# THE EFFECT OF PROGRESSIVE MUSCLE RELAXATION ON, ANXIETY, MOOD AND DOTA 2 PERFORMANCE

**MOK HUA ANN**

**UNIVERSITI SAINS MALAYSIA**

**2020**

# TITILE: THE EFFECT OF PROGRESSIVE MUSCLE RELAXATION ON, ANXIETY, MOOD AND DOTA 2 PERFORMANCE

by

**MOK HUA ANN**

SUBMITTED IN

FULFILLMENT OF THE REQUIRMENTS FOR

THE MASTER OF SCIENCES (SPORT SCIENCE)

UNIVERSITI SAINS MALAYSIA

**SEPTEMBER 2020**

## ACKNOWLEDGEMENT

There are many inspiring and helpful people who have walked alongside me while I was on my way to complete this research. They have guided me through difficult times and allow me to have a deeper understanding of my capabilities. I always will be indebted to them. Firstly, I would like to express my truthful gratitude to my supervisor, Assoc Prof Dr Garry Kuan Pei Ern, for his continuous support towards my studies with his patience, motivation, and immense knowledge. I could not have imagined having a better advisor and mentor for my study. Having the opportunity to work with Assoc Prof Dr Garry Kuan Pei Ern has been an honour and privilege. I also would like to thank my co-supervisor, Dr Marilyn Ong Li Yin, for providing me guidance and support, which helped to improve my thesis writing. I also would like to thank Dr. Kueh Yee Cheng, for providing guidance in statistical analysis. My sincere appreciation goes to all the staffs and friends in Exercise and Sports Science Programme, School of Health Sciences. I would also like to thank all my research participants who have shown great commitment towards my research and given time from their academic-related commitments to carry out my work in an uninterrupted manner during the movement control order due to the COVID-19 pandemic.

Along with that, I would like to express my gratitude to Universiti Sains Malaysia (USM) for providing me with a platform at the School of Health Sciences to carry out my research smoothly. I would also like to thank the reviewers of this thesis for their valuable comments. At the very end, I would like to dedicate this research work to my most precious possession in life, my family for their love, sacrifices, persuasion, efforts, encouragements, and wisdom without whom I would never have enjoyed the studies without them. Thank you.

Sincerely,

Mok Hua Ann

August 2020

## Table of Contents

## LIST OF TABLES

## LIST OF FIGURES

## LIST OF ABBREVEIATIONS

| | |
|---|---|
| PMR | Progreesive Muscular Relaxation |
| CSAI-2R | Revised Competitive State Anxiety Inventory-2 |
| BRUMS | Brunel Mood Scales |
| GPM | Gold Per Minutes |
| XPM | Experience Per Miunutes |
| DOTA 2 | Defense of the Ancients |
| SOP | Standard Operation Procedure |
| MCO | Movement Control Order |
| MOBA | Multiplayer Online Battle Arena |

## ABSTRAK

Esports telah menjadi fenomena global baru sepanjang tarikan dan pertumbuhan permainan dalam talian yang kompetitif. Persaingan dapat mewujudkan tekanan dan kegelisahan yang tinggi (Ford, Ildefonso, Jones, & Arvinen-Barrow, 2017; Hanton, Mellalieu, & Williams, 2015). Kajian membuktikan bahawa teknik relaksasi otot progresif (PMR) dapat membantu mengurangkan mood negatif, tekanan dan kegelisahan, dan meningkatkan prestasi sukan. Walau bagaimanapun, terdapat kajian yang amat terhad mengenai teknik PMR di esports. Tujuan kajian ini adalah untuk mengkaji kesan teknik PMR terhadap tekanan, mood dan prestasi DOTA 2. Terdapat 15 peserta lelaki yang direkrut, berumur 19 hingga 29 tahun ($M$ = 24.80, $SD$ = 1.474) dan jumlah jam bermain setiap minggu peserta adalah dalam linkungan 4 ke 20 jam setiap minggu ($M$ = 8.40, $SD$ = 4.501). Berdasarkan reka bentuk kajian hantaran silang dengan pra-ujian, intervensi, dan pasca-ujian, Emas Per Minit (GPM) digunakan untuk mengukur prestasi DOTA 2 peserta, sementara, aspek psikologi diukur menggunakan 'Competitive State Anxiety Inventory – 2 Revised (CSAI-2R)' dan 'Brunel Mood Scale'. Hasil dari ANOVA faktorial campuran tidak menunjukkan perbezaan yang signifikan antara kumpulan PMR dan kumpulan kawalan dalam kegelisahan, mood dan prestasi DOTA 2. Kesimpulannya, latihan relaksasi otot progresif (PMR) tidak mempunyai pengaruh yang signifikan terhadap kegelisahan, mood dan prestasi DOTA 2



Kata kunci: Relaksasi otot progresif (PMR), prestasi DOTA 2, kegelisahan, mood

## ABSTRACT

Esports has become a new global phenomenon throughout the attraction and growth of competitive online gaming. Competition can create high levels of stress and anxiety (Ford, Ildefonso, Jones, & Arvinen-Barrow, 2017; Hanton, Mellalieu, & Williams, 2015). Studies had proven that progressive muscle relaxation could help to reduce negative mood, decrease stress and anxiety, and enhance performance. However, there are limited studies conducted on progressive muscle relaxation for esports. This study aims to examine the effect of progressive muscle relaxation on anxiety, mood and DOTA 2 performance. There were 15 male participants recruited, age 19 to 29 years old ($M$ = 24.80, SD = 1.474), and the total hours playing per week of the participant was from 4 to 20 hours per week, ($M$ = 8.40, SD = 4.501). Based on a pre-test, intervention, and post-test with cross-over study design, the Gold Per Minutes (GPM) was used to measure the participant DOTA 2 performance, while the psychological aspects were measured using the Competitive State Anxiety Inventory-2 Revised (CSAI-2R) and Brunel Mood Scale (BRUMS). The result from the mixed factorial ANOVA showed no significant difference between PMR group and control group in anxiety, mood and DOTA 2 performance. In conclusion, progressive muscle relaxation (PMR) training had no significant effect on anxiety, mood and DOTA 2 performance.



*Keywords*: Progressive muscle relaxation, DOTA 2 performance, anxiety, mood

# CHAPTER 1

# INTRODUCTION

## 1.1 Background of study

In the modern technological period whereby, Malaysia is entering into the industrial revolution 4.0; playing the video game is getting common as a medium for leisure activity, especially for children, adolescents and young adults (Entertainment Software Association 2017). Over the past decade, the video game has evolved from the offline single-player game such as Space Marines (1962) and Pong (1972) into a multiplayer online game where different player all over the world play together against the games' non-player enemies or against other players (Bányai, Griffiths, Kiraly & Demetrovics, 2018). Rapidly, the playing video game has become professionalised, and the player even began to choose gaming as their career choice in the competitive gaming world (Faust, Meyer, & Griffiths, 2013; Griffiths, 2017). This professional gaming activity has been known as esports (electronic sports).

South Korean, is a platform where the community of competitive video game began with the rise of popularity of the game such as First-Person Shooter (FPS) games, Massive Multiplayer Online Role Play Game (MMORPG) and Real-Time Strategy (RTS). These contribute to the development of competition in Asia and Western countries (Taylor, 2012; Wagner, 2006). The esports become even more popular after the new released of Multiplayer Online Battle Arena such as DOTA 2 and League of League (LOL) games. This new esports industry has attracted many bigger investors to build up their own team organisation to compete at the tournament and competition. The very first esports event was being organised in 1980 with Atari's Space Invaders Championship. These events have attracted over 10,000 competitors (Klim, 2019). In

2016 The League of Legends World Final was held in front of almost of 20,000 fans at the Staples Centre in Los Angeles with 43 million more viewers watching online (Kennedy & Rozelle,2016) lead to the growth of esports event and audiences. In 2019 international DOTA 2 had created the history to have the bigger price pool of $34 million compared to any other esports game (Pete, 2019).

According to the definition of esports by Wager (2006), he defined esports as "an area of sports activities in which people develop and train mental or physical abilities in the use of information and communication technologies". Besides, Hemphill (2005) address that esports as "alternative sport realistic that is, to electronically extended athletes in digitally represented sporting worlds". Esports can be defined as "an umbrella term used to describe organized, sanctioned video game competition, most often in the context of video game tournament" (Whalen 2013). Overall, it means esports is another sport and very unique that using video game and engaging in game-play (Adamus, 2012).

Esports player usually practises very long hour between 10 to 12 hours a day in front of the computer without moving from the chair (Ozkurt, 2019). Esports lack a level of physical activity, which might affect the stress on the competitor's cognitive abilities. Kuro "Kuroky" Takhasomi, one of the best team leaders in esports stated, "mental preparation is the main part of esports overall… so it's all in the mind… just about being stable" (DOTA 22, 2015). These statements are supported by other sport psychology researchers that in the competition it can create high levels of stress and anxiety (Ford, Ildefonso, Jones, & Arvinen-Barrow, 2017; Hanton, Mellalieu, & Williams, 2015). According to Woodman and Hardy (2003), based on research finding, there is a significant relationship between cognitive anxiety and competitive sport performance. Moreover, in esports competition, OG team has made the first history in

esports to win twice in The International 2018 and 2019 in the DOTA 2 tournament (Ellison, 2019). One of the keys that lead this team to win is having a psychologist working with the team members. The team responded with the help of psychologist the whole team able to remain calm and relax through the game even though making a mistake during the tournament (Ellison, 2019). In conclusion, when a person is highly aroused, he or her performance will deteriorate. Therefore, it is important to teach the esports player to learn to control their arousal level to achieve the optimal level of performance.

## 1.2 Problem statement

According to Lim (2018), Malaysia has the second higher competitive esports team after China. These prove that there are a lot of talented players in the competition and making esports as their career. Yap Jian Wei is one of the Malaysian esports players that has earned U$4.1 million from the International 2018 tournament of DOTA 2. Yet, he even claimed that there are a lot of Malaysia player joining other international teams because Malaysia esports still not a very good platform to sustains their career. A lot of Malaysia esports players were struggling to create their own team and staying as a team. To build up a proper team, it requires a coach, manager, sport psychologist, game analyst, and nutritionist (Lim, 2018). Therefore, Malaysia esports is still in need of a lot of improvement in term knowledge and proper training that help esports player perform better.

There are numerous researches on the effect of relaxation training on sports performance (LaGrange & Ortiz, 2006; Karimian, Kashefolhagh, Dadashi, & Chharbaghi, 2010; Pelka, Ferrauti, Meyer, Pfeiffer, & Kellmann, 2016). It has been proven that relaxation training can help to enhance sports' performance successfully.

Esports consider as a competitive sport similar as the traditional sport which athletes' performance can be affected by the level of stress and anxiety (Ford et al., 2017; Hanin, 2010). However, there is very scarce research conducted on using relaxation on esports performance. Besides, many studies have been conducted on the relationship between Progressive muscle relaxation techniques and sports performance (Kudlackova 2011; Parnabas, Mahamood, Parnabas, & Abdullah, 2014). However, we also found minimal research conducted using the relationship Progressive muscle relaxation on esports performance. One that was found is a qualitative study suggesting that relaxation training is essential for esports athletes, especially during the competition (Himmelstein, Liu & Shapiro, 2017). Therefore, in this present study was to examine the effect relaxation training techniques on esports performance.

### 1.3 Significant of study

There are not many studies conducted for improving the esports performance, especially using the relaxation techniques. Thus, this research can be used as a baseline for future researchers to further improve and explore this topic with other types of psychological variables. Besides, this study can contribute to knowledge as a guideline for the future sport psychologist to use these psychological tools for working with esports players. Besides, based on the literature that relaxation (low beta wave) can help to improve the esports performance. Therefore, by conducting this research, it will provide beneficial information for researchers, coaches, sport psychologists, and even esports players incorporate this relaxation techniques in their training regime. Besides, esports players can also apply this knowledge not only in training but also in their daily life as a coping mechanism tool and to promote personal well-being.

## 1.4 Research question

1. Is there any difference in anxiety level between the progressive muscle relaxation group, and control group?
2. Is there any difference in the mood between the progressive muscle relaxation group and control group?
3. Is there any difference between the progressive muscle relaxation group and control group on the pre- and post-DOTA 2 performance?

## 1.5 Research Objectives

1. To examine the difference of anxiety level between the progressive muscle relaxation group and control group.
2. To examine the difference of mood between the progressive muscle relaxation group and control group.
3. To examine the difference between the progressive muscle relaxation group and control group on the pre and post DOTA 2 performance.

## 1.6 Hypotheses

$H_{01:}$ There is no significant difference between the progressive muscle relaxation group and control group in the anxiety level.

$H_{A1:}$ There is a significant difference between the progressive muscle relaxation group and control group in the anxiety level.

$H_{02:}$ There is no significant difference between the progressive muscle relaxation group and control group in the mood.

$H_{A2:}$ There is a significant difference between the progressive muscle relaxation group and control group in the mood.

$H_{03:}$ There is no significant difference between the progressive muscle relaxation group, and control group on the pre-and-post DOTA 2 performance.

$H_{A3:}$ There is a significant difference between the progressive muscle relaxation group, and control group on the pre-and-post DOTA 2 performance.

## 1.7 Operational definition

**1.7.1 Esports.** Esports is defined as sports events that persons train and develop physical and mental skill, using communication and information technology. Esports also described as a competitive sport using video games, and esports require a lot of mental skills rather physical skill. For the esports game such as DOTA 2, individual skill is determined by the number of killed, death and assist, followed by the Gold Per Min (GPM) and the Experience Per Min (XPM) gain by the character in the game.

**1.7.2 Progressive muscle relaxation (PMR).** PMR is a relaxation technique that uses to control stress and anxiety level such as systematically tensing and relaxing particular muscular group in our body such as, face, hand shoulder, abdomen and leg (Essa, Ismail & Hassan, 2017).

**1.7.3 DOTA 2.** DOTA 2 stand for Défense of the Ancients and is also known as a multiplayer online battle arena (MOBA). In the game, there will be two teams which consisted of 5 members. The goal is to destroy each other base which also known as Ancient and team that destroy their enemies base will count as the winner. Each member of the team will control their own single character or hero. Every single hero has their own special skill or ability. Throughout the game, each player needs to gain gold and experience from the death of enemy units to make their character stronger so the team can defeat the enemy's hero, but the main objective will be the base. Individual performance is determined by the Gold Per Min (GPM) and Experience Per Min (XPM). But in this research, only GPM will be used to determine the DOTA 2 performance because the XPM will stop once the player reaches maximum level, but the GPM will still be counted until the game end. The GPM result can be acquired from the scoring board after the game end.

# CHAPTER 2

# LITERATURE REIVEWS

## 2.1 Esports

Esports has become a new global phenomenon throughout the attraction and growth of competitive online gaming. In 2010, the World Cyber Games (WCG) had successfully gather approximately 450 players from 53 countries, joining across 13 official computer game stages and attracted more than 9.5 million viewers worldwide" (Seo, 2013; World Cyber Games, 2012). The esports audience will continue to grow, and the total number of spectators has increased from 335 million in 2017 to 454 million in 2019 (Pannekeet, 2019). Besides, based on the global revenue growth for esports will hit $1.1billion by the end of 2019, representing a 26.7% year-over-year growth rate compared to the $ 897.2 million in 2018 (Pannekeet, 2019). These esports market will eventually reach 1.8 billion by 2020 (Pannekeet, 2019). Majority of the revenue is contributed by the investment of advertisement, sponsorship, media rights. The rest of the revenue will come from consumer expenditure, ticket, product including the game organisation partnership and organising competition. By investing in esports, it could help to generate the country economically since it involving huge million-dollar industry.

Moreover, esports consider as a competitive sport similar as the traditional sport which athletes' performance can be affected by the level of stress and anxiety (Ford et al., 2017; Hanin, 2010). According to Whalen (2013) stated that esports and traditional sport have similar fundamental issues as their need to control concentration and focus, confidence, arousal level and stress during the competition. There was a qualitative study being done on League of Legend player to identify the mental obstacle usually experience by the esports player in the competition (Himmelstein, Liu

& Shapiro, 2017). Throughout the interview player perceive all these as the challenger that could affect their performance such as trouble performing under pressure, confidence issue, handling harassment, lack of ability to control emotion, mental preparation, inadequate physical, ineffective communication, limited understanding of the game, having difficulty forget the past performance, going on tilt (state of confusion or frustration) and lack of team trust (Himmelstein, Liu & Shapiro, 2017). Then, these eight specific mental skills such as imagery, attentional control, anxiety management, goal setting, energy management, motivation, communication and emotional regulation, were exposed to the subject and then they were required to rate whether is useful or not in the game. Every subject responded that every mental skill was helpful, but 4 out of 5 members thought anxiety management was useful in the competition (Himmelstein et al., 2017).

## 2.2 Effect of arousal on physiological and behavioural

There have numerous studies being conducted on arousal on the physiological biochemical, and behavioural aspects (Perkins et al., 2001). Arousal can be measured through the physiological response of the body such as heart rate, blood pressure brain wave activity, respiration rate, galvanic skin response, hormonal activity and temperature (Kuan, 2014). Physiological arousal in the form of raised systolic blood pressure (Noteboom, Bamholt, & Enoka, 2001) respiratory rate (Landers, 2007) and heart rate (Landers, Qi, & Courtet, 1985), shows changes in both the endocrine system and the autonomic nervous system. Arousal level can affect the biochemical in the brain. Based on the previous study, athletes with high arousal showed a higher level of cortisol level released by the adrenal cortex among the Judo players before the competition compared to athletes with lower arousal level (Salvador, Suay, Gonzalez-Bono & Serrano, 2003). A similar result was found that most of the losing player has

a higher level of cortisol in among the tennis player (Filaire, Alix, Ferrand, & Verger 2009). Moreover, arousal can also be affected on individual behavioural changes such as reduces in attention control, reduces in awareness, reduces in the information process, reduces in body defence mechanism (Beuter, Duda, & Widule, 1989; Higuchi, Imanaka, & Hatayama, 2002; Tanaka & Sekiya, 2010; Yoshie, Shigemasu, Kudo, & Ohtsuki, 2009), decreased (Higuchi, 2000) or increased (Tanaka & Sekiya, 2006) variability of displacement, and improve the reaction time in motor movement which could resulted in increased or decreased of performance (Beuter & Duda, 1985).

Arousal level is significantly related to sport performance (Hanin, 1997; Weinberg & Gould, 1999). According to Oxendine (1970) stated that high levels of arousal provide advantage on maximal strength performance but is also can constrain athletic performance. Other researchers proposed that increasing in arousal level could lead to the deterioration in sports performance (O'Brien & Crandall, 2003). Perkins et al. (2001) stated that high arousal experienced as unpleasant anxiety in the serious state, lead to deteriorating performance, whereby in the playful state, high arousal is likely to be experienced as pleasant involvement or excitement, which may benefit athletic performance (Perkins et al., 2001). Therefore, it is important to understand the athlete's profile and way of regulating their arousal level as a benefit to improve their performance.

## 2.3 Progressive muscle relaxation

Progressive muscle relaxation is commonly used relaxation tool for relaxing athletes. This technique involves tensing up the different parts of the muscular and holding it extremely tenses for a few second then slowly relaxing the muscular (Ampofo-Boateng, 2009). There has been a numerous study on competitive anxiety on sport (Marten, Vealey & Burton, 1990) and the relaxation method (Humara, 2001; Martens, Vealey & Burton, 1990; Richards, 2004). Based on the previous study, the result showed that most of the successful athletes usually practising relaxation techniques compare to less successful athletes. According to Williams (2010), the fluctuation in performance is affected by the fluctuation in athlete's mental ability. Thus, the performance will drop when the athletes lose control on their cognitive control such as the ability to maintain optimal motivation, concentrate and inappropriate aroused (Williams, 2010).

Practising relaxation techniques help athletes improve their performance by increasing concentration, self-confidence, decreasing anxiety and stress, muscular tense and blood pressure (Pragman, 1998; Vincent & Yahaya, 2012; Weinberg & Gould, 2011). Another study conducted on the use of relaxation techniques on different Olympic sport athletes showed a significant reduction on their arousal level and improvement in performance (Pineschi & Pietro, 2013). Study also found that progressive muscle relaxation proven to reduce those negative mood which are tension, fatigue, confusion, anger and depression (Hashim, Hanafi, & Yusof, 2011). Progressive muscle relaxation can help to increase the level of self-awareness (Behncke, 2004). Self-awareness is very important when competing in the higher-pressure competition sport because they provide the advantages in monitoring and

regulating their focus. Therefore, progressive muscle relaxation can help as a coping tool for the athletes to improve their performance.

## 2.4 Theories of anxiety performance relationship

Anxiety usually refers to affect, mood, emotion and stress. Anxiety and arousal use to be considered the same but arousal is a physiological state where a person is highly aroused or lowly arousal. According to Gill and William (2008) stated that competitive state anxiety is caused by arousal when it is perceived as worrisome and unpleasant feeling. Besides that, anxiety consists of cognitive and somatic components. Cognitive anxiety refers to worries, fear of failure and other negative thought. Meanwhile, somatic anxiety refers to the physical response such as muscular tension, sweating, increased heart rate and tremor. Based on previous study, cognitive anxiety is the key factor that can inhibit a person performance during the competition (Gallucci, 2008). There are few theories that discuss the arousal-performance, those are the invented U-hypothesis, Multidimensional anxiety theory, catastrophe theory and individual zone of optimal functioning.

In the invented U-hypothesis, it suggested that the performance will increase when it is on the optimal level of arousal, but the performance will decrease when the arousal is low or high (Gallucci, 2008). The complexity of the task will affect the arousal and anxiety on sports performance. The arousal and performance relationship can be affected by task complexity and individual differences (Landers & Boutcher, 1998). The different sport will have different complexity of the task need different task performance, and different task in sport need different levels of arousal for optimal performance. For example, archery need a low level of arousal compare to weightlifting so the person can aim better on the target before shooting.

For the catastrophe theory will be looking into three aspects, which will be the cognitive anxiety, physiological arousal and performance (Hardy & Parfitt, 1991). When the somatic anxiety is low and the cognitive are high it, the performance will increase, but when both of this somatic and cognitive is higher the optimal performance will drop (Gill & Williams, 2008). Increased in competitive performance will increase the arousal level, which will lead to a decrease in performance. Therefore, once the athletes already achieve the optimal level, they should recover back to low arousal level and try to rebuild their suitable arousal levels (Gill & Williams, 2008).

Lastly, the individualised zone of functioning model (IZOF) suggested that there is not exactly point which mean every individual have their own optimal performance with certain arousal level or anxiety (Raglin & Hanin, 2000). For instance, some people still able to perform well in a large range of anxiety and some other only can perform well when there is a narrow range of anxiety. Based on the previous study conducted on effect of somatic anxiety and cognitive anxiety on swimming performance (Davis & Cox, 2002). The result showed that cognitive anxiety that fell in his or her IZOF zone, show the best performance in their swimming (Davis & Cox, 2002).

## 2.5 Mood on performance

Lane and Terry (2000) define mood as "a feeling, ephemeral in nature, varying in intensity and duration and usually involving more than one emotion". In other words, mood is an unstable emotional status that react to the environment stimulus and it can influence a person exertion either in physical or mental (Gendolla & Krusken, 2001). Study have shown that athletes with positive mood perform better than those athletes with negative mood (Andrew, Peter, Matthew, Barney & Sarah, 2004; Neil, Hanton,

Mellalieu, & Fletcher, 2011). Another study conducted on volleyball player found that the winning volleyball player score higher in positive mood in vigour than the losing volleyball player (Bita, Sarina & Jourkesh, 2015). Therefore, a person with higher vigour demonstrate higher capability in maintain a positive mindset when encountering any difficulty or unexpected situation during the competition. According to Morgan, (1980) he had developed an iceberg profile which mean the ideal mood state for the athletes to achieve higher level in performance. The ideal mood state for the athletes is to have lower level in negative mood such as anger, tension, depression, fatigues and confusion while higher in positive mood such as vigour.

## 2.6 Conceptual framework

This study aims to examine the effect of progressive muscle relaxation on esports performance. In esports, it is important for the athletes to control their arousal properly in order for them to obtain optimal performance. Therefore, the use of progressive muscle relaxation could help the athletes to manage arousal level, which will contribute to the increase of performance.

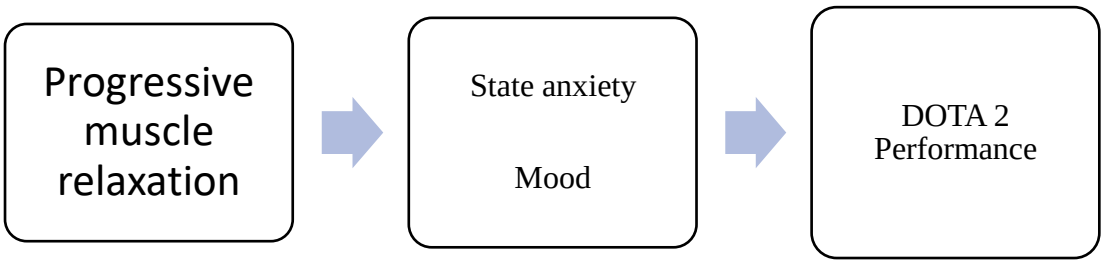


**Figure 2.1** Conceptual framework of study

# CHAPTER 3

# METHOD

## 3.1 Introduction

This chapter discusses the research design, study setting, sample population, sampling method, sample size determination, exclusion and inclusion criteria, measures, data collection procedure, and data analysing procedure that had been used in the present study. The main objective of this study was to determine the effect of using progressive muscle relaxation techniques on esports performance between the intervention group and the control group.

## 3.2 Research Design

This thesis is a quantitative research that involved experimental study know as pre-, intervention, and post-test with randomised cross-over study design to measure the result of DOTA 2 performance predicted by the intervention of 1) Progressive muscle relaxation (PMR) and 2) no intervention (control). In this study, fifteen volunteer participants were recruited using a purposive sampling method through the poster by posting on social media via Facebook. The participants should fulfil the requirement familiar with the DOTA 2 with at-least 100 hours of training before they could take part in this study. The research was a cross-over design using the same participant for both interventions and the control group for pre- and post-test. Then, the participant was assigned using the computer-generated randomisation (randomization.com) to the intervention groups and control group. Next, with counterbalancing the participant were required to complete each condition in a different order. For example, the first 8 participants completed the condition A, then B while the remaining 7 participants completed the B then A. The participants were

required to play DOTA 2, and answer the questionnaires in this research. The first time at the pre-test and the second time at the post-test to observe the differences of DOTA 2 performance (gold per minute in the game) from pre-test to post-test. There were two research conditions, which are 1) Progressive muscle relaxation group, and 2) control group. In this present study, it was started with pre-test, first, the participant was requested to complete the questionnaire and DOTA 2 performance after the pre-test completed it was followed with the intervention. The intervention groups were requested to perform the progressive muscle relaxation while the control groups were requested to watch a short movie. After finished the intervention, post-test was being conducted following the same protocol as per-test, CSAI-2R, BRUMS and DOTA 2 performance were being recorded. All the study was be conducted through online and the participants progression were monitored through the webcam due to the COVID-19 pandemic issue that require all participants to practise social-distancing.

### 3.3 Study settings and period of study

This study was being conducted at the Exercise and Sports Science lab, Kubang Kerian, Universiti Sains Malaysia. The period of study lasted approximately one month with four sessions for the interventions and control conditions. There was a 1-week gap between the different research condition for the purpose of washed off period and 1-week gap are considering a minimum range wash-off period for human subject to reduce the treatment effect from the body (WHO, 2006).

## 3.4 Sample Population

In this study, 15 participants were recruited from the Health campus, Universiti Sains Malaysia were age between 19 to 29. The target population was the DOTA 2 player in Malaysia, and the sampling pool was the DOTA 2 player in Kelantan. The sampling frame was the DOTA 2 player in the health campus, Universiti Sains Malaysia.

## 3.5 Subject Criteria

Purposive sampling method was being used to select participants and self-constructed health questionnaire was being used to identify the participant whether there are mental and physically healthy before participating in this research. There were inclusion and exclusion criteria that need to be fulfil by the participant before they were allowed to participate in this study as a protection of the participants' vulnerability and reducing the dropout rate from the study. The inclusion criteria for the participant were 1) aged between 19 to 29, which is being categorised as young adult (Wein, Pery & Zer, 2010), 2). Individual need to fulfil the minimum requirement at least have 100 hours of experience playing DOTA 2 which can be determine by look at the DOTA 2 account profile, male individual, non-competitive esports athletes. 3) Not practising any other relaxation training such as progressive muscle relaxation, autogenic relaxation or techniques during the study period. The exclusion criteria included the individual who had self-proclaimed to have mental health, neurological, and medical issues were being excluded. Lastly participants who did not attend 70% of the given sessions were being excluded in this study. All participant had the right to withdrawal from the study if they not feeling well during participating the study. An

RM10 incentive were provided to the participant once their completed the study as a token appreciation.

### 3.6 Sample size estimation

The objective was to identify the difference among the three research conditions, which includes a) Progressive muscle relaxation group, and b) control group, on DOTA 2 performance, mood score and anxiety level during pre and post-test. The number of measurements = 4, number of groups = 2. alpha = .05, power = .80, effect size sets as 0.50 (Muangnapoe, Morris, & Kuan, 2016), The sample size calculation for repeated factorial ANOVA repeated measures, within and between interaction was a minimum of 14 participants with the use of G-power version 3.1.9.2. After included the dropout rate 10%, a total sample size of 15 participants was judged to be sufficient to detect the hypothesised differences.

### 3.7 Sample Method

Non-probability sampling was being used in present study. Specifically, the purposive sampling method was used to recruit participants by displaying a poster following the inclusion criteria and exclusion criteria.

### 3.8 Instruments

**3.8.1 Competitive State Anxiety Inventory-2 Revised (CSAI-2R)** was be used to measure state anxiety. CSAI-2R is a revised version from the original version CSAI-2 (Cox, Martens & Russell, 2003). This questionnaire is consisting of 17 items that include three different measurements of subscales for cognitive state anxiety, somatic state anxiety and self-confidence (Cox, Martens & Russell, 2003). There will be 5 items for cognitive state anxiety, 7 items for somatic state anxiety and 5 items for

self-confidence. This questionnaire is using 4-points Likert scale from 1 is “not at all” to 4 is “very much so”. The validity of this test for the Malaysian population is 0.81, and the reliability for different subscales is 0.78 for somatic anxiety, 0.83 for self-confidence and 0.76 for cognitive anxiety. (Hashim & Baghepour, 2016). The scoring system are categories into 3 subscale score and each subscale score is calculated by adding up the score of each item in each subscale, then divided by the number of item and multiply by 10. (Terry, Lane, & Shepherdson, 2005). The scoring range is 10 to 40 which mean 10 indicate low and 40 indicate high for each subscale. In this study only cognitive state anxiety and somatic anxiety score were used to determine the DOTA 2 performance to identify is there any changes in the cognitive state anxiety and somatic state anxiety on pre-test and post-test

**3.8.2 Brunel Mood Scale (BRUMS)** was used to measure mood state of the subject. It consists of 24 item which consist of 6 subscales known as tension, anger, confusion, fatigues and vigour, and depression each subscale consists of 4 items (Terry, Lane, Lane, & Keohane, 1999; Terry, Lane & Fogarty, 2003). These questionnaires are using 5-point Likert scale from 0 represent (not at all) to 4 represent (extremely) to rate on the respond. The total score for each subscale is ranging from 0 to 16. Study had shown that BRUMS is valid and reliable in measuring mood with the Cronbach alpha coefficients ranging from 0.74 to 0.90 (Terry et al., 1999). According to Morgan, (1980) categories mood into positive mood such as vigour and negative mood such as tension, anger, confusion, depression and fatigues. The ideal mood for better performance is to have lower level negative mood and higher level in positive mood.

**3.8.3 DOTA 2 performance.** The game is designed in two teams with five players in each team. The players collect gold (GPM) and experience (XPM) by defeating the opponent character, enemy creeps and destroy the enemy base. In this game, the team that destroyed the enemy base first win. In this study, Gold Per Minute will be used to determine their performance the higher the GPM of an individual, the better the performance indicated better performance. The result can be obtained from the score board after their finish the game and the score board provide all the list detail about the individual score in term of kill, death, assist, Gold Per Minutes and Experience Per Minutes XPM.

## 3.9 Procedure

Participants were recruited by using purposive sampling method, which were within the inclusion and exclusion criteria. After receiving the approval from the Universiti Sains Malaysia (USM) Human Research Ethics Committee, participants were recruited through the poster based on the inclusion and exclusion criteria. Information sheet and informed consent were given to the participants before they involve in the data collection. The participants were required to attend for both PMR intervention group and control group. After, the participant agreed to participate in the research, they were randomly assigned to the intervention group and control group. The study begins with the pre-test where the participant was requested to completed the questionnaire for CSAI-2R, BRUMS and perform single match of DOTA 2. To avoid any confounding variable and to create the similar stimulated competition environment, every participant was facing the similar AI (artificial intelligence) enemy team with unfair difficulty mode. The all the score was written down and key in into the Statistical Package for Social Sciences (SPSS). Once the pre-test was completed, it was directly followed by the intervention. For the intervention group, they were

requested to perform 1 session of PMR. The intervention for PMR which include 16 group of muscle was used and it was been conducted using verbal PMR recording. The participant was required to listen and follow the instruction from the recording by tensing the muscle for 5 second then follow by 10 second of relaxing from top to bottom of the body. The estimate duration for one PMR session was lasted around 15 minutes. On other hand, the control group, was not been given any training but they were asked to watch a short movie while waiting for the post-test. Then, post-test was carried out directly, follow the same protocol as pre-test all CSAI-2R, BRUMS and DOTA 2 performance were assed again. Each condition session was lasted around 1 hour because the subject was required to perform twice for pre-test and post-test for the DOTA 2 performance. There was a one-week gap between the different condition. Throughout the PMR session, the participants were being monitor by us through the WEBEX to ensure the participant was doing the step correctly, however there were few participants does not allow us to monitor them through the WEBEX therefore, a short PMR video was being provided to guide them to perform the PMR accurately.

The data collected was kept safely in the computer with an external drive for backup using a coded numbering system. Then, the data was been further analysed with Mixed factorial ANOVA in SPSS. The result was then be documented.

### 3.10 Data collection

Data collection was done through observe and record, and collection of completed questionnaire for CSAI-2R, BRUMS and demographic form.

### 3.11 Data management

The collected data was remained confidential between the researcher for at least three years from the completion of the research. Data softcopy files was also be backed up in an external drive to confirm the safety and avoiding any unwanted loss of data. Only coded data was been stored, and no name was reviewed in the storage file.

### 3.12 Ethical consideration

Before data collection, the proposal received the ethical clearance from the Universiti Sains Malaysia (USM) Human Research Ethics Committee (JEPeM) to ensure that the result in this study was valid, ethical, and was not provide unwanted consequences to the community and society. The study conformed to the guidelines of the International Declaration of Helsinki.

### 3.13 Vulnerability

Participants were selected from the poster and was not been forced to participate in this study. Only interested participants volunteered themselves to participate in this study.

### 3.14 Conflict of interest

There was not conflict of interest in this study

### 3.15 Privacy and confidentiality

All the information and data of the participants were remained confidential. This data can only assess by myself and my supervisors of this project. Data was presented as grouped data and the identity of the respondent was not been reported.

### 3.16 Community Sensitivity and benefits

The participants involved in this study include young adult in the age range of 19 to 29. Participants were asked to understand the study thoroughly and signed the consent form before proceeding to the study data collection. The benefits to participate in this study includes 1) relaxation training can helped to reduce their muscular tension, reducing fatigue and anxiety, 2) relaxation training can help to improve their muscular coordination, improve concentration and to reduce the level of cortisol hormone released in response to stress. 3) Next, this training not only provides benefit in esports but also in their daily life which can helped to improve the participants' quality of life. For example, practising relaxation can helped reduce the blood pressure, improved sleep, and also their physical activity when doing the progressive muscle relaxation. During the data collect, the participant might experience some common risks that was related to DOTA 2 playing such as getting fatigue and increased in anxiety level due to the nature for the esports. The participant might feel distress due to the unexpected performance or unable to perform well in DOTA 2. To reduce this risk, participant is advised to have enough rest the day before the session.

### 3.17 Honorarium and incentives

An incentive was be provided to the participant as a token of appreciation for their participation in this study.