

3D IMMERSIVE ENVIRONMENT AS A PSYCHOLOGICAL TRAINING TOOL TO ENHANCE SELF-CONFIDENCE AND REDUCE COMPETITIVE ANXIETY FOR MALAYSIAN VOLLEYBALL ATHLETES

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Abstract

Currently, great emphasis is placed on the development and intervention of psychology in sports in order to address the problem of athletes' failure to achieve peak performance in actual competitions. This problem is primarily due to internal factors, such as anxieties, as well as external factors, such as the high pressure of the competitive environments athletes encounter. In this study, the cognitive anxiety, somatic anxiety and self confidence levels amongst elite and sub-elite Malaysian volleyball players are defined (male sample $n = 50$; female sample $n = 35$; age range between 17 to 25 years). These parameters were measured using the Competitive State Anxiety Inventory (CSAI-2), in which the questionnaires were completed by all respondents 30 minutes prior to the start of a competition. The findings indicated that there was a significant difference ($p < 0.005$) in cognitive anxiety, somatic anxiety and self-confidence among elite and sub-elite Malaysian (male and female) volleyball athletes. According to the findings, the competitive anxiety levels of the sub-elite athletes were higher than the elite, mainly due to the inability of the sub-elite athletes to control their emotions using psychological skills. In order to minimize this problem, a novel approach that involves using virtual reality to reduce the athletes' competitive anxiety was proposed. This approach utilizes a 3D immersive environment that was developed based on the challenging real-world situations encountered during a volleyball match. The design and development of this approach is predicted to enhance athletes' psychological skills, and in turn ensure that they can achieve peak performance under high pressure conditions.

Keywords: Sport psychology, pre-competitive anxiety, 3D immersive environment, volleyball

Introduction

In sports, both psychological and physiological factors play an important role in defining the performance levels for athletes (Schilling & Hayashi, 2001; Grange & Kerr, 2010). Undeniably, in today's development of sports psychology, psychological skills have been considered a crucial element in improving athletes' overall performance. Sports psychology is impossible to be ignored in aiming for optimal performance by athletes, as it plays a great role in enhancing their overall level of performance (Grobbelaar, 2007). Sports psychology involves the combination of the areas of kinesiology and psychology. Moreover, it also involves the study of how psychological factors influence athletes' performance, and the process of how they are affected by psychological and physical features during tournaments (Weinberg & Gould, 2010).

Athletic performance is determined by the level of an individual's physical fitness and skillset, a competition's environmental factors, such as the audience, the competitors (Schmidt & Wrisberg, 2004), and the weather. Anxiety in sports has been exhaustively investigated for many years, as it plays an important role in competitions (Lizuka, Marinovic, Machado, & Vilani, 2005). Meanwhile, sports psychologists reported that athletes' performance could be worsened, and may even result in failure, if they are facing intolerably high anxiety levels during a competition (Hann, 2000). A recent study (Athar & Sampson, 2013) emphasized that competitive anxiety is still considered a critical issue for many athletes. Consequently, positive thinking and better psychological skills are important factors to consider in solving these critical issues, which might help athletes to maintain their performance (Gualberto & Wiggins, 2008).

Pre-competitive anxiety situation will occur when athletes are unable to control their performance or unable to manage their emotions. Pre-competitive anxiety is described as involving negative emotions, and feelings of nervousness and tension caused by the environment, where athletes become debilitating on performance, and in turn are unable to achieve their expectations (Weinberg & Gould, 2010; Raglin & Hanin, 2000). Besides that, pre-competitive anxiety could significantly hinder athletic performance (Tamorri, 2004). If athletes are unable to manage their anxious feelings during competitions, this could lead them to lose control of their emotions, and consequently their performance levels (Tamorri, 2004). Athletes may encounter feelings of anxiety during many situation. They may feel nervous during an encounter with a higher level team opponent. They may feel their heartbeat pumping at an abnormally fast pace prior to a competition. Their movement may change as a result of muscle stiffness during a tournament where the stadium is full of spectators. Due to these particular situations (Jarvis, 2006; Kimberly, 2013) it has been identified that competitions can create an emotional state of anxiety. Most athletes face anxiety not only prior to a competition, but during it as well.

In the past, most coaches and athletes put more emphasis on physical fitness. However, athletes often realize and acknowledge that mental toughness is another crucial element to consider in the process of achieving optimal sporting performance

(Hanton & Connaughton, 2002; Kelly, 2012). Unfortunately, psychological skills training has seldom been emphasized by athletes. Sport psychologists believe that, to coaches and athletes, psychological skills are more important to consider than physical fitness, in order to achieve peak performance (Leunes & Nation, 2006). According to (Gould & Weinberg, 2010), athletes can concentrate better, obtain a higher level of self-esteem, and become more successful during competitions if they habitually utilize psychological skills in sports.

As a result, part of this study is proposed to observe and investigate the state of cognitive anxiety, somatic anxiety and self-confidence among elite and sub-elite Malaysian volleyball athletes.

Background and Related Study

The term “choking” is associated to pre-competitive anxiety, as it refers to a situation in which threatening and tension are increased during a sports event. Although widely used, most athletes, coaches, and media are unclear with choking. Most researchers opined that choking is able to adversely influence athletes’ performance levels (Weinberg & Gould, 2010). Choking has been defined as the inability of an athlete to perform, mainly due to lack of one’s his or her self-abilities, (Masters, 1992) and is considered among the most uncomfortable and embarrassing experiences (Sampras, 2000). Extensive pressure and stress could result in weak performance (Wang, 2002). Pre-competitive anxiety is one of the factors that triggers the decrement of self-confidence and concentration, ultimately leading to athletes’ loss of performance (Mamassis & Doganis, 2004). Besides that, competitive anxiety could influence their decision-making, and lessen their confidence levels in high-pressure circumstances, consequently causing them to fail to perform as expected (Marten, 1990). In support, (Alison, 2006) categorized five factors that trigger pre-competitive anxiety: physical complaints (digestive disturbance, shaking and yawning), fear of failure (losing, choking, making mistakes), feeling inadequate (poor conditions and low ability), loss of control (bad luck and poor weather) and feeling guilty.

Poor performance has always been interrelated with cognitive processing; cognitive thoughts convey the feeling of anxiety through the brain, and gradually weaken the mental ability of an athlete to focus on the important elements during competitions (Eysenck, Derakshan, Santos, & Calvo, 2007). A pilot study by Wilson and Vina (2009) revealed that athletes experienced impaired cognitive processing and could not perform in high anxiety situations. Besides that, Marten (1990) stated that there are many factors to induce pre-competitive anxiety in athletes, such as: fear of failure, lack of confidence and perfectionism. Athletes who faced high pre-competitive anxiety could tolerate higher risk levels during actual competitions (Marten, 2002).

In general, Cox (2002) acknowledged that there are two main types of competitive anxiety in sport psychology: trait anxiety and state anxiety. Trait anxiety refers to anxiety as an aspect of personality (Jarvis, 2006) which involves an experience of anxiety in stressful environments (Filaire, Sagnol, Ferrand, Maso, & Lac, 2001). In this case, an individual tends to view a situation as threatening or risky (Athanasios, 2013).

State anxiety is the feeling of hesitation, stress and fear in extreme situations. This is a direct emotional state (Zeng, 2008), such as fear and tension, in response to a specific situation. State anxiety is a short-term condition; it may increase or decrease, during, or after, a competition (Cashmore, 2008).

In terms of state anxiety, (Zeng, 2008) proposed a multidimensional anxiety theory that involves cognitive anxiety, somatic anxiety, as well as self-confidence. Cognitive anxiety is considered a mental component that is characterized by anxious thought, emotional distress, negative self-talk, worries about performance, images of failure and the inability to concentrate, and is typically accompanied by somatic anxiety (Cashmore, 2008). Somatic anxiety involves the physiological aspects and emotional components of anxiety, and is associated with physical symptoms such as rapid heartbeat, faster breathing, dry throat, high blood pressure, butterflies in the stomach, and muscular tension. The level of somatic anxiety rises prior to state anxiety.

A third component in the multidimensional theory has been characterized as self-confidence, which is a person's belief in his or her abilities (Woodman, 2010). This component is crucial, as its absence could lead athletes to experience both cognitive anxiety and somatic anxiety (Marten, 1990). The level of self-confidence before and during a competition is negatively correlated with low anxiety levels (Besharat, 2011). Besides that, Marten (1990) stated that males display lower cognitive anxiety and higher self-confidence than women. This finding is also in line with another study on swimming (Voslo, 2009); it was stated that females displayed higher levels of somatic anxiety and lower levels of self-confidence than males. In addition, athletes with high anxiety levels encounter debility and performance descent (Woodman, 2010). The anxiety level of athletes is increased when their performance is poor.

On the other hand, Cox (2008) proposed that cognitive anxiety is negatively related to performance, and that the performance level drops when cognitive anxiety is increased. Based on the findings of Pigozzi (2004), amateur athletes have high anxiety conditions and weak performance, and are unable to manage pressure during a competition. In contrast, elite athletes who habitually use psychological skills, such as visualization and feeling in control to motivate or boost-up self-confidence, are better able manage their emotions during a competition. Thus, Pigozzi (2004) concluded that an athlete's skill level is one of the factors to consider in overcoming his or her competitive anxiety condition; Mellalieu, Neil, and Hanton (2006) also supported this finding, and advised that coaches should convey some approaches to athletes to raise their self-confidence levels.

Based on gender, Marten (1990) reported that females exhibit higher cognitive anxiety and lower self-confidence compared to males. Furthermore, in a study that involved 151 young swimmers, Vosloo (2009) explained that females showed higher levels of somatic anxiety and lower levels of self-confidence compared to males. Based on the findings of (Craft, 2003; Besharat, 2011), high self-confidence levels before and during competitions are connected with low anxiety levels.

Mental toughness is the ability to cope with competitive anxiety, act tough and not be affected by opponents (Loehr, 1994 & Jones, 2002); this helps to handle environmental stressors (Fletcher, 2005). Mental toughness is demonstrated by an individual's capability to cope with stress and anxiety during competitive situations (Jones, 2001). A high level of mental toughness gives athletes the ability to handle high-pressure situations in competitions. Hence, the purpose of the current study is to investigate the cognitive anxiety, somatic anxiety and self-confidence levels among elite and sub-elite Malaysian (male and female) volleyball athletes.

Purpose of the study

The purpose of this study is to determine the cognitive anxiety, somatic anxiety and self-confidence levels among elite and sub-elite Malaysian (male and female) volleyball athletes. These underlying factors influence athletes' performance levels, and merit further investigation.

Methodology

Participants

The present investigation was carried out during UTM Open Invitation Games, which was held on May, 2014 at Universiti Teknologi Malaysia (UTM), Skudai, Malaysia. A total of 86 volleyball athletes served as the respondents for this study. Data for the study were collected from male elites (n=25), male sub-elites (n=25), female elites (n=18) and female sub-elites (n=18). The respondents were generally aged between 17 and 25 years.

Research Instruments

The instruments used for this research were the Competitive State Anxiety Inventory (CSAI-2), as well as the demographic information sheet, which includes data about the respondents' age, gender and sports level.

Competitive State Anxiety Inventory (CSAI-2)

The Competitive State Anxiety Inventory (CSAI-2) (Marten, Cox, & Russell, 2003) is the most commonly used instrument to measure competitive state anxiety. It was distributed at the time the UTM Open Invitation Competition took place. It was used to estimate the respondents' cognitive and somatic types of anxieties, as well as their self-confidence prior to the competition. The CSAI-2 consists of 27 questions that involve the evaluation of three subscales, namely, cognitive anxiety (9 items), somatic anxiety (9 items) and self-confidence (9 items). It includes a four-point Likert-scale, where 1 represents *not at all*, 2 represents *somewhat*, 3 represents *moderate*, and 4 represents *very much*. Therefore, overall scores could range from 9 (very low) to 36

(very high), with 9 indicating low anxiety/confidence, and 36 indicating high anxiety/confidence. Previous research for this instrument was found with reliability coefficients between 0.80 and 0.90 for each subscale. The Cronbach's Alpha values for the cognitive, somatic, and self-confidence anxiety were 0.80, 0.83, and 0.87, respectively.

Experiment Procedure

In this study, quantitative data was used to examine the Competitive State Anxiety Inventory (CSAI-2) of athletes who participated in the study. The inventories were given to the selected athletes with various sport levels. In order to ensure that respondents completed the inventories as required, a five-minute session was conducted to explain the purpose of the inventory, and to provide information about the completion of the inventory. All participants completed the inventories 30 minutes prior to the start of their games. The inventories were collected immediately once the participants completed the inventories.

Data Analysis

An independent T-test was used to measure the significant differential between elites and sub-elites based on cognitive anxiety, somatic anxiety and self-confidence. The SPSS version 16 software application was used for statistical analysis.

Findings

This section presents the findings obtained from the data analysis phase.

Table 1: Results from descriptive statistics of cognitive anxiety, somatic anxiety and self-confidence among male elite and sub-elite athletes.

| Component | Level | N | Mean | Std. Deviation | <i>t</i> | sig |
|-------------------|-----------|----|------|----------------|----------|------|
| Cognitive Anxiety | Elite | 25 | 2.57 | 0.34 | 3.15 | .003 |
| | Sub-elite | 25 | 2.88 | 0.36 | | |
| Somatic Anxiety | Elite | 25 | 2.50 | 0.24 | 3.56 | .001 |
| | Sub-elite | 25 | 2.80 | 0.37 | | |
| Self Confidence | Elite | 25 | 2.52 | 0.15 | 3.15 | .003 |
| | Sub-elite | 25 | 2.40 | 0.13 | | |

Table 1 shows the results of cognitive anxiety, somatic anxiety and self-confidence among male elite and sub-elite athletes. Sub-elite athletes had higher mean scores in cognitive anxiety (2.88) and somatic anxiety (2.80) compared to elite athletes, who had cognitive anxiety and somatic anxiety mean scores of 2.57 and 2.50 respectively. Besides that, elite athletes had higher self-confidence compared to sub-elite athletes, with mean scores 2.52 and 2.40. Based on the statistical findings

obtained, there was a significant difference in cognitive anxiety, somatic anxiety and self-confidence between male elite and sub-elite athletes ($p < 0.005$).

Table 2: Results from descriptive statistics of cognitive anxiety, somatic anxiety and self-confidence among female elite and sub-elite athletes.

| Component | Level | N | Mean | Std. Deviation | <i>t</i> | sig |
|-------------------|-----------|----|------|----------------|----------|------|
| Cognitive Anxiety | Elite | 18 | 2.61 | 0.11 | 3.29 | .000 |
| | Sub-elite | 18 | 2.87 | 0.25 | | |
| Somatic Anxiety | Elite | 18 | 2.39 | 0.19 | 3.75 | .001 |
| | Sub-elite | 18 | 2.65 | 0.23 | | |
| Self Confidence | Elite | 18 | 2.46 | 0.13 | 3.2 | .003 |
| | Sub-elite | 18 | 2.29 | 0.18 | | |

Table 2 shows the results of cognitive anxiety, somatic anxiety and self-confidence among female elite and sub-elite athletes. The results indicated that sub-elite athletes had higher mean scores for cognitive anxiety (2.87) and somatic anxiety (2.65) compared to elite athletes, who only had cognitive anxiety and somatic anxiety mean scores of 2.61 and 2.39 respectively. Meanwhile, female elite athletes showed higher self-confidence mean scores (2.46) than sub-elite athletes (2.29). Based on the statistical findings obtained, there was a significant difference in cognitive anxiety, somatic anxiety and self-confidence between female elite and sub-elite athletes ($p < 0.005$).

Discussion

Based on the findings, the cognitive anxiety, somatic anxiety and self-confidence level indicated a significant difference between elite and sub-elite Malaysian male and female volleyball athletes. It can be noted that cognitive anxiety is negatively related to performance; as performance levels drop, cognitive anxiety levels rise (Cox, 2002). It is clear that the cognitive and somatic anxiety levels for elite and sub-elite athletes were higher than their self-confidence levels. Undeniably, self-confidence has been seen as an aspect that can facilitate performance. The manner in which an athlete manages his or her anxiety symptoms prior to a competition could lead to a significant effect on their performance (Dominikus, 2009).

In a previous study by (Shinke & Costa, 2001), it was indicated that competitive anxiety is the reason of reduction in performance, especially in amateur (sub-elite) athletes. Elite athletes have higher motivation and self-confidence due to their ability to control their competitive anxiety through psychological skills, some of which are imagination, self-talk, relaxation (Shinke & Costa, 2001). In contrary, sub-elite athletes experience an incensement of anxiety during competitions, and consequently a lower level of performance. Skill level is essential feature to consider in managing athletes competition stress (Pigozzi, 2004). Talented elite athletes are able to switch their competitive anxiety through psychological skills (such as mental rehearsal, relaxation and self-talk), and exhibit better enthusiasm and self-confidence.

In contrast, amateur athletes experience high anxiety, and unable to manage their anxiety, which leads to poor performance during competitions. Activity level (professional or amateur), type of sport (individual or group-based), as well as competition experience, are important and factors that influence competition anxiety (Pears, 2007).

According to Jones (2002), professional athletes use various types of mental and cognitive skills in order to present their excellent performance confidently. Meanwhile, amateur athletes use mental skills during competitions only to decrease their anxiety and feel relaxed (Jones, 2002). The common sources that cause athletes to lost competitions, and main causes of bad performance, are: lack of experience, concentration, and self-confidence, which in turn decrease performance and create unusual behaviors (Shinke, 2001). Therefore, coaches should maintain applicable strategies in exercise sessions in order to control and modify the tension and anxiety before a competition in a planned and regular manner.

According to the results of (Sotoodeh, 2012), self confidence levels among elite taekwondo athletes were significantly better than sub-elite athletes. These results are in conformity with the results of (Kruger, 2010; Criun, 2009) who stated that self-confidence plays an important role for an elite athlete's performance. Furthermore, Joel (2009) and Cristina (2004) indicated that the nature of sport (individual or group-based), kind of sport, and gender of athletes, are significant factors that affect athletes' performance. Based on a comparison between anxiety and self- confidence according to gender, Vosloo (2009) opined that females demonstrated significantly higher somatic anxiety and self-confidence levels than males.

2nd Stage Design and Development for 3D Immersive Environment

A virtual reality environment is a computer-generated environment that is able to drum up a user's senses and allow him or her to actively interact with it. Virtual reality has been used to describe 3D environment displays, virtual environment technology (VET) and virtual environments (VEs) or immersive environments; all of these terms are referred to as virtual reality. A 3D environment is a computer-generated world seen from a first-person point of view, where the user is able to control the viewpoint (Bowman, 2007). Virtual reality environments (VREs) provide a simulated condition in which the user could feel the "presence" of physically being in it, using a special glove or head mounted device (HMD).

Previously, virtual reality was considered a technology that has broken the grounds of psychological treatments, such as for the acrophobia, social phobias and agoraphobia (North, 1998). Virtual reality technology could help in reducing anxiety levels of patients (Rothbaum, 2006). The high level of realistic simulation in a virtual reality environment is allows users to develop confidence and proper techniques to overcome a similar real-world situation (Smith, 2001). Furthermore, virtual reality can deliver a safety environment in a convenient way for disabled persons to enhance their experiences (Andrea, 1996). According to (Katz, 2005), virtual reality has been used effectively to train astronauts, pilots, and currently, athletes.

Based on (Sorrentino, n.d.), athletes felt that the nervous feeling to participate in the Olympics was decreased after they engaged in the virtual environment of the Salt Lake City Olympic Oval as a sport visualization aid. Two of the athletes pointed out that the virtual environment tools could be useful in improving athletes' abilities to individually visualize the scenario, empowering them to successfully visualize it without disrupting images acting in their mind. To conclude, a virtual environment is able to be used as a regular training tool, and help in improving athletes' visualization.

Moreover, virtual reality also provides the capacity to enhance sport and fitness training quality by creating a realistic environment for athletes. Movements in sports is always complex and lively, and requires a physical space and specialized equipment (Stinson, 2013). Hence, a virtual reality system should be designed based on real-world sports scenarios, and this way, athletes can interact with the virtual environment to engage in practice lessons.

Based on the brief explanation above, using virtual reality as a treatment tool helps to enhance self-confidence and decrease anxiety levels among athletes. Therefore, there is a need for future research on the application of virtual reality in sport psychology, which can be used as a psychological skill training tool. In this study, the development of a 3D immersive virtual reality environment was developed based on real-world situations in volleyball, and was integrated with Paivio's Analytic Model (Paivio, 1985), with the main aim of strengthening athletes' psychological skills.

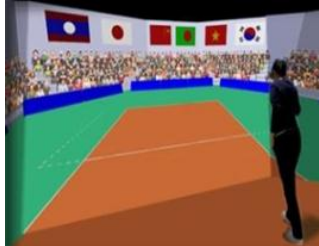


Figure 1: User is required to wear the head-mounted device (HMD) during the intervention of 3D immersive environment sessions.

Conclusion

According to the results of this study, it can be concluded sport level variable is different in cognitive anxiety, somatic anxiety and self confidence level. Therefore, the sport level should be considered as an important factor as it could significantly affect athletes in achieving good performance. These results revealed that elite athletes are able to better manage their emotions during competition. Therefore, it is suggested that coaches and athletes to improve their psychological skills in order to achieve higher level performance and to maintain their competition level. It is not possible to ignore psychological skills in achieving winning. Thus, coaches can be advised to focus on these psychological skills to help their athletes in managing their anxiety feeling.

However, further research is required to determine if utilisation of 3D immersive environment as a psychological tool to help Malaysian volleyball athletes in their multidimensional state-anxiety level.

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