhancing exercise performance and assisting with training adaptations (Lentholtz & Kreder, 2001; Williams, 1999). The results reported by Zaggelidis et al. (2008) indicate that elite judokas do not pay particular attention to their diets and that there is a significant lack of knowledge regarding required nutritional intake before and during competition. Results indicate that most elite judokas engage in the use of ergogenic aids pre-competition, but that there is a lack of scientific approach towards the use of such supplements. Most elite judokas indicated that they consume creatine monohydrate. Creatine monohydrate is the most effective clinical form of creatine for use in nutritional supplements in terms of the uptake of metabolically active creatine in the muscle and therefore the ability to increase high intensity exercise capacity (Volek, Kraemer, Bush, Boetes, Incledon, Clark & Lynch, 1997).

3.8 Summary

The available literature on the internal sport environment identified the psychological factor of mental readiness as one of the major factors influencing sport performance. An athlete's level of mental readiness is dependent in part on his/her mental toughness. Mental toughness is related to a number of variables, such as arousal and anxiety, concentration, confidence and motivation. One construct of concentration, namely self-efficacy, is particularly related to the performance of an elite judoka.

Besides psychological factors that have a direct influence on the performance of athletes, socio-cultural factors are identified that impact on performance in an indirect, but enduring impact on the performance of athletes. These socio-cultural factors include ideology and cultural identity, significant others such as the coach, peers, team members, parents/guardians, gender, and social support. In particular, the parent-athlete-coach triad is identified as a major factor influencing the performance of athletes in individual sports, such as judo.

Further to psychological and socio-cultural factors relating to sport performance and the external environment, physical factors that were identified through their interrelatedness with environmental factors that influence sport performance as a whole, are discussed. Selected physical factors are nutrition and sleep. Literature indicates that relationships exist between sleep and a number of factors such as arousal and visibility, and between temperature and nutrition.

The performance of an elite judoka is clearly dependent on many factors at various levels (psychological, social and physical). In order for a judoka to perform optimally, these factors must be combined in a holistic, integrated programme that exposes judokas to an optimal level of training and performance. The following chapter describes the research methodology.

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CHAPTER 4

RESEARCH METHODOLOGY

4.1 Introduction

According to Cresswell and Plano-Clark (2007), a mixed methods research design makes use of both qualitative and quantitative data in order to explore a phenomenon in depth and assess its prevalence. For this research different data sets were gathered, namely quantitative data from judokas through the use of three questionnaires that included the Sports Competition Anxiety Test, the Sports Mental Toughness Questionnaire, and a self-designed questionnaire on the impact of environmental factors and selected physical aspects on the performance of elite South African judokas competing in the under 17 age category. The questionnaires aimed to determine the profile and effect of psychosocial and environmental factors on performance. Two physical factors, namely the lack of sleep and nutrition were also included for their detrimental effect on the psychological well-being of judoka as indicated by the literature study. The research design of this study is embedded within the salutogenic framework developed by Antonovsky (1991). The salutogenic framework proposes that people more capable of adjusting to internal stressors such as psychosocial factors and external stressors such as environmental factors should be able to perform at high levels and maintain good health.

Qualitative data was gathered by way of a focus group and interviews with a sample of under 17 elite judokas (n=8) and judo coaches (n=8) respectively. The qualitative data provides a contextual explanation and ensures validation through triangulation of mixed methods and different types of research participants (Hussein, 2009). The multi-method approach thus allows for empirical verification of data as it is triangulated and explained through contextual and lived-reality experiences obtained through narrative reporting (Hammond, 2005). The data gathered substantiate the experiences of judokas with regard to the most important environmental factors that influence their performance, as well as the perceived degree of such influence. Data gathered from the interviews with coaches was transcribed in order to

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establish what environmental and psychosocial factors judo coaches perceive to be the most influential on their judokas' performance.

To ensure gender representivity and avoid biases, proportional representations of male and female judokas were selected through purposive sampling. This was attained by selecting judokas as respondents (from the entire population) by way of their participation in the 2012 South African Open Judo Championship in the Group 4 (under 17) age category. Gender representivity was ensured by approaching and encouraging participation in the research of most male and female judokas in the target group.

4.2 Research design and methodology

Cresswell and Plano Clark (2007: 5) describe mixed methods research as "a research design with philosophical assumptions as well as methods of inquiry." Philosophical assumptions of mixed method research guide the direction of data collection and analysis that in turn determines the mixture of quantitative and qualitative data, whether it be a single study or a series of studies. The main premise of mixed method research is that the integration of both data sets (quantitative and qualitative) provides more accurate and holistic data than a single approach using either one or the other. According to Fielding (2012), the mixed methods approach emphasises the importance of triangulation to validate the research data and reveal competing or alternative perspectives, complex and dynamic categories and development of analytic density.

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4.3 Population

The total population of registered Group 4 (under 17) judokas in South Africa is 298, whereas the number of judokas who participated at the 2012 South African Open Judo Championships and were the target group of this study, was 139. The participants who compete at the South African Open do so based on a qualification system that allows a maximum of three participants per age and weight category per province. There are eight female weight divisions and nine male weight divisions in the Group 4 age category. These are elite judokas based on their performance criteria (they qualified for the SA Open Judo Championships by

finishing in the top three positions at their provincial trials, and many of them appeared on the national ranking list of Judo South Africa), providing for a highly elite population.

Judokas who participated at Judo South Africa's National Ranking Events (NREs) and the South African Open Judo Championships receive points for their participation; 20 points for first position, 15 points for second and 10 points for third position. Elite judokas are identified by their placement in the top three of each weight and age categories on Judo South Africa's national ranking list. Prior to the 2012 SA Open Judo Championships, there were 28 girls and 36 boys ranked in the top three positions in the Group 4 age category in their respective weight divisions (n=64). The relatively high number of elite judokas was due to a number of players being tied on points creating a situation where the top three positions were not necessarily limited to only three judokas. The total number of judo coaches who registered for the 2012 South African Open Judo Championships was 33.

4.4 Sample

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The criteria for selecting research participants related to the highest level of performance at national level judo tournaments. Most under 17 (Group 4) judokas who competed at the South African Open Judo Championships from the 24th to the 30th of June 2012 in Welkom (in the Free State) were recruited to participate in the research. The total number of judokas in the target group who took part in the tournament consisted of 98 boys and 41 girls (n=139). The total number of judokas who participated in the study was 65 (47%). Eight judokas took part in a focus group. These judokas were selected on the basis that they were gold medal winners at the SA Open Judo Championships.

The criteria for the selection of judo coaches for interviews related to their experience of coaching under 17 judokas at all levels, namely club, provincial, regional, national and international. Eight judo coaches were identified who met the criteria for participation in this study.

4.5 Researcher

The researcher in this study is an insider with extensive knowledge and expertise of judo. He is one of Judo South Africa's national coaches and has been actively involved in the sport for the past 22 years. Besides having insider knowledge as coach, the researcher also has insider knowledge and insight from many years of national and international participation as a competitor.

Due to the fact that a number of the respondents were aware of the status of the researcher, there was an immediate trust based on shared experiences. The researcher was careful not to influence their responses and allowed participants to respond in their own time. The researcher was available for requests during the time that respondents were completing the questionnaires, however he attempted at all times to allow respondents to interpret the questions independently.

The benefit of being an insider is that the researcher is familiar with the culture and social world of being a judoka as well as that of a judo coach. Insiders also enjoy enhanced rapport with research participants, and interaction between the insider researcher and the research participant creates a forum through which both parties can develop a meaning of the situation (Eide & Kahn, 2008; Hockey, 1993).

Prior to the collection of data, a number of procedures had to be followed in order to ensure that protocol within judo was observed and adhered to. In order to ensure this, the researcher contacted the president of Judo South Africa, Mr Tembani Hlasho, via e-mail. The electronic letter included the topic of research and explained the purpose, aims and objectives, procedures and target group of the study. The president was asked for approval of the study as well as approval for data collection during the South African Open Judo Championships of 2012. Approval was received in writing and the research could continue.

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4.6. Procedures

In order to conduct this explorative study, a number of procedures were followed that are described accordingly.

4.6.1 Pilot study

A pilot study was conducted at the 2011 South African Open Judo Championships in Cape Town to simulate the circumstances and procedures of actual research. The pilot study consisted of a focus group with seven judokas who all participated at the national tournament. Six of these judokas were in their final year of the under 17 (group 4) age category, and one was in the u/20 (group 5) age category. Interviews were conducted with seven judo instructors. All these coaches had experience of coaching teams in the target group at club, provincial, national and international level. Coaches and judokas who participated in the pilot study were fluent in English. One of the advantages of the pilot study was that it was conducted in a similar environment to that of the actualy research.

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Through the pilot study, evidence emerged that warranted more in-depth literature study into certain topics such as the effect of temperature on the performance of judokas. All judokas and coaches indicated that they regarded temperature as the most predominant potential environmental performance inhibitor at judo events, and especially major tournaments. The South African Open is hosted during the winter in South Africa, however tournaments take place from January to December, therefore including all seasons. Altitude was also identified as a major environmental topic for research as most coaches mentioned altitude as a performance inhibitor for judokas that train at coastal (low) altitude and compete at high altitude. Training at high altitude was identified as a potential performance enhancer for judokas training at high altitude and competing at low altitude.

4.6.2 Data collection

Most judokas who fitted the criteria of the target group for this study were recruited at the 2012 South African Open Judo Championships to participate in the study. The aims and

objectives of the study were clearly communicated and the purpose of the research explained. Judokas were informed that their participation was entirely voluntary and that the information they provided would be treated as private and confidential. They were ensured that their identity would be protected throughout the research process as well as in the results of the study. Participants were requested to complete and sign an informed consent form prior to their participation in the study, ensuring their voluntary participation and anonymity. It was also requested that a parent or legal guardian sign a child (minor) assent form, thus permitting the child to participate in the research.

Upon completion and receipt of the child assent form as well as the consent form, the questionnaires were disseminated to those who agreed to participate in the study. Participants completed the questionnaires in approximately 20 minutes and returned the completed questionnaires prior to leaving the tournament venue. Questionnaires were available in English and to ensure that there was no language barrier present, a team manager was present to assist in the explanation of the questionnaire to the judokas in their home language. Five judokas left the venue directly after their competition and therefore delivered their questionnaires via e-mail, post or at a following tournament to the researcher.

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4.7 Methods

4.7.1 Focus group

A focus group is a semi-structured group interview that deals with a topic familiar to the members of the group (Whitley, 2002). It is important with focus groups to select respondents who are as homogenous as possible (Luntz, 1994). According to Luntz (1994), it has been consistently proven that people will reveal their innermost thoughts when they believe that those present share a common bond with them. Characteristics that exist with focus group respondents and are important in gaining meaningful insight are break characteristics and control characteristics. Break characteristics are characteristics that "differentiate groups from each other" and control characteristics are characteristics "that are common to all groups" (Knodel, 1993: 39).

In terms of this study, the judokas who took part in the focus group were selected by way of their performance at the 2012 South African Open Judo Championships. All eight judokas were gold medal winners at the tournament in the target age group (group 4). The majority of judokas were from Gauteng, and two judokas were from the Eastern Cape. This provided the opportunity to gain insight from judokas from the coast and from the inland. Respondents were made up by both males (n=5) and females (n=3) and a variety of ethnicities (African (n=1); White (n=4); Coloured (n=3)). All judokas who participated in the focus group were fluent in English, although to some English was their second language. Therefore, the researcher was careful to define terminology in the event of judokas being uncertain of the meaning thereof.

The focus group with judokas was conducted on the 5th of July 2012. This was the day after the individual tournament when judokas participated in their provincial teams against other provinces. Due to the fact that time with judo coaches was limited, the interviews were conducted on the first day of the individual competition (3 July 2012), during refreshment breaks on the day of the tournament.

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4.7.2 Qualitative data analysis

Major topics of discussion recorded during the focus group and interviews focussed on the effect of environmental factors on the performance of judokas, psychosocial factors that affected their performance, and the effect of physical factors such as sleep and nutrition on judokas' performance. Questions related to the literature study on environmental, psychosocial and physical factors that influence sport performance, were structured in the same order as in the literature study.

4.7.2.1 Coding of focus group and interviews

Based on the guidelines of Gorden (1992), the coding procedure was commenced by defining the coding categories. In the case of this focus group, coding categories included three main themes, namely environmental factors, psychosocial factors and physical factors. Following assigning of categories, each category was assigned with a unique symbol. The researcher then proceeded to classify all relevant information. All relevant information that could be

included under the different categories was identified and underlined. In order to classify this information into different categories, category codes were assigned to the information and in the case that more than one response were similar, these responses were grouped together. This was done in order to ensure that the researcher could determine how frequently certain responses occurred.

4.7.3 Ensuring trustworthiness of qualitative data

Shenton (2004) described four criteria to assess the trustworthiness of qualitative reasearch. The first is the establishment of crebility. Credibility consists of a number of constructs. In the present study, credibility was ensured by the triangulation of methods with the use of quantitative and qualitative research, a development of familiarity with the culture of the participation sample, particularly due to the fact that the researcher had insider knowledge of judo, and the adoption of well established research methods. The second criteria is transferability. Transferability of data was ensured by conducting the interviews and focus group in a judo competition environment. The pilot study was also conducted in a similar environment to the actual research. Dependability is the third criteria and can be achieved through the use of overlapping methods such as a focus group and individual interviews, as was the case in the present study. The final criteria is conformability and refers to the the level of objectivity maintained in reporting the data. In the present study all care was taken to ensure that the exact responses of judokas and coaches were recorded and reported.

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4.8 Quantitative data analysis

A number of methods that were used to analyse data qualitatively by way of the statistical programme for the social sciences (SPSS) at STATCON (Statistical Consultation Services of the University of Johannesburg) are presented next:

In order to determine possible continuous and categorical predictors, the Pearson product-moment correlation was used. The Pearson product-moment correlation describes the strength and direction of the relationship between two variables (Pallant, 2010). Correlation coefficients “provide a numerical summary of the direction and the strength of the linear relationship between two variables (Pallant, 2010: 123).

Whilst parametric techniques such as correlation coefficients make assumptions based on normally distributed scores and the nature of the data such as interval level scaling, non-parametric techniques such as the Spearman's rank correlation coefficient (Spearman's rho) have less stringent assumptions that are more suitable for smaller samples, such as in the current study (n=63) (Pallant, 2010). However, parametric techniques are also used as they are more appropriate for psychological research (Anderson, 1961).

In order to assess the reliability of the self-designed questionnaire used in this study, Cronbach's alpha coefficient was used. Cronbach's alpha coefficient is the most commonly used statistic to assess internal consistency by providing an indication of the average correlation amongst all items that make up a scale (Pallant, 2010).

Logistic regression is used for categorical dependent variables and indicates the predictive power of a set of variables as well as indicating the relative contribution of each individual variable (Pallant, 2010; Cortina, 1993).

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4.9 Measuring Instruments

4.9.1 Sport Competition Anxiety Questionnaire (SCAT)

The SCAT is a questionnaire originally developed by Martens (1977) and has excellent reliability and validity as a sport-specific measure of competitive anxiety (Gill & Deeter, 1988). The SCAT has been further developed and research has shown that by analysing responses to a series of statements about how athletes feel in a competitive situation, it is possible to assess their level of anxiety. This is a 15-item questionnaire that evokes responses on a three-point Likert scale, with 1 (hardly ever), 2 (sometimes) and 3 (often). Ten questions are included in the calculation of the anxiety score that could range from 10 to 30. A norm scale developed by Martens (1977) indicates that a score between 10 and 15 would indicate a low level of anxiety, 16 – 22 a moderate level of anxiety, and a score above 22 would indicate a high level of anxiety during competition. An ideal level of anxiety for competition would range between 16 and 22.

4.9.1.1 Reliability and psychometric properties of the SCAT

The 10 items of the SCAT were subjected to principal component analysis (PCA) using SPSS. Prior to performing the PCA, the suitability of data for factor analysis was assessed. Inspection of the correlation matrix revealed the presence of numerous coefficients of .3 and above. The Kaiser-Mayer-Olkin value was .67, exceeding the recommended value of .6 (Kaiser, 1970, 1974), but Bartlett's Test of Sphericity did not reach statistical significance with p=.12 (Bartlett, 1954). Therefore results of this factor analysis were interpreted with caution. Furthermore, the reliability of this scale based on 10 items was acceptable (α=.75) (Pallant, 2010), however further analysis revealed that the highest reliability existed when 8 items were subjected to a test of internal consistency, with a Cronbach Alpha value of .84. This indicates that the SCAT requires further testing and adaptations for the South African context.

Table 4.1 Psychometric properties of the SCAT

Variable	KMO	P value	Cronbach's Alpha for 10 items	Cronbach's Alpha for 8 items
SCAT (anxiety)	.67	.12	.75	.84

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4.9.2 Sports Mental Toughness Questionnaire (SMTQ)

The SMTQ was developed by Sheard, Golby and Van Wersch (2009) and is the first psychometrically acceptable measure of mental toughness (Sheard, 2010). The SMTQ is a three factor 14-item questionnaire that measures confidence, constancy (ability to concentrate, willingness to take responsibility for setting training and competition goals, determination in training and competition, and an unyielding attitude) and control (perceived ability to achieve a desired outcome).

According to Sheard (2010), the SMTQ has been validated extensively and exploratory analysis has shown good internal consistency of the questionnaire. Differences between results on age and gender showed that the test has good discriminative power and good content validity. The SMTQ is also the only mental toughness instrument that includes items of emotional and negative energy control.

4.9.3 Self-designed questionnaire on environmental factors

The self-designed questionnaire was developed by the researcher in order to assess the perceived impact of environmental factors on the performance of judokas. The questionnaire consists of 18 items that specifically measure the effects of temperature, altitude, air quality, noise, ambience and spectator support, weight cutting and sleep.

4.9.3.1 Reliability and psychometric properties of the self-designed questionnaire

Although the Bartlett's Test of Sphericity for temperature was significant ($p < .005$), the Kaiser-Meyer-Olkin value was .53 and therefore below the recommended score of .6 (Kaiser, 1970, 1974). Cronbach's Alpha was .53. A minimum recommended score for Cronbach's Alpha is .7 indicating a reliability score below the recommended range, therefore results are interpreted with caution.

The Bartlett's Test of Sphericity for the spectator support scale (consisting of three items) was significant ($p < .005$) and the Kaiser-Meyer-Olkin value of .68 was above the recommended minimum score of .6. Cronbach's Alpha was .72, indicating moderate reliability.

Bartlett's Test of Sphericity for noise (consisting of two items) was significant ($p < .005$), although the Kaiser-Meyer-Olkin was below the recommended score of .6. Reliability was slightly below the recommended range with a Cronbach Alpha score of .62.

The psychometric properties of the environmental factors discussed above are displayed in the following table.

Table 4.2 Psychometric properties of the environmental factors

Variable	No. of Items	Mean	Variance	SD	KMO	P value	Cronbach's Alpha
Temperature	4	12.58	8.04	2.84	.33	.00	.53
Spectator support	3	10.78	7.62	2.76	.68	.00	.72
Noise	2	4.20	4.13	2.03	.50	.00	.62

Due to the fact that there are fewer than 10 items in the scale, inter-item correlations are reported in Table 4.3. Recommended scores for inter-item correlations range from .2 to .4 (Briggs & Cheek, 1986) and was found to be satisfactory.

Table 4.3 Inter-item correlations of environmental factors

Environmental factor: Temperature				
	Item 1	Item 2	Item 3	Item 4
Item 1	1.000	.240	-.280	.332
Item 2	.240	1.000	.271	.009
Item 3	-.280	.271	1.000	.473
Item 4	.332	.009	.473	1.000
Environmental factor: Spectator behaviour				
	Item 1	Item 2	Item 3	
Item 1	1.000	.493	.447	
Item 2	.493	1.000	.444	
Item 3	.447	.444	1.000	
Environmental factor: Noise				
Item 1	.493	1.000		
Item 2	.447	.444		

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4.10 Ethical considerations

The President of Judo South Africa was approached in writing and gave his permission to conduct the research at the 2012 South African Open Judo Championships. All judokas who participated in this research were provided with an information sheet, explaining the purpose and objectives of the study. Due to the fact that the judokas selected for this study were under 18 years of age, their parents/legal guardians were required to complete a parent consent and assent form, giving permission for them to participate, as well as acknowledging that they have prior knowledge of the purpose and objectives of the study. Parental consent was a prerequisite to participate in this study.

Once parental consent had been gained, each judoka who agreed to participate in this study was required to complete a child assent form. The information sheet and consent forms informed the judokas and their parents that all information and data will be kept anonymous and confidential throughout the research study, as well as in the results of the study. Where required, the information obtained from the questionnaire was communicated between the researcher and the research supervisors. If at any time during the course of the study the

participant chose to no longer partake in the research study, including the completion of the questionnaire, the individual had the right to do so. The letter of informed consent accompanied every questionnaire that was disseminated amongst judokas.

In order to ensure anonymity, confidentiality and privacy, all interviews and focus group recordings were destroyed after the reporting of data in this paper.

4.11 Summary

This chapter describes the process followed by the researcher in order to lay the foundation for research. Of particular importance was the identification and selection of an appropriate research design. Available literature revealed that the mixed-methods research design was most appropriate, as this design allows for the interpretation of both quantitative and qualitative data.

Further to the research design, this chapter discusses the order in which the research took place, providing for a structured order of reporting of data in Chaper 5. The population of elite judokas (n=139), the sample that participated in this study (n=65) and the researcher as an insider. The focus group conducted with eight judokas (n=8), and the interviews conducted with eight judo coaches (n=8) are also described as well as the process of coding. Questionnaires provided the researcher with qualitative data such as biographical information and the focus group and interviews provided qualitative data. Of particular importance is the fact that the Sport Competition Anxiety Test, the Sports Mental Toughness Questionnaire, and the self-designed questionnaire on environmental factors, were all completed by the same judokas in the sample. Psychometric properties such as validity and reliability of all the questionnaires are provided.

Finally ethical considerations are discussed. The researcher was careful to inform all judokas that they were participating in this study by own choice and were able to withdraw at any time. Due to the fact that participats were all under 18 years of age, parents/legal guardians were required to complete a parent consent form.

The following discussion in Chapter 5 relates to the results and discussion of data.

CHAPTER 5

RESULTS AND DISCUSSION OF DATA

5.1 Introduction

This chapter reports the results of this study based on the analyses, interpretation and discussion of different data sets captured through the methodology, design and procedures described in Chapter 4. Qualitative data was obtained from methods such as interviews with judo coaches (n=8) and a focus group session with judokas (n=8) during the 2012 SA Open Judo Championships. Quantitative data sets were obtained by administering the Sports Mental Toughness Questionnaire (SMTQ), the Sports Competition Anxiety Test (SCAT) and a self-designed questionnaire that captured the perceptions of judokas regarding various environmental aspects of competition. Completed questionnaires were analysed with guidance from STATCON for further analysis, whilst the recordings were transcribed and analysed. Methods used for statistical analyses are described in Chapter 4.

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The discussion in this chapter is thematically structured with biographical data reported first, followed by environmental data, inferential statistics that include psychological skills such as anxiety and mental toughness, relationships between variables, correlational statistics and finally, variables that directly influence performance as indicated by logistical regression. Environmental data is reported separately as the data was gathered through a separate data set, and qualitative data gathered by way of interviews and a focus group is discussed following each theme.

5.2 Descriptive statistics

The following section deals with the analysis and interpretation of data from the questionnaires.

5.2.1 Biographical information of the sample

The biographical information of the sample is presented in Table 5.1. Sixty three judokas (45%) participated in this study, representing participants from all 11 provinces in the structure of Judo South Africa from a total population of 139 judokas who participated in the SA Open 2012 in the target age group (under 17).

Various biographical details of the sample were captured. Of the 63 judokas, 23 (36.5%) were females and 40 (63.5%) were males providing for a proportionally representative sample for both genders in this study. The ethnicity of judokas was largely caucasian (n=45, 71.4%), whilst four judokas (0.06%) were African, six (0.1%) Indian/Asian and eight (0.13%) coloured (refer to Table 5.1). The sample was consistent across all questionnaires and all judokas completed the same questionnaire.

In order to differentiate between ranked and non-ranked elite judokas, their current ranking was taken into consideration and is presented in Table 5.1. The majority of judokas appeared on the national ranking list of Judo South Africa prior to the SA Open (n=36, 57%), as compared to 27 non-ranked judokas (42.9%) who did not appear on the list prior to the tournament.

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Table 5.1. Biographical information

Variable	Groups	N	Percentage (%)
Province	Kwa-Zulu Natal	4	6.3
	Western United	7	11.1
	Eastern Province	2	3.2
	Northern Free State	1	1.6
	Central Gauteng	8	12.7
	Western Province	9	14.3
	Southern Free State	7	11.1
	Northern Gauteng	9	14.3
	Boland	9	14.3
	Eastern Gauteng	6	9.5
	Border	1	1.6
	Total	63	100
What is your current position on the	1st	13	20.7
	2nd	6	9.5

national ranking list of Judo South Africa?	3rd	6	9.5
	4th	5	7.9
	5th	6	9.5
	Not ranked	27	42.9
	Total	63	100
Position at SA Open 2012	First	13	20.6
	Second	10	15.9
	Third	7	11.1
	Fourth	6	9.5
	Fifth	7	11.1
	Sixth and lower	20	31.8
	Total	63	100
Gender	Males	40	63.5
	Females	23	36.5
Ethnicity	White	45	71.4
	Black	4	6.3
	Indian	1	1.6
	Asian	5	7.9
	Coloured	8	12.7

5.3 Environmental factors

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The self-designed questionnaire on environmental factors attempted to determine the perceived effect of environmental factors such as air quality, altitude, temperature, ambience, noise and visibility on the performance of judokas. These environmental factors are discussed in detail in Chapter 2. The only environmental factor significantly correlated to performance was temperature, with an increase in temperature leading to a decline in performance (refer to Table 5.6, p. 97). An analysis of variance (ANOVA) indicated that temperature is significantly correlated with confidence (refer to Table 5.10, p. 101).

5.3.1 Qualitative data relating to environmental factors and performance

During interviews with coaches, they were asked to indicate what factors they believe had the greatest effect on the performance of judokas. All eight coaches agreed that temperature, especially high temperatures, and altitude, could severely affect the performance of judokas. One coach regarded heat acclimatisation and exposure as vital for successful performance, indicated by the following narrative:

> "*Due to the climate in South Africa serious consideration must be taken regarding temperature. I close our dojo's windows during training so that my players can get used to training in the heat and stuffiness. Sometimes I let them train with sweat shirts as well*."

Another coach commented on temperature, saying that:

> "*High temperatures can make players feel lazy. They should have well designed warm-up routines in order to ensure that they overcome those feelings*."

A common factor that emerged from all the interview responses was that the coaches felt that high temperatures are more likely to inhibit the performance of judokas. This is in contrast to the responses of judokas who indicated that the majority of medal-winners perceived themselves as capable of performing optimally in temperatures above 30 degrees Celcius.

One coach indicated that acclimatisation plays a major role in performance:

> "*Players who do judo inland have the advantage that their bodies adapt to high altitude and less oxygen during training and competitions. This gives them a major advantage when they compete at the coast as there is much more oxygen available*."

Another coach felt that the lack of pre-competition exposure and training at different altitudes prior to major competitions remains problematic:

> "*Players who train at low altitude often complain about a burning chest and difficulty in breathing when they train and compete at high altitude. This shows you that it is advantageous to train and compete regularly at high altitude*."

During the focus group with judokas, all ten judokas who participated indicated that temperature had a major effect on their performance. Interestingly, one of the multiple national champions claimed that: "*I hate competing in hot conditions, it makes me lazy and uncomfortable*." Other judokas indicated that they preferred the heat to having to warm-up and compete in the cold during winter time as they are more used to hot conditions in South Africa.

When asked about internal conditions at venues, such as the effect of the climate on the day of the tournament, only one judoka indicated that this influenced his/her mood and therefore the performance on the day, whilst the others were undecided as to the effects thereof.

Judokas were also questioned on the effect of altitude on their performance. One judoka indicated that "*it has no effect on me where I compete, I just fight to win*", whilst four judokas agreed that training at high altitude has major benefits when competing and training at low altitude. One judoka who lives at the coast (Eastern Cape) responded by indicating that "*my chest burns when I compete in places like Johannesburg. It takes me time to get used to the thin air*." The altitude in Johannesburg is 1 753 metres above sea level (Gateway to Africa, 2013), whereas the altitude in certain areas in the Eastern Cape is as low as 60 metres (Port Elizabeth Climate, 2013).

Other focus group questions related to the following:

- What the effect of air quality is on their performance. The majority of judokas had never thought about this before, although one did indicate that she does not like dry, dusty air as it negatively influences her breathing during participation.
- What type of venue judokas prefer to compete in. All judokas indicated that they preferred a spacious venue that has enough room for spectators to move freely without interfering with other judokas. Three judokas indicated that a venue with a moderate temperature was preferable to high or low temperatures.
- What type of noises judokas notice most during competition, and if noise is allowed during training. Six judokas indicated that their coaches do not allow talking during training, while two indicated that their coaches were a bit more relaxed and allowed them to talk a little. One judoka indicated that he noticed the sound of people falling on the competition mat most readily at tournaments, whilst the majority (n=5) indicated that they noticed the spectator noise mostly when they compete.
- Sleep and nutrition. Two judokas indicated that they have to lose weight in order to participate in their preferred weight division, whilst one indicated that: "*I lose my weight in the month before the competition so that I don't have to diet during the last week before I fight*". Four indicated that they do not engage in any form of drastic weight loss prior to tournaments. One judoka said that losing weight helps him to perform better, whilst the

other seven indicated that they are not negatively affected. In terms of sleep, only one judoka was aware of sleeping problems prior to major events, saying that she "*cannot sleep the night before*."

5.4 Inferential statistics

The following results refer to the psychological skills of judokas in the sample as investigated through the Sport Competition Anxiety Test (SCAT) and Sports Mental Toughness Questionnaire (SMTQ). Psychological skills include anxiety and mental toughness. Constructs of mental toughness include aspects dealing with confidence, constancy and control.

5.4.1 Anxiety

The competition anxiety levels of the participants were assessed with the SCAT prior to their competing at the 2012 SA Open. A norm scale developed by Martens (1977) was used to categorise the participants' anxiety levels, where a score between 10 and 15 indicates a low level of anxiety, 16 – 22 a moderate level of anxiety and a score between 23 and 30 would indicate high levels of anxiety during competition. An anxiety score ranging between 16 and 22 is indicated as the range that produces optimal performance (Martens, 1977).

The mean anxiety score of the sample (refer to Table 5.2, p. 90) is 23.29 with a standard deviation of 4.73, indicating that the participants on average had relatively very high anxiety levels when competing, especially considering the fact that the general sports median for South African athletes is 22 (Potgieter, 2009). Further analysis of the SCAT (presented in Table 5.3, p. 90) indicates that in total 8.1% (n=5) of judokas experienced a relatively low level of anxiety, whilst 35.5% (n=22) experienced relatively moderate anxiety and 56.5% (n=35) experienced relatively high anxiety. These differential levels indicate that more than half of the judokas compete with relatively high anxiety during competition, which could affect their performance negatively.

5.4.1.1 Qualitative data relating to anxiety and performance

During the focus group, judokas were requested to indicate whether they experience anxiety prior to major judo tournaments such as the SA Open, and whether they believe that anxiety inhibits or enhances their performance.

All judokas agreed that they experience varying levels of anxiety prior to major competitions. Six judokas felt that their anxiety inhibits their performance, with one saying: "*I am sometimes so nervous that I feel like I can't breathe, but once I start fighting I'm fine*."

Four judokas indicated that the anxiety helps them perform better. One indicated that the nervous feeling he gets makes him sharper and react faster. The majority of judokas perceived their levels of anxiety as ranging from moderate to high. This is a prime example of Kerr's (1988) theory on anxiety that anxiety can be used as either a debilitating or facilitating factor in performance.

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5.4.2 Mental toughness

The Sports Mental Toughness Questionnaire is described in Chapter 4, 4.9.2, p. 72. Low mental toughness is indicated by a mean score ranging between 14 and 28, whereas a mean score ranging between 29 and 42 would indicate moderate mental toughness, and high mental toughness would be indicated by a mean score ranging between 43 and 56. The mental toughness results are presented in Table 5.2 (p. 90), and indicates that judokas in this study had a mean mental toughness score of 41.66 (SD=5.76), falling within the category of moderate mental toughness. Although a score of 41.66 indicates moderate mental toughness, the judokas do fall within the upper range of moderate mental toughness. Results therefore indicate that judokas should focus on developing their mental toughness through psychological skills training to enter the 'high mental toughness' range.

The confidence scale revealed a mean of 17.81 (n=61) with a standard deviation of 3.37. A mean confidence score between 6 and 12 indicates low confidence, a mean score between 13 and 18 indicates moderate confidence, and high confidence is indicated by a mean score

ranging between 19 and 24. The mean score of 17.81 of the judokas indicates a relatively moderate level of confidence.

A mean score of 4 to 8 indicates low constancy, 9 to 12 indicates moderate constancy, and 13 to 16 indicates high constancy. A mean constancy score of 13.31 (SD=2.10) indicates that judokas have a relatively high level of constancy. Low control is indicated by a mean score ranging between 4 and 8, moderate control between 9 and 12, and high control between 13 and 16. The mean control score for judokas was 10.52 (SD=2.24), indicating that judokas have a relatively moderate level of control.

Table 5.2 Means and Standard Deviations of psychological skills

Variable	Low	High	N	Mean	SD
Anxiety	12	30	62	23.29	4.73
Confidence	12	24	61	17.81	3.37
Constancy	8	16	61	13.31	2.10
Control	6	15	61	10.52	2.24
Mental toughness	30	53	61	41.66	5.76

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Furthermore, 6.6% (n=4) of judokas measure relatively low in confidence, 55.7% (n=34) have a relatively moderate level of confidence, and 37.7% (n=23) displayed relatively high confidence. A relatively low constancy score was found with 3.3% of judokas (n=2), 27.9% (n=17) measure relatively moderate in constancy and 66.7% (n=42) measure relatively high in constancy. Twelve judokas (n=12) measured relatively low in control accounting for 19.7% of judokas, whilst 68.9% (n=42) measured relatively moderate in control and 11.5% (n=7) measured relatively high in control. No judokas measured low in mental toughness, however 52.5% of judokas (n=32) measured in the moderate range of mental toughness and 47.5% (n=29) measured in the high range of mental toughness.

Table 5.3 Measurement scores of psychological skills

Psychological skills	Low	Moderate	High
Anxiety	5 (8.1%)	22 (35.5%)	35 (56.5%)
Confidence	4 (6.6%)	34 (55.7%)	23 (37.7%)
Constancy	2 (3.3%)	17 (27.9%)	42 (68.9%)
Control	12 (19.7%)	42 (68.9%)	7 (11.5%)
Mental toughness	0 (0%)	32 (52.5%)	29 (47.5%)

In light of the fact that none of the judokas appear in the low mental toughness group, it is clear that judokas are relatively mentally tough. The majority of judokas are however relatively very anxious prior to major judo competitions. It is essential that judokas maintain a relatively moderate level of anxiety prior to participation in major events together with improving their mental toughness in order to ensure that they can perform optimally.

5.4.2.1 Qualitative data relating to mental toughness and performance

Based on the interviews with judo coaches, it became evident that six coaches had similar opinions regarding the possibility that psychological training is necessary to improve the mental toughness of judokas in the under 17 age category. Two coaches indicated that psychological training was not necessary at this age, with one of them saying that "*judokas at this age do not experience nervousness and do not need a big focus on psychological aspects of competing*."

Of the six coaches who indicated that psychological training was necessary, all but two indicated that they use techniques that they learned during years of working with professionals in the psychology field. One very successful coach said "*I have a friend who's a psychologist and I use the techniques that he teaches me*."

Another coach's opinion on the necessity and practicality of psychological training for judokas is expressed by the following narrative:

> "*There is no doubt that psychological training is necessary, however it is time consuming and expensive, hence the fact that we don't use a sport psychologist and this is also the reason why many other judo clubs in South Africa cannot use professionals such as these*."

The implication of the referred narrative is that only judokas with adequate financial resources have the means to receive professional training in psychology. It also implies that judo coaches as a rule do not incorporate professional psychological training in their training programmes. This could be one of the major reasons for the above average levels of anxiety and the large number of elite judokas who have a

relatively moderate confidence level. Resultingly, this may inhibit the performance of elite judokas in South Africa and could lead to poor performance at important tournaments.

5.4.3 Socialisation agents

The most signficant sources of motivation (in order of importance) were indicated as the father (n=53, 84.1%), judo coach (n=51, 81%), mother (n=47, 74.6%), siblings (n=36, 57.1%), friends (n=28, 44.4%) and others (n=14, 22.2%) as displayed in Table 5.4.

Table 5.4 Social agents as significant influences

	Category	N	Frequency (%)
Social agent	Mother	47	74.6
	Father	53	84.1
	Siblings	36	57.1
	Friends	28	44.4
	Judo coach	51	81.0
	Others	14	22.2

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The socio-economic status of the participants in this study was established by asking what type of school they attended. In South Africa, 3.8% (n=479 958) of the total population of school learners attend independent schools, 0.9% (n=108 240) attend special schools, 2.2% (n=284 595) attend Early Childhood Development centres and 93.1% (n=11 808 036) attend public schools (Department of Basic Education, 2013). Scholarships are awarded to students regardless of the schools they attend, i.e. a child from a poor family may receive a scholarship to study at an independent school and practise his/her sport at that school. Options in the questionnaire included (1) no-fee (your parents do not pay school fees), (2) fee (your parents pay school fees) and (3) sport scholarships. Fifty one (81%) of these judokas attended schools where their parents were responsible for paying their school fees, three judokas (0.05%) attended schools where their parents were not responsible for paying their school fees, and nine judokas (0.14%) were attending school on a sport scholarship.

5.4.3.1 Qualitative data relating to socialisation agents and performance

During the interviews, all eight coaches were asked to indicate which socialisation agents they believe influence a judoka's competition performance most, and they were asked to describe their relationship with their judokas.

One coach indicated the importance of multiple social agents with the following narrative:

> "*Parents are the most important source of support, especially in terms of transport to and from judo, and financially. It's important to understand that judokas at this age more readily associate with peers and rebel against adult authority. It will often almost appear like a personality change as hormonal changes take place*."

Another coach was convinced that the effect of parents on the performance of judokas is significant and believes parents should engage in sessions with a sport psychologist in order to ensure that they "*understand the pressures that judokas deal with and know how to act and interact with their children prior to a major judo event*." He indicated that this is standard practice in some European countries.

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In response to their relationship with their players, one coach responded by saying that "*all my judokas regard me as friendly, but they know that we are not friends. I am ultimately in charge*." Another coach's response was:

> "*I am a mentor to my players. They know that I will be there for them during difficult times. It is important to keep a certain amount of distance in the relationship to maintain authority and respect*."

Interviews with coaches revealed that all coaches regarded the coach-athlete relationship as crucial for judokas' performance at optimal level, especially due to the fact that judo is an individual sport and there is a large amount of one-on-one interaction between coach and judoka. A common theme throughout all the interviews was that mentorship is important and that coaches are responsible for setting good examples for their judokas. There is thus a clear acknowledgement of differential power relations and social distance between the judoka and the significant other.

In the focus group, judokas were asked to describe their relationship with their coach and indicate who they believed were their most important sources of motivation prior to and during judo competitions. All judokas indicated that their relationship with their coach is important, in particular for the reason that the coach is the one they mainly interact with at both training and tournaments. Two judokas agreed that their coach is like a father figure to them.

The majority of judokas agreed that their parents are important, with two indicating that their siblings supporting them is vital as their parents do not attend tournaments.

5.5 Relationships between variables

Cross-tabulations were done to show the relationships between various variables. The only statistically significant relationships that existed with performance at the SA Open 2012 were support from brothers and sisters (siblings) and competing in temperatures above 30 degrees Celcius (refer to Table 5.5, p. 95), indicating that social support and environmental temperature are important factors in performance.

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As can be seen in Table 5.5. (p. 95), a Chi-square test for independence (with Yates Continuity Correction) indicated a significant association between performance at the SA Open and judokas' relationship with their brother(s) and/or sister(s), χ^2 (1, n=63)=8.27, p=.00, phi=-.40. This indicates that medal winners are substantially less dependent upon the support that they receive from their siblings in order to perform successfully at major judo events such as the SA Open. Non-medal winners, in contrast, perceive their relationship with their sibling(s) to be substantially significant in terms of their influence on their level of performance at major tournaments such as the SA Open. It is clear that medal winners experience a shift towards the self prior to major events, whereas non medal winners experience a shift away from the self to others such as siblings.

A Chi-square test for independence also indicated that a significant association exists between performance of judokas at the SA Open and competing in temperatures above 30 degrees Celcius, χ^2 (1, n=61)=8.15, p=.02, phi=.37. Medal winners at the SA Open 2012 perceived themselves as more capable to perform at higher levels in conditions where temperatures are

high (above 30 degrees Celcius). Almost all respondents (96.6%) who captured medals at the SA Open in 2012 indicated that they 'sometimes' and 'often/always' perform better in hot temperatures, as compared to 22 out of 32 respondents (68.8%) who did not manage to win a medal at the SA Open 2012.

Table 5.5 Relationships between variables

Performance at the SA Open 2012 was significantly affected by:						
Variable	**Category**	**Medal winners (N)**	**Non medal winners (N)**	**Value**	**P-value**	**Phi**
Siblings (Brothers/Sisters)	Unmarked	19	8	8.27	.004	.40
	Marked	11	25			
Temperature (above 30˚Celcius)	Never/Hardly ever	1	10	8.15	.02	.37
	Sometimes	11	10			
	Often/Always	17	12			

5.6 Correlational statistics

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Preliminary analyses were performed prior to all correlational calculations in order to ensure that no violation of the assumptions of normality, linearity and homoscedasticity existed.

The main purpose of this study was to determine which variables significantly correlate with performance of judokas at the South African Open 2012. The relationship between performance and psychological, social and environmental variables was considered, and four variables indicated a significant relationship namely temperature, confidence, anxiety and the number of entries in the judokas' respective weight categories. The results that are indicated in Table 5.6 (p. 97) indicate the extent to which an increase in anxiety, number of entries in a participant's weight category, and temperature inhibits performance and an increase in confidence improves performance.

The results in the following section were calculated using the Pearson product-moment correlation coefficient. A small correlation is indicated by a score ranging between .10 and .39, a medium correlation by a score between .30 and .49 and a large correlation between .50 and 1.0.

5.6.1 Anxiety

The relationship between anxiety (as measured by die Sports Competition Anxiety Test) and the performance of judokas (determined by the position achieved at the South African Open of 2012) was investigated using the Pearson product-moment correlation coefficient. There was a statistically significant negative correlation between the two variables, r=-.27, n=63, p<.05. This indicates that there is a small but negative relationship between higher anxiety and performance, indicating that performance decreases as anxiety increases.

5.6.2 Confidence

The relationship between confidence (as measured by the Sports Mental Toughness Questionnaire) and the performance of judokas (determined by the position achieved at the South African Open of 2012) was investigated using the Pearson product-moment correlation coefficient. A small but statistically significant relationship existed (r=.28, n=61, p<.05), indicating that an increase in confidence leads to an increase in performance.

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5.6.3 Temperature

The relationship between temperature (as measured by the self-designed Environmental Questionnaire) and the performance of judokas (determined by the position achieved at the South African Open of 2012) was investigated using the Pearson product-moment correlation coefficient. A moderate statistically significant relationship existed (r=-.39, n=61, p<.01), indicating that when judokas experience the perception of an increase in temperature, their performances tend to decline.

5.6.4 Number of entries in a weight category

The relationship between the number of entries in the judoka's respective weight category (as determined from the entry list of the SA Open) and the performance of judokas (determined by the position achieved at the South African Open of 2012) was investigated using the Pearson product-moment correlation coefficient. A strong statistically significant relationship

existed (r=.45, n=63, p<.01), indicating that the higher the number of entries in the judoka's weight category, the better the performance.

Table 5.6 Performance correlations

Variable		Confidence	Anxiety	Temperature	Entries
Performance at SA Open 2012	Pearson Correlation	.28*	-.27*	-.39**	.45**
	P-value	.03	.04	.00	.00
	N	61	63	61	63

*Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)

5.6.5 Anxiety and mental toughness

The relationship between anxiety (as measured by the SCAT) and the subscales of the SMTQ (confidence, constancy and control) was investigated using the Pearson product-moment correlation coefficient and are presented in Table 5.7, p. 98. There was a moderate, negative correlation between all three subscales of mental toughness and anxiety, indicating that higher anxiety levels associate with a decrease in confidence (r=-.35, n=60, p < .01). Higher anxiety also associated with a decrease in constancy, although the P-value was not statistically significant (r=-.24, n=60, p=.06), and a strong relationship existed between control and anxiety, indicating that an increase in anxiety was associated with a decrease in perceptions of control (r=-.49, n=60, p<.01). Overall, anxiety has a negative relationship with factors of mental toughness, indicating that a higher level of anxiety could be associated with mental weakness in sport. Judokas should attend to their levels of anxiety and learn to deal with anxiety effectively in order to improve their mental toughness by developing mental coping mechanisms.

The relationship between anxiety (as measured by the SCAT) and the total mental toughness score of judokas (as measured by the SMTQ) was also investigated using the Pearson product-moment correlation coefficient. There was a moderate negative correlation between anxiety and mental toughness, indicating that mental toughness relates to the anxiety levels that judokas experience, i.e. judokas with stronger mental toughness tend to experience lower levels of anxiety during performance at important judo events than their counterparts who are mentally weaker (r=-.48, n=60, p<.01).

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Table 5.7 Correlation between anxiety and mental toughness

Variable		Confidence	Constancy	Control	Mental toughness
SCAT (Anxiety)	Pearson Correlation	-.35**	-.24	-.49**	-.49**
	Sig. (2-tailed)	.00	.06	.00	.00
	N	60	60	60	60

*Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)

5.7 Differences between groups

An independent samples t-test was performed to compare the performance of medal winners and non-medal winners at the SA Open of 2012 with a variety of variables in this study. Results indicated that there was a statistically significant difference between medal winners and non-medal winners for number of entries in the judoka's respective weight category and the confidence scale of Mental Toughness.

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5.7.1 Number of entries

Results on the analysis of the number of entries in a competitor's weight category for medal winners were (M=8.73, SD=4.88) and for non medal winners (M=12.03, SD=4.19; t (63)=2.89, p=.01, two-tailed). The magnitude of the differences in the means (mean difference=3.30, 95% Cl: 1.01 to 5.58) was moderate (eta-squared=.12) (Cohen, 1988). This represents a moderate to large effect size, indicating that the difference between the two groups have practical significance in the preparation of judokas for competition.

5.7.2 Confidence

Differences for confidence between medal winners (M=3.14, SD=.56) and non medal winners (M=2.82, SD=.53, t (61)=-2.30, p=.03, two-tailed) indicated a very small magnitude of differences in the means (mean difference=-.32, (95% Cl: -.60 to -.04; eta squared=.08). The moderate effect size (eta squared) of .08 indicates that the difference between the two groups have practical significance in the preparation of judokas for competition.

Table 5.8 Confidence and number of entries in category

Performance at SA Open 2012								
Variable		**Mean**	**SD**	**N**	**T (63)**	**P-value**	**MD**	**Effect size (eta squared)**
Number of entries in category	Medal winners	8.73	4.88	30	2.89	0.01	3.30	.12
	Non medal winners	12.03	4.19	33				
Confidence	Medal winners	3.14	.56	29	-2.30	0.03	-.32	.08
	Non medal winners	2.82	.53	32				

5.7.3 Training hours

A paired-samples t-test was conducted to determine the difference between the number of hours spent in judo training during the competition season of judokas who participated in the SA Open 2012, as compared to the number of hours spent in judo training during their non-competitive season. A comparison was also drawn between the number of hours spent in training across both seasons according to gender. The results of the number of training hours spent in both seasons as well as the difference between genders are displayed in Table 5.9 (p. 100).

Results for male judokas revealed a statistically significant reduction in the amount of hours spent on judo training from the competitive season (M=5.40, SD=3.30) to the non-competitive season (M=3.70, SD=2.26), t (39)=6.07, p < .0005 (two-tailed). The mean decrease in training hours was 1.70 with a 95% confidence interval ranging from 1.13 to 2.27. The eta-squared statistic (.49) indicated a large effect size (Cohen, 1988).

A statistically significant decrease in the number of training hours for females is also present with females engaging in a greater number of training hours during the competitive season (M=5.13, SD=1.89) as compared to the non-competitive season training time (M=3.57, SD=1.75, t (22)=6.47, p < .0005 (two-tailed)). The mean decrease in training hours was 1.57 with a 95% confidence interval ranging from 1.06 to 2.07. The eta-squared statistic (.66) indicated a large effect size (Cohen, 1988).

Results indicate that both male and female Judokas decrease their hours of training during the non-competitive season. Whilst 49% (n=40) of males decrease their hours of training, 66% (n=23) of females decrease their training time. Males engage in a greater amount of training both during the competitive season and the non-competitive season than their female counterparts.

Table 5.9 Difference in training hours by gender

Gender	Season	Mean	SD	N	t	P-value
Male	Competitive	5.40	3.30	40	6.07	.00
	Non-competitive	3.70	2.26	40		
Female	Competitive	5.13	1.89	23	6.47	.00
	Non-competitive	3.57	1.75	23		

5.7.4 Qualitative data relating to training hours and performance

From the interviews it became clear that coaches (n=8) regarded hours spent in training as crucial to the success of the judokas. Coaches were asked how many hours of training are regarded as necessary for the success of their judokas at the level of competition that they are currently enaged in. The majority indicated that 10 to 13 hours of judo training per week are necessary during the competitive season. Considering that males indicated that they train 5.4 hours per week on average and females 5.13 hours in the competition season, it is evident that what coaches expect and what is done in reality are far removed from one another.

The following section deals with factors identified in the literature study that positively correlated with success in judo competitions by way of logistic regression.

5.8 Analysis of variance

A one-way analysis if variance (ANOVA) was conducted to explore the impact of temperature (as measured by the self-designed questionnaire on environmental factors) on confidence (as measured by the sports mental toughness questionnaire) of the judokas. Participants were divided into three groups indicating how well they performed in extreme temperatures, namely: (1) never/hardly ever, (2) sometimes, and (3) often/always.

There was a statistically significant difference at the p < .05 level for the three groups: F (2, 61)=3.5, p=.04. Despite reaching statistical significance, the actual difference in mean scores between the groups was quite small. The effect size, using eta-squared, was .01. Post-hoc comparisons using the Hochberg test indicated that the mean score for group 1 (never/hardly ever) (M=2.59, SD=.56) was significantly different from group 3 (often/always) (M=3.09, SD=.63) . Group 2 (sometimes) did not differ significantly from either group 1 or group 2. The results are displayed in Table 5.10.

Table 5.10 ANOVA temperature and confidence

Temperature		Mean Difference	Std. Error	P-value
Never/Hardly ever	Sometimes	-.409	.201	.132
	Often/Always	-.501*	.191	.033
Sometimes	Never/Hardly ever	.409	.201	.132
	Often/Always	-.092	.155	.910
Often/Always	Never/Hardly ever	.501*	.191	.033
	Sometimes	.092	.155	.910

* The mean difference is significant at the .05 level.

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5.9 Factors predicting success in judo competitions

Direct logistic regresssion was performed to assess the impact of a number of factors on the likelihood of whether or not judokas would qualify as medal winners at the SA Open 2012. The model contained three independent variables (number of entries, confidence and anxiety). The full model containing all predictors was statistically significant, χ^2 (3, n=61)=14.15, p < .005, indicating that the model was able to distinguish between judokas who won medals at the SA Open 2012 and those who did not. The model as a whole explained between 20.7% (Cox & Snell R-squared) and 27.6% (Nagelkerke R-squared) of the variance in performance at the SA Open, and correctly classified 68.9% of cases.

As shown in Table 5.11 (p. 102), two of the independent variables made a unique statistically significant contribution to the model (number of entries and confidence). The strongest predictor of medal winners was confidence, recording an odds ratio of 2.90. This indicated that judokas who were medal winners at the SA Open were almost three times more likely to report high levels of confidence than those who did not win medals, controlling for all other factors in the model. This is a clear indication of the importance of confidence in success.

The odds ratio of .86 for number of entries in a judoka's respective weight category was less than 1, indicating that for every additional entry in a judokas' category, judokas were .86 times less likely to win a medal, controlling for all other factors in the model.

Table 5.11 Logistic regression predicting likelihood of winning a medal at the SA Open 2012

	B	S.E.	Wald	df	P-value	95% C.I. for Odds Ratio	
Number of entries	-.155	.063	5.942	1	.015	.757	.970
Confidence	1.065	.538	3.919	1	.048	1.011	8.327
Anxiety	-.063	.051	1.517	1	.218	.849	1.038
Constant	-.585	1.908	.094	1	.759		

5.10 Impact of psychosocial and environmental factors on performance

Anxiety is described as one of the most important factors influencing sport (Jarvis, 1999). The majority of elite athletes have lower levels of anxiety than non-elite athletes, and elite athletes are capable of channelling their anxiety (nervous energy) into positive performances more effectively than non-elite athletes (Williams & Krane, 2001).

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Zeng et al. (2008) found that athletes with relatively high levels of cognitive state anxiety and somatic anxiety are relatively lower in self-confidence than athletes lower in cognitive state anxiety and somatic anxiety. Higher anxiety was associated with poorer performance.

In terms of the results of this study, the majority of judokas rated relatively high in anxiety. Kuuseok and Ratassepp (2001) found that younger athletes are more likely to experience higher levels of anxiety prior to competition, and Jarvis (1999) indicated that athletes engaged in explosive sports such as judo have higher levels of pre-competition anxiety.

Self-efficacy is an individual level, situation-specific form of self-confidence that reflects the perception that an athlete has of his/her abilities (Weinberg & Gould, 2003). Stevens et al. (2006) determined that the strongest correlation with performance outcomes of a male judoka competing in Olympic qualification events existed with high self-efficacy. It is clear that confidence plays a vital role in the successful performance of judokas. Results of the current

study indicate that the majority of judokas are relatively moderate in confidence. Weinberg and Gould (2003) indicated that a link exists between anxiety and self-efficacy, with high self-efficacy correlated with lower anxiety and vice versa.

Results from the quantitative data in the current study confirm the correlation between confidence and anxiety reported by Weinberg and Gould (2003), as a significant relationship existed between anxiety and confidence (Table 5.7, p. 98). Confidence and anxiety are two constructs presented by logistical regression as having a significant effect on the performance of judokas (Table 5.11, p. 102).

Qualitative data indicates that elite judokas perceive themselves as relatively high with regard to pre-competition anxiety. Focus group responses indicate an example of Kerr's (1988) theory on anxiety postulating that anxiety can be used as either a debilitating or facilitating factor in performance. Some judokas have managed to develop coping mechanisms for anxiety that enables them to perform successfully, regardless of the intensity of the anxiety that they experience prior to major events. This skill is in accordance with findings reported by Weinberg and Gould (2003). Le Bars et al. (2009) reported that athletes experienced higher levels of confidence when they invested a greater amount of confidence in their coaches. As reflected in Table 5.4 (p. 92) and in focus group responses, judokas view their coaches as highly influential role-players. Fathers are indicated as the most important support base for judokas prior to and during tournaments. Ullrich-French and Smith (2006) reported that a strong father-child relationship in the sport context enhances feelings of competence and self-efficacy, whilst the mother-child relationship (third behind coaches and fathers) relates to self-determined motivational behaviour and self-efficacy.

It is evident from the available data that the parent-athlete-coach triad proposed by Jowett and Timson-Katchis (2005) is applicable. In this model parents are responsible for emotional support and providing opportunities to their children. Parents influence the relationship between their child and the coach in terms of their closeness, level of commitment and complementarity. Collins and Barber (2005) indicated that the performance of children in sport is related to the expectations of success that parents have for their children, although this may also lead to undue pressure and higher anixety. Accordingly, the results of this study may suggest that the dynamics of the parent-athlete-coach triad may contribute to the

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relatively high anxiety levels of elite judokas, thus inhibiting their performance. The hypothesis that elite judokas experience relatively low levels of anxiety prior to major tournaments is rejected.

The only environmental factor correlated to the performance and confidence of judokas is temperature (Table 5.6, p. 97). Maughan and Shirreffs (2010) indicated that hot temperatures together with training increase the body's core temperature which leads to a decline in performance. Similar findings were reported by Siegel (2011) and Duffield et al. (2009) who also reported that core temperatures exceeding 37 degrees Celcius lead to poor muscle recovery. Judokas in the sample indicated that they struggle to compete in temperatures above 30 degrees Celcius. Qualitative data suggests that both coaches and judokas perceive high temperatures as inhibiting to performance. Although there are coaches who realise the importance of simulation training in order to prepare judokas adequately for competitions, it is evident that simulation methods used by coaches in South Africa are not adequate. Dankanich (2012) suggested that an athlete's core body temperature should be monitored and Lehnert (1994) indicated that successful simulation methods include using saunas and training in climatically controlled chambers. Of further concern is that Riviera-Brown & De Felix-Davila (2012) reported that adolescent judokas (n=24) engaged in health-risk practices prior to and during training sessions by participating in a slightly dehydrated state and not taking in adequate amounts of fluid during training. There is a significant decrease in performance and confidence when judokas perceive temperatures as extremely hot (above 30 degrees Celcius). The perception of extreme temperature is therefore a contributing factor to the fact that the majority of judokas display relatively moderate levels of confidence. The hypothesis that environmental factors influence the performance of elite judokas is partially accepted as temperature is the only statistically significant environmental factor related to performance.

In terms of mental readiness, findings reported by Gould et al. (1999) indicated that American Olympic teams were more successful when the athletes were mentally prepared for competition. A study by Van Rossum and Gagné (1994) indicated that judo coaches rated mental fitness as a top-three priority for performance. Results of the current study indicate that the mental toughness of judokas is relatively moderate. A significant correlation was found between mental toughness and anxiety, indicating that mentally tough judokas experience relatively less anxiety during performance (Table 5.7, p. 98). The hypothesis that

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elite judokas have relatively high levels of mental toughness is partially accepted due to the fact that no judokas fall within the low range of mental toughness.

Although no significant relationship could be established between the number of training hours that judokas engage in and the mental toughness of judokas, it is noteworthy that the optimum number of training hours required according to judo coaches, is far removed from actual training hours that judokas engage in. The hypothesis that the number of training hours that elite judokas engage in influences their mental toughness is therefore rejected, however this assertion requires further investigation.

The majority of judo coaches acknowledge that psychological training is essential in order to successfully cope with anxiety, however in reality this is not being incorporated successfully into training programmes for a variety of reasons, mainly due to financial constraints. Judo coaches who claimed that psychological training is not necessary for judokas in the target age group should be educated in order to bring their perspective in line with available research and literature.

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Logistic regression identified two psychological constructs (confidence and anxiety) and the number of entries in a judoka's category as significant factors influencing performance of judokas. Confidence and anxiety have been thoroughly discussed. A lower number of entries in a judoka's category was correlated with better performance. It can be assumed that the fewer the number of entries, the higher the final positions of all judokas, for example a category with 16 entries will have final positions ranging from first to 16th, whilst categories with five entries will have final positions ranging from first to fifth.

5.11 Summary

The biographical data indicate that judokas from all provincial bodies registered to Judo South Africa, participated in this study. The majority of judokas in the sample were white and male.

Qualitative results on environmental factors reveal that coaches and judokas regard temperature and altitude as two of the major environmental variables impacting on their performance. Qualitative data indicated a significant correlation between temperature and

confidence. The majority of judokas indicated that they did not consider the effect of air quality on their performance prior to this study.

Inferential statistics revealed that the majority of judoas have a relatively moderate level of mental toughness. The subscales of mental toughness were mainly represented in the 'moderate' and 'high' categories, however the subscale of constancy was mainly represented in the 'low' and 'moderate' categories. This has implications for psychological training, as control is the weakest element of mental toughness for elite judokas.

Temperature, anxiety and confidence are significantly correlated to performance. High temperatures (above 30 degrees Celcius) lead to a relative decline in performance and confidence, whilst a decline in confidence leads to a relative decline in performance. Medal winning judokas perceive themselves as capable of performing better in high temperatures than non-medal winning judokas. In terms of social agents, medal winners are less dependent on siblings than their non-medal winning counterparts.

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The results of this study indicate an interrelatedness amongst numerous psychosocial and environmental factors on the performance of elite judokas in South Africa. Coaches should emphasise simulation methods and psychological training that would prepare judokas adequately for thermally stressful environments, whilst enabling their judokas to engage in psychological training with professionals. Simultaneously, training should emphasise appropriate development of important relationships such as the coach-athlete-parent triad, and emphasise a shift to the self during performance.

Whilst there was no significant correlation between the number of training hours and the performance of judokas, qualitative data from interviews with coaches indicates that there is a substantial difference between the ideal number of training hours, and the reality. This may have an impact on the performance of judokas.

The final chapter provides a conclusion and recommendations.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1 Introduction and overview of main findings

The results of this study have important implications for future preparation of South African judokas for major events. Results indicate that elite judokas in South Africa have relatively moderate mental toughness and relatively high anxiety. The performance of judokas during competitions and trainings is also significantly negatively influenced by relatively hot temperatures of higher than 30 degrees Celcius.

Significant correlations exist between perceived hot temperatures and a relative decline in performance, a decline in confidence and a decline in performance, and hot temperatures and a decline in confidence. A relative decline in performance is also significantly correlated to an increase in anxiety.

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Regarding the importance of social agents, medal winning judokas are significantly less dependent upon family members (specifically siblings) during performance than non-medal winners. This indicates that medal winners experience a shift towards the "self" during participation, whilst non-medal winners remain reliant on significant others.

In order to improve and sustain higher levels of performance, the entire environment should be considered and environmental, psychosocial, and selected physical factors should be incorporated into a holistic and simulated training programme. Recommendations for training programmes are thus made accordingly.

6.2 Achievement of objectives

Considering the objectives as set out in 1.2 Problem statement, aim and objectives (p. 2) and the main findings of this study, the aims and objectives were achieved successfully. The sport competition environment was described with an extensive literature study (refer to Chapter 2,

p. 7 and Chapter 3, p. 28). The extent to which selected physical factors and environmental factors, psychosocial factors, and various other factors such as gender, locality, frequency of participation and access to resources, influenced the performance of elite judokas in the target group was assessed by way of a self-designed questionnaire, the Sports Competition Anxiety Test, the Sports Mental Toughness Questionnaire, and a comparative analysis based on various aspects of the biographical section of the questionnaire. Results are discussed on Chapter 5, p. 83.

6.3 Recommendations for training programmes

Evidence from interviews with judo coaches suggest that the majority of training programmes do not incorporate mental training. The fact that judokas are generally not exposed to sport psychologists may be a contributing factor to judokas displaying relatively moderate mental toughness, relatively moderate confidence, and relatively high anxiety levels. Judo coaches should prioritise the incorporation of mental skills training that should enhance mental toughness whilst simulateously maintaining relatively moderate anxiety levels.

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According to Connaughton, Wadey, Hanton and Jones (2008), mental toughness develops over a long period of time. A number of factors function in a combined way to contribute to this development, such as i) the motivational climate, the contribution of various individuals such as parents, peers, coaches, sport psychologists and team mates, ii) experiences within and outside of the sport, iii) psychological strategies and mental skills, and iv) internalised motives and an absolute desire to perform at the highest level. Once mental toughness is developed, there are three perceived factors that contribute to the maintenance of this construct. Firstly, the desire to achieve should be insatiable and internalised. Secondly, a support network that includes sporting and non-sporting personnel and individuals should be in place. Finally, athletes should be aware of and be able to effectively use both basic and advanced psychological skills.

In essence, judo coaches should focus on acquiring and displaying appropriate knowledge that creates a enabling training environment. This environment should promote friendly rivalry amongst training partners and simulate the competition environment. Results of this study indicate that one of the main focusses of competition simulation during training should be on

training in relatively hot temperatures. Judokas generally perceived competing in hot temperatures negatively, with confidence declining during participation under such circumstances.

The findings on temperature have implications for coaches. Acclimatisation training should be incorporated, implying that coaches should take the temperature of the training venue into consideration, as well as the clothing that judokas wear during training. In order to prepare more adequately for events where hot temperatures are predicted, coaches should consider increasing the temperature of training venues. This creates implications for nutrition as hydration levels of judokas should be monitored. It is thus vital that coaches gain the relevant knowledge and insight in order to be able to develop training programmes that incorporate simulation of environmental factors such as temperature without sacrificing the health and safety of judokas. This may also lead to the inclusion of medical staff consultants into training programmes in order to monitor hydration levels. Literature revealed that judokas train in a significantly dehydrated state (Riviera-Brown & De Felix-Davila, 2012).

Significant others play a vital role in the performance of judokas. Parents should be encouraged to provide support to athletes and promote pleasure and enjoyment as the motivation for their children to participate in sport. The support base should also consist of qualified sport psychologists that educate both coaches and judokas on the development of mental toughness. Sport psychologists should work with judokas from a young age and not only once they reach elite level. It is essential that sport psychologists and coaches promote a shift towards the self during participation.

The parent-athlete-coach triad together with the potential impact of siblings on the performance of judokas should be incorporated into the preparation for major competitions. Parents should be informed and educated on the pressures that athletes experience and the ways in which they should support their children. Sport psychologists should conduct sessions with parents separately from sessions with judokas.

A similar process should be followed with siblings and spectators. A code of conduct for parents, coaches, siblings and spectators should be created in order to ensure that athletes are supported accordingly, and the training and competition environment promote optimal performance.

It is of vital importance that judokas understand the training programme that they are involved in as well as the expectations of their coaches, parents and significant others. Simulation environmental factors in training should be explained to judokas in order for them to engage fully and pursue the goals of training with full commitment and motivation.

6.4 Implications for future studies

This study focused on the perceived effects of environmental, psychosocial and physical factors on elite judokas. Topics for future research could include:

- A comparison between different age groups such as under 17 years and under 20 years.
- A comparison of experiences and adaptation to environmental factors (e.g. gender, ethnicity, age lower level of competition.
- Pursue correlations between environmental and psychosocial factors.

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6.5 Summary

This study contributed to the existing body of knowledge by providing valuable information regarding environmental, psychosocial, and selected physical factors that influence the performance of elite judokas in South Africa. This is the first study in South Africa of its nature.

Environmental factors that athletes are confronted with during participation in sport consist of two categories, one constituting the external environment and the other the internal environment. The external environment consists of factors such as air quality, altitude, temperature, ambience, noise, and visibility. The internal environment consists of psychosocial and selected physical factors such as arousal and anxiety, concentration, self-efficacy and self-confidence, achievement motivation and sociocultural factors such as ideology, cultural identity, significant others, social support and gender. The selected physical aspects are sleep and nutrition.

There is a link that exists between a number of factors in the internal environment and the external environment with performance of judokas. The most significant links were present between temperature, confidence and performance. A number of other factors may also influence performance, such as hot temperatures that lead to dehydration. Dehydration may in turn inhibit the performance of judokas.

When comparing medal winners with non-medal winners, a significant correlation exists with siblings. This indicates that medal winning judokas are capable of shifting their focus to the self, whilst non-medal winners cannot do so.

Insights gained from this study contribute to a greater understanding of the environment that judokas compete in, as well as creating awareness of the need for simulated training that targtes specific areas of expected competition circumstances and conditions. It is necessary for coaches, parents, and judokas to consider the findings of this study and incorporate the suggestions into the planning of training programmes, thereby creating an environment in which judokas may be able to produce optimal performances.

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ANNEXURE A

PARENT CONSENT FORM

Dear Parent/Guardian

I, Louis Nolte, am presently working on my Masters degree in Sport Science at the University of Johannesburg, South Africa. As part of my degree requirements, I am conducting a research project at the South African Open Judo Championships in Bloemfontein, 2012 that will help me learn more about the effect that environmental factors, psychosocial factors and selected physical factors such as sleeping habits and nutritional practices have on your child's Judo performance at elite level Judo tournaments. The target group for this study is all under 17 years old Judo players that appear on the national ranking list of Judo South Africa and the fundamental goal of this research study is to provide Judo players and coaches in South Africa with information that will assist in improving their training methods in preparation for major Judo competitions, as well as to increase Judo players' awareness of potential performance influencing factors. This will hopefully result in optimization of the performance of elite Judo players in this age category. A comparison will also be drawn between male and female Judokas which will assist Judo coaches to apply training methods appropriately according to gender differences.

As part of this research project, your child will be required to complete a number of questionnaires assessing their psychological skills in competitive situations, their anxiety levels in competitive situations, and their sleeping and eating habits. The completion of these questionnaires will take only 20 minutes of their time. All data captured from these questionnaires will be treated as confidential and therefore no personal details of your child will be distributed in the results of the research.

I am requesting permission from you to use your child's data in my research study. Please understand that your permission is entirely voluntary. If you have any questions or concerns, please feel free to contact me at on 082 907 1341 or by emailing me at pretoriajudo@mweb.co.za.

Please complete the form below and return to Louis Nolte. Thank you for your interest in my study.

As the parent or guardian of _____

(Please print your child's name and surname)

- ☐ I grant my permission for my child to participate in this research project. I voluntarily consent to Louis Nolte using any of the data gathered about my child in his study. I fully understand that the data will not affect my child's Judo participation in any way, will be kept completely confidential, and will be used only for the purposes of her research study.
- ☐ I do not grant my permission for Louis Nolte to use my child's data in his research project.

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Signature of Parent/Guardian:_____Date:_____

ANNEXURE B

CHILD ASSENT

PROJECT TITLE

The effect of environmental, psychosocial and personal factors on the performance of elite youth Judo players in South Africa.

WHAT IS A RESEARCH STUDY?

A research study is a method used to discover new information about any given topic. Children do not need to be in a research study if they don't want to.

WHY ARE YOU BEING ASKED TO BE PART OF THIS RESEARCH STUDY?

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You are being asked to take part in this research study because we are trying to learn more about the effect that environmental, psychosocial and personal factors have on your Judo performance at major events. Environmental factors include air quality, altitude, temperature, ambience, noise and lighting. Psychosocial factors include arousal regulation, mental alertness, concentration, self-efficacy, socio-cultural factors and interaction with parents/caregivers, peers, coaches and siblings. Personal factors include sleep and nutritional habits. We are inviting you to be in the study because you are included on Judo South Africa's national ranking list in the under 17 years age category, thus indicating that you are an elite Judo player in South Africa and therefore fit the criteria for this study. An estimated total of 160 male and female Judo players will participate in this study.

CONSENT BY RESEARCH PARTICIPANT

Details of Research Study

Research Title

The effect of environmental, psychosocial and selected physical factors on the performance of elite youth Judo players in South Africa.

Principal Investigator: Louis Nolte

Contact number: 082 907 1341

Subject's Particulars

Name: Surname:

Sex: Female / Male Date of birth _____

dd/mm/yyyy

Signature:

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ANNEXURE C

QUESTIONNAIRE TO DETERMINE THE EFFECT OF ENVIRONMENTAL, PSYCHOSOCIAL AND SELECTED PHYSICAL FACTORS ON THE PERFORMANCE OF ELITE UNDER 17 JUDOKAS IN SOUTH AFRICA

Instructions for completing the questionnaire

1. The questionnaire consists of three sections, please complete all questions.

2. It is important, when replying to each statement, that you are not idealistic. Your answer should reflect your view of yourself as **you really are, not as you think you should, or would like to be**.

3. This questionnaire will only take 20 minutes of your time.

4. The information obtained will only be used for research purposes only.

5. Mark the answer with an X where appropriate.

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SECTION A: BIOGRAPHICAL INFORMATION

1. Do you appear on the current National Ranking List of Judo South Africa?

Yes	No

2. What is your current position on the National Ranking List of Judo South Africa?

1st	2nd	3rd	4th	5th	Not listed

3. Date of birth (for example: 13 / 11 / 1990)

Day	Month	Year

4. Gender

Male	Female

5. ID Number

6. Ethnicity

White	Black	Indian	Asian	Coloured	Other (please specify)

7. Weight category that you compete in:

MALE		FEMALE	
-46		-40	
-50		-44	
-55		-48	
-60		-52	
-66		-57	
-73		-63	
-81		-70	
-90		70+	
90+			

8. Hours Judo training per week on average (e.g. 15 hours):

Competitive season:	Non-competitive season:

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9. Province that you participate for

Kwa-Zulu Natal		Northern Free State		Southern Free State		Eastern Gauteng	
Western United		Central Gauteng		Northern Gauteng		Gauteng Vaal	
Eastern Province		Western Province		Boland		Border	

10. Who motivates you to participate in Judo tournaments (mark all that are applicable)?

	YES	NO
Mother		
Father		
Brothers/Sisters		
Friends		
Judo coach		
Others? Please specify below		

11. Indicate the scale of your relationship with:
(e.g. 0_____x_____10)

Family: 0_____10

Friends: 0_____10

Judo coach: 0_____10

12. Type of school (no fee, fee, scholarships)

Fee (your family pays school fees)	
No fee (your family does not pay school fees)	
Sport scholarship	
Academic scholarship	

SECTION B: SPORTS COMPETITION ANXIETY TEST

Consider each statement below and mark the corresponding box that best describes your experience of the following situations.

	SITUATIONS: I find…	Never	Hardly ever	Sometimes	Often	Always
1.	Competing against others is socially enjoyable					
2.	Before I compete, I feel uneasy					
3.	Before I compete, I worry about not performing well					
4.	I am a good sport when I compete					
5.	When I compete, I worry about making mistakes					
6.	Before I compete, I am calm					
7.	Setting a goal is important when competing					
8.	Before I compete, I get a queasy feeling in my stomach					
9.	Just before I compete, I notice my heart beats faster than usual.					
10.	I like to compete in games that demand considerable physical energy					
11.	Before I compete, I feel relaxed					
12.	Before I compete, I am nervous					
13.	Team sports are more exciting than individual sports					
14.	I get nervous waiting to start the contest					
15.	Before I compete, I get uptight (tense)					
16.	Before tournaments I feel anxious about making my weight category					

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SECTION C: SPORTS MENTAL TOUGHNESS QUESTIONNAIRE

Consider each statement below and tick the corresponding box which you feel most accurately describes how often you experience the following situations.

	SITUATIONS: I find…	Not at all true	Somewhat true	Mostly true	Very true
1.	I can regain my composure if I have momentarily lost it				
2.	I worry about performing poorly				
3.	I am committed to completing the tasks I have to do				
4.	I am overcome by self-doubt				
5.	I have an unshakeable confidence in my ability				
6.	I have what it takes to perform well while under pressure				
7.	I get angry and frustrated when things do not go my way				
8.	I give up in difficult situations				
9.	I get anxious by events I did not expect or cannot control				
10.	I get distracted easily and lose my concentration				
11.	I have qualities that set me apart from other competitors				
12.	I take responsibility for setting myself challenging targets				
13.	I interpret potential threats as positive opportunities				
14.	Under pressure, I am able to make decisions with confidence and commitment				

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SECTION D: VARIABLE ENVIRONMENTAL FACTORS AND SELECTED PHYSICAL ASPECTS

To what extent do the following scenarios have an influence on your performance?

	SCENARIO	Never	Hardly ever	Sometimes	Often	Always
1.	I am able perform at my best in hot (above 30^{o}C) conditions					
2.	I am able perform at my best in cold (below 15^{o}C) conditions					
3.	Low temperatures negatively affect me when I have to spend long periods of time (3 hours or more) waiting in the competition venue					
4.	High temperatures negatively affect me when I have to spend long periods of time (3 hours or more) waiting in the competition venue					
5.	I usually perform at my best when there are many people present in the competition venue					
6.	I usually perform at my best when there are many people supporting me					
7.	I usually perform at my best when there are many people supporting my opponents					
8.	Noise distracts me whilst competing (e.g. announcements over the intercom whilst competing)					
9.	I prefer competing in a relatively quiet venue					
10.	My reactions are fastest in a brightly lit hall					
11.	I perform at my best when I am wearing a white Judo gi					
12.	I prefer competing on yellow Judo mats					
13.	I prefer competing on green Judo mats					
14.	I usually perform worse at a competition venue where the air is dusty					
15.	I take longer to recover when I compete at high altitude venues (e.g. Johannesburg) than coastal venues (e.g. Cape Town)					
16.	I have to cut weight drastically prior to tournaments					
17.	Cutting weight enables me to perform better					
18.	I sleep less prior to important tournaments					

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