

**EFFECT OF VIRTUAL REALITY HEADSET
TOWARDS ANXIETY AND KICK SERVE
PERFORMANCE AMONG SABAH
MSSM MALE TENNIS PLAYERS**

SUBRAMANIAM A/L SOORINARAYANAN

SULTAN IDRIS EDUCATION UNIVERSITY

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SERVE PERFORMANCE AMONG SABAH MSSM MALE TENNIS PLAYERS**

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ABSTRACT

This study examined the effectiveness of using Virtual Reality (VR) Headset Gear to reduce anxiety among male Sabah MSSM tennis players during the execution of a kick serve. A quasi-experimental design was utilized, comprising three phases: needs analysis with 26 coaches, validation by 10 experts, and an assessment of 40 male MSSM tennis players, 14 and 17 years old. The research instruments included the Competitive State Anxiety Inventory-2R (CSAI-2R) for measuring anxiety levels, the Sports Imagery Ability Measure (SIAM-M) for assessing mental imagery related to the kick serve, and the Relaxation State Questionnaire (RSQ) to evaluate relaxation levels. Results from the needs analysis indicated that 63.34% of the coaches agreed or strongly agreed on the potential benefits of VR in enhancing the training environment, with a mean score of 3.63 (SD = 1.22). Expert validation of the VR-based Psychological Mental Training Assessment demonstrated high reliability, achieving an overall mean of 4.31 (SD = 0.321). The pre-test mental imagery ability scores showed no significant difference between the control group and treatment group, indicating homogeneity prior to the intervention. Following the intervention, serve performance and anxiety levels showed significant improvement in the treatment group, with substantial increases in serve performance scores and decreases in anxiety levels, while relaxation levels remained stable. Statistical analysis confirmed that the VR-based mental imagery training produced significant improvements across mental imagery ability, serve performance, anxiety, and relaxation, $F(6, 33) = 11618.493$, $p < 0.05$. These findings suggest that VR-based mental imagery training can be a valuable tool for reducing anxiety and enhancing performance in sports. This technology offers an immersive and controlled environment that helps athletes practice mental skills more effectively, potentially leading to improved mental readiness and focus in high-pressure situations.





KESAN HEADSET REALITI MAYA TERHADAP ANXIETY DAN PRESTASI “KICK SERVE” DALAM KALANGAN PEMAIN TENIS LELAKI MSSM SABAH

ABSTRAK

Kajian ini mengenal pasti keberkesanan penggunaan alat *Headset* realiti maya dalam mengurangkan kebimbangan semasa melaksanakan *kick serve* atau teknik servis dalam tenis yang menghasilkan lantunan tinggi selepas bola mendarat dalam kalangan pemain tenis lelaki MSSM di Sabah. Reka bentuk kuasi eksperimen telah digunakan, yang terdiri daripada tiga fasa: analisis keperluan dengan 26 jurulatih, pengesahan oleh 10 orang pakar, dan penilaian ke atas 40 pemain tenis lelaki MSSM, yang berumur 14 dan 17 tahun. Instrumen kajian adalah *Competitive State Anxiety Inventory-2R* (CSAI-2R) untuk mengukur tahap kebimbangan, *Sports Imagery Ability Measure* (SIAM-M) untuk menilai *mental imagery* berkaitan servis, dan *Relaxation State Questionnaire* (RSQ) untuk menilai tahap relaksasi. Hasil daripada analisis keperluan menunjukkan bahawa 63.34% jurulatih bersetuju dan sangat bersetuju dengan manfaat potensi *Virtual Reality* (VR) dalam meningkatkan persekitaran latihan, dengan skor purata 3.63 (SD = 1.22). Pengesahan pakar terhadap Penilaian Latihan Mental Psikologi berasaskan VR menunjukkan kebolehpercayaan yang tinggi, mencapai purata keseluruhan 4.31 (SD = 0.321). Skor kemampuan *mental imagery* sebelum ujian tidak menunjukkan perbezaan ketara antara kumpulan kawalan dan kumpulan rawatan. Dengan peningkatan substansial dalam skor prestasi servis dan penurunan dalam tahap kebimbangan, sementara tahap relaksasi kekal stabil. Analisis statistik mengesahkan bahawa latihan *mental imagery* berasaskan VR menghasilkan peningkatan yang signifikan dalam kemampuan imejan mental, prestasi servis, pengawalan kebimbangan, dan relaksasi, $F(6, 33) = 11618.493, p < 0.05$. Dapatan ini mencadangkan bahawa latihan *mental imagery* berasaskan VR boleh menjadi alat yang sesuai untuk mengurangkan kebimbangan dan meningkatkan prestasi dalam sukan. Teknologi ini menawarkan persekitaran yang mendalam dan terkawal yang membantu atlet mengamalkan kemahiran mental dengan lebih berkesan, berpotensi meningkatkan kesiapsiagaan mental dan fokus dalam situasi tekanan tinggi semasa bermain.



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LIST OF ABBREVIATIONS

CBT	<i>Cognitive Behavioral Therapy</i>
CSAI-2R	<i>Competitive State Anxiety Inventory-2 Revised</i>
GAD	<i>Generalised Anxiety Disorder</i>
IN	<i>ITF International Number</i>
ITF	<i>International Tennis Federation</i>
LTAM	<i>Lawn Tennis Association Malaysia</i>
MSSM	<i>Malaysian School Sports Council</i>
MST	<i>Mental Skill Training</i>
PMR	<i>Progressive Muscle Relaxation</i>
PMT	<i>Psychological Mental Training</i>
PTSD	<i>Post Traumatic Stress Disorder</i>
RSQ	<i>Relaxation State Questionnaire</i>
SIAM	<i>Sport Imagery Ability Model</i>
VR	<i>Virtual Reality</i>





CHAPTER 1

INTRODUCTION



Tennis, as a sport, demands a high level of skill and mental resilience. Anxiety has been identified as a significant factor influencing sports performance, and addressing it becomes crucial for tennis players to achieve their full potential. The kick serves, a specialized tennis serve, adds a layer of complexity to the performance, requiring precision and technique. The unique geographical and cultural context of Sabah, Malaysia, may introduce additional factors that impact anxiety levels and performance among male tennis players in this region. Therefore, there is a compelling need to explore and understand how relaxation techniques, video modelling, and mental imagery, implemented through virtual reality (VR) technology, can collectively influence anxiety levels and kick serve performance in this specific demographic.





The research on the effect of relaxation techniques on anxiety and kick serve performance among tennis players is an area that has not been extensively explored. While there is a considerable body of literature on the psychological aspects of sports performance, there is a noticeable gap in the specific investigation of relaxation interventions and their impact on the performance of a specialized tennis skill like the kick serve. Existing studies may touch upon anxiety management or performance enhancement in general, but few delve into the nuanced relationship between relaxation, anxiety, and the execution of a specific tennis technique. This gap is crucial to address as the kick serve is a complex skill that requires precise coordination and mental composure.

One possible reference supporting this research gap is a study by (Weinberg & Gould, 2019), which provides an overview of psychological skills training in sports. While they cover various aspects of mental skills training, the specific connection between relaxation techniques, anxiety reduction, and tennis performance may not be thoroughly explored. Additionally, a study by Robazza et al. (2018) examines anxiety and coping strategies in tennis players, but it may not specifically address the impact of relaxation interventions on a particular tennis stroke. In recent study by Bühlmayer et al. (2019) investigated the effects of mindfulness-based interventions on athletic performance, including specific motor skills in sports like tennis. Their findings suggest that such interventions can positively influence performance by enhancing attentional control and reducing anxiety. These references highlight the need for more targeted research investigating the role of relaxation in addressing anxiety and enhancing the kick serve performance among tennis players.





The examination of the effect of video modelling on anxiety and kick serve performance in tennis players represents an underexplored area in sports psychology research. While studies have investigated the influence of various psychological interventions on sports performance, there is a noticeable gap when it comes to understanding how video modelling, a technique where athletes observe and imitate successful performances on video, can impact both anxiety levels and the execution of a specific tennis skill like the kick serve. Existing literature may touch upon video modelling in general, but the specific relationship between this method, anxiety reduction, and enhanced performance in the context of a specialized tennis stroke remains largely unexplored.

One relevant reference underscoring this research gap is a study by Cumming and Ste-Marie (2021), which delves into the effectiveness of video modelling in skill acquisition and performance in sports. However, this study may not specifically focus on the kick serve in tennis or its impact on anxiety levels. Additionally, a study by Weinberg et al. (2019) explores the use of video modelling in enhancing performance, but the anxiety aspect and its connection to a specific tennis stroke may not be thoroughly addressed. These references highlight the need for more targeted research investigating how video modelling can be employed to alleviate anxiety and enhance kick serve performance among tennis players.

According to the report from the MSSM Technical Officer of Sabah Tennis, En Mansor Mohd Noor, the Sabah state tennis players have not reached the second round of MSSM interstate tennis tournament organize by the Education Ministry of Malaysia and Malaysian Sports Council for the past four years since 2015. Sabahan players has





been trained well physically by the coaches and naturally has strong cardiovascular and muscle strength. He again asserted that the Sabahan players are lacking in mental preparation. All the coaches have never been given psychological mental trainings for the Sabah tennis players. Even though the players able to excel well in Sabah Tournaments, but fails to win at interstate level. The feedback that the coaches and technical officer got from each of the players is, nervousness, worries, cold sweats and stiff muscles during playing. When the players are encounters these symptoms, they are unable to perform to their level best.

Psychology is the study of the mind while Sports Psychology is the scientific study of people and their behaviours in sports. Mental strength is an important factor for improving performance for all competitive athletes. Many coaches are aware of this importance but they hardly know how to apply these mental training skills during trainings for their players. It's a great hope this study will bring great improvement in uplifting the mental strength among tennis players. Since the coaches have been training the players well for skills and physical fitness, the mental training will be added advantage to balance the players mentally and physically. Subsequently, this study will be done at major tennis academies in state of Sabah, I believe even the school coaches will benefits from this research. The mental preparation in tennis is very much needed for this current situation to improve the performance of the players. Despite training hard and playing competitive tennis, continuous losing at national level MSSM tournament will lead players to burn out mentally. It's the right time to impose the mental preparation with proven sports psychological skills by the coaches for the Sabah Tennis elite players in enhancing their performance while overcoming the anxieties'.





1.2 Background of Study

Tennis is a sport that demands a combination of physical prowess and mental acuity for success, (Kremer et al., 2019). Among the various skills required, serving accurately and powerfully holds particular importance. The kick serves, in particular, presents a challenge to athletes due to its intricate mechanics and the need for precise timing. In an effort to enhance the kick serve performance of Sabah MSSM male tennis players, this essay delves into the potential impact of relaxation techniques, video modelling, and mental imagery when integrated with virtual reality (VR) headsets. These approaches have the potential to yield significant effects on kick serve performance among these players. Relaxation techniques can effectively mitigate anxiety and bolster focus, while video modelling enables players to visualize and replicate correct techniques. Mental imagery exercises enhance skill execution by fostering vivid visualization. By combining these methodologies with VR technology, athletes can partake in immersive and lifelike training experiences. Further research and practical application of these methods will help ascertain their efficacy in enhancing kick serve performance, consequently contributing to the development of comprehensive training protocols for Sabah MSSM male tennis players and beyond.

Current science and technology developed era, sports circles have penetrated into enhancement of science technology with modern day athletes are struggling to improve and attain success in their choice of game. Developments in technology and technique have allowed today's athletes to perform at a higher level than their successors (Berge & Krueger, 2018).





1.2.1 Sports Science

Sports science has played a bigger role recently in enhancing athletic performance. Sports science is a multidisciplinary discipline that incorporates physiology, biomechanics, nutrition, and psychology. It has been used to develop training regimens, improve technique, lower the risk of injury, and hasten recovery times. The creation of training regimens is one area where sports science has had a significant impact. Sports scientists can create training plans that specifically target the physiological and biomechanical requirements of a sport by studying the sport's demands. Soccer players' sprint performance, agility, and power output were all enhanced by a 12-week resistance training regimen (Silva et al., 2018).



Sports technique has benefited from the application of sports science. For

instance, biomechanical analysis can be used to pinpoint parts of a player's technique that can be strengthened to increase performance. Spotting technical shortcomings in young tennis players, and corrective activities enhanced their performance (Kostopoulos et al., 2017). Injury prevention is another area in which sports science has been influential. By understanding the causes of sports injuries, sports scientists can develop strategies to reduce the risk of injury. Neuromuscular training program, designed to improve balance and control, reduced the risk of knee injuries in female soccer players (Emery et al., 2019).

Sports science has also been used to optimize recovery after exercise. By understanding the physiological processes involved in recovery, sports scientists can develop strategies to accelerate the recovery process. Consuming a protein-rich





beverage after exercise improved muscle recovery and reduced muscle soreness (Rowlands et al., 2017). Sports science has been used to enhance mental performance in sports. By understanding the psychological factors that influence performance, sports psychologists can develop strategies to improve mental toughness, focus, and confidence. A mental skills training program, designed to improve athletes' attentional control, significantly improved their shooting accuracy in basketball (Beckmann et al., 2020).

1.2.2 Sports Psychological Skills

Psychological skills have long been known as being critical and important for the performance of athletes and their success in any sport. Sport psychologists learn skills that help and inspire athletes to develop their teaching procedures and build strategies for high performance, to handle competitive processes, fine-tune the required level of awareness to reach optimal performance, and to maintain their concentration amidst a lot of distractions in a competitive environment.

Sport contribution has long been assumed as a means for youth and adolescents to develop fundamental psychological characteristics such as self-confidence, interpersonal abilities, and emotional control (Hardy et al., 2018), yet most MST programs have been focused on the improvement and measurement of youth athletes' athletic performance. The programs should aim to help both youth athletes' athletic and psychosocial development (Camire, 2018).





1.2.3 Mental Training Tools

Mindfulness meditation is one of the most widely used methods for mental training. Studies have demonstrated that mindfulness meditation improves cognitive function and reduces stress, anxiety, and depression (Tang et al., 2017). It is possible to practise mindfulness meditation in many different methods, such as through breathing exercises or body scanning, and it entails paying attention to the present moment without passing judgement. Cognitive-behavioural therapy is an additional efficient method of mental training (CBT). CBT is a form of talk therapy that assists people in recognising and altering unfavourable thought patterns and behaviours that contribute to mental health conditions including anxiety and depression (Hofmann et al., 2017). CBT has been demonstrated to be useful in enhancing mental health outcomes and can be practised in-person or online. Virtual reality (VR) is a relatively new method for increasing mental performance that has demonstrated promising effects. By exposing patients to virtual scenes that trigger their anxiety or trauma in a secure and controlled environment, VR has been used to treat phobias, anxiety disorders, and post-traumatic stress disorder (PTSD) (Lindner et al., 2017). VR has also been utilised to help athletes feel less stressed and anxious while improving cognitive function.

Another method for mental exercise is biofeedback, which has been around for a while but has lately been improved by technology. In order to teach people how to control their stress responses, biofeedback includes monitoring physiological responses, such as heart rate variability or skin conductance, and giving them immediate feedback (van der Zwan et al., 2015). Both wearable technology and smartphone apps can be used for biofeedback. Mental training techniques have





developed quickly in recent years, giving people a variety of possibilities to enhance their performance and mental health. The numerous useful methods for improving one's mental fitness include mindfulness meditation, cognitive-behavioural therapy, virtual reality, and biofeedback, to name just a few. To attain the best results for their mental health, people should identify the mental training method that suits them and include it into their daily routine.

1.2.4 Goal Setting

Goal setting is important for athletes because it helps them concentrate their efforts on achieving specific goals. Setting difficult but realistic goals can boost motivation, enhance performance, and raise the likelihood of sporting success, according to study (Locke & Latham, 2019; Feltz, Short, & Sullivan, 2021). Setting both short-term and long-term objectives can also help an athlete feel like they are making progress and give direction to their training and competition strategies (Hatzigeorgiadis et al., 2020). Ultimately, setting goals can help athletes attain their objectives and enhance their entire sporting performance. A study was done to see effects of goal setting on college athletes about motivation, confidence, and performance. The study found that goal setting led to improvements in motivation, confidence, and performance, particularly in athletes who set more challenging goals. (Weinberg, 2014). Another study was done to see the effectiveness of a goal-setting intervention on basketball players' free-throw shooting performance. The study found that the goal-setting intervention led to significant improvements in free-throw shooting performance compared to a control group. (Biggs, 2016).





1.2.5 Mental Imagery

Imagery is also called visualization or mental rehearsal. Imagery techniques involve a wide range of strategies to improve motor learning, enhance performance in sports and increase motivation (Callow et al. 2013, 2016; Gregg et al. 2016). Sports players use mental imaging, commonly referred to as visualisation, as a cognitive strategy to enhance their performance. By the use of mental imagery, athletes can practise particular acts, motions, and scenarios in their minds' eyes, which can boost their confidence and sense of readiness before competitions (Cumming & Ramsey, 2019; Williams & Cumming, 2022).

According to research, mental imagery can help athletes stay motivated, pay attention, and concentrate while also encouraging the acquisition of new abilities and tactics (Munroe-Chandler et al., 2020). Additionally, it has been discovered that mental imagery is a useful tool for athletes recovering from injuries as it can help with the healing process (Moran & Williams, 2021). In general, using mental images is a useful strategy for athletes wanting to enhance their performance and get beyond mental obstacles

1.2.6 Relaxation in Sports

Relaxation exercises, meditation, and progressive muscle relaxation are a few of the strategies that might help you relax. Relaxation is a condition of physical and mental calmness. Recent studies have shown that relaxation techniques can improve sleep





quality, lower blood pressure, and reduce stress and anxiety, among other health advantages. Also, it has been demonstrated that relaxation improves mood, cognitive function, and general well-being. Studies reveal that relaxing may stimulate the parasympathetic nervous system and boost activity in brain regions linked to good emotions.

Ultimately, learning how to relax is an effective way to improve both your physical and mental health. Studies have also investigated the neural mechanisms underlying relaxation, with findings suggesting that relaxation may activate the parasympathetic nervous system and increase activity in brain regions associated with positive emotions (Tang et al., 2019). Furthermore, relaxation techniques have been shown to be effective in reducing symptoms of certain mental health disorders, such as depression and anxiety (Hoge et al., 2018).

Relaxation techniques are one of the most effective ways to manage anxiety and stress. They help to reduce muscle tension, slow down breathing, and calm the mind. There are various relaxation techniques that can be used to manage anxiety, including progressive muscle relaxation, deep breathing exercises, meditation, yoga, and visualization. Progressive muscle relaxation is a technique that involves tensing and relaxing different muscle groups in the body. This technique has been shown to be effective in reducing anxiety and stress levels in individuals with anxiety disorders (Keller et al., 2021).

Deep breathing exercises involve slow and deep breathing, which helps to slow down the heart rate and reduce anxiety and stress (Harris et al., 2019). Meditation





involves focusing the mind on a particular object or thought to calm the mind and reduce anxiety (Cramer et al., 2021). Yoga combines deep breathing, stretching, and meditation to help reduce anxiety and stress levels in individuals with anxiety disorders (Joshi et al., 2019). Visualization involves imagining a calming and peaceful scene, which helps to reduce anxiety and stress levels (Ponte et al., 2021).

1.2.7 Video Modelling in Sports

Video modelling has become a key element in modern sports training and skill acquisition, helping athletes perform better and learn faster. Athletes can watch recorded videos of themselves or others performing particular abilities or techniques repeatedly in order to internalise and duplicate these moves. This is known as video modelling. Drawing from the ideas of observational learning, this approach has been popular in a variety of sports because it works well for improving technique, tactical understanding, and overall performance. Video modelling has a built-in benefit for athletes: it may provide them with visual examples of how to execute specific skills. Studies highlight the fact that visual learning can be just as successful as verbal instruction, if not more so, when it comes to activities requiring complex

Video modelling also makes it easier to do thorough analysis and feedback, which is essential for sports players to keep getting better. Video recordings are utilised by coaches and athletes to thoroughly examine performances and identify areas that require improvement. This analytical method helps find tactical or technical shortfalls that could go unnoticed in real practice sessions. In tennis, for instance, players can use





video modelling to analyse their serves frame-by-frame and modify their stance or grip to increase the force and accuracy of their strokes on the court. Additionally, video modelling strengthens athletes' ability to visualise, which improves their mental preparation. According to Cumming and Ramsey (2009), visual imagery is a fundamental component of mental rehearsal and has a substantial impact on athletes' confidence and performance during competitive pressure. Athletes cement their knowledge by repeatedly visualising their successful performances, which is made possible via video modelling.

1.2.8 Self-Talk in Sports

Research studies on self-talk have increased significantly over the past 20 years (Hardy, Comoutos, & Zourbanos, 2018) Beyond sport psychology, self-talk has also been considered an important aspect in other areas of psychology. For instance, self-talk has been linked to the treatment of emotional disorders, with special focus on anxiety (Kendall et al., 2016). They say there's nothing wrong with talking to yourself, but when you start answering back, it's time to worry. Self-talk, or one's internal monologue, is a fundamental component of sports psychology. It can be characterised as the words, expressions, or declarations that athletes make to encourage themselves or control their moods, thoughts, and actions during workouts or tournaments. It has been demonstrated that self-talk, which can be either positive or negative, significantly affects an athlete's performance, frame of mind, and confidence (Van Raalte, Brewer, Rivera, & Petitpas, 2016).





Recent research has revealed that using encouraging self-talk can improve athletic performance. In a study, it was discovered that positive self-talk had a significant impact on runners' endurance abilities, (Abdoli & Mullen, 2017). In this study the participants were told to talk to themselves positively while running for 5 kilometres. The findings demonstrated that individuals who engaged in constructive self-talk fared better than those who did not. Similarly, positive self-talk was found to assist collegiate swimmers perform better in a study (Van Raalte et al, 2018).

1.2.9 Stress in Sports

Athletes frequently suffer stress, which can be harmful to both their overall health and physical performance. Many stress-reduction strategies used in sports, such as mindfulness meditation, cognitive-behavioural therapy, and relaxation training, have been studied in detail (Kranz & Fuchs, 2020). These methods have been proven to be successful in lowering stress and enhancing athletic performance. Athletes may also benefit from goal-setting, positive self-talk, and social support, according to studies (Kranz & Fuchs, 2020). It is significant to remember that several factors, such as performance expectations, injuries, and pressure from coaches and teammates, can cause stress in athletes. As a result, by giving tools and assistance, coaches and other support personnel can play a critical role in aiding athletes in managing stress (Kranz & Fuchs, 2020).





1.2.10 Anxiety

Anxiety is one of the most feared by athletes and people react to environmental stressors in different ways, particularly in terms of emotional experiences like multidimensional state anxiety that unfold over time. Athletes often feel anxiety, which can be detrimental to both their overall health and physical performance. Anxiety can lower self-confidence, affect motor function, and raise the chance of injury, according to research (Nieuwenhuys & Oudejans, 2018). Additionally, anxiety can influence the emergence of some mental health conditions, including social anxiety disorder and generalised anxiety disorder (Wadey & Evans, 2019).

A number of therapies, like as relaxation techniques, cognitive behavioural therapy, and goal-setting, have been suggested to assist athletes in managing their anxiety (Nieuwenhuys & Oudejans, 2018). Athletes' anxiety has been found to be reduced by mindfulness meditation (Kuehl & Elliot, 2019). Social support has also been found to be a key component in helping athletes manage anxiety (Wadey & Evans, 2019). It is crucial that coaches and support staff are aware of how common anxiety is among athletes and that they offer resources and assistance to help them manage their anxiety. By addressing anxiety effectively, athletes can improve their performance and overall well-being.

Many factors, including genetic predisposition, stressors in the environment, and cognitive processes, might contribute to somatic anxiety. According to research, people with a family history of anxiety disorders may be more prone to developing physical symptoms (Fonseka et al., 2020). Moreover, stressful life events might cause





somatic symptoms in people who are predisposed to anxiety, such as relationship problems or work stress (Hinz et al., 2017). Somatic anxiety can also be influenced by cognitive variables including panic and catastrophic thinking. The term "hypervigilance" describes a condition of increased vigilance and sensitivity to prospective hazards, which can heighten anxiety and cause physical symptoms (Robinaugh et al., 2017). Imagining the worst-case scenario in a circumstance is known as catastrophic thinking, which can also raise anxiety and cause physical symptoms (Asmundson et al., 2019).

1.2.11 Virtual Reality in Sports

Sports are rapidly utilising virtual reality (VR) technology to improve performance, training, and recovery. VR enables athletes to practise certain talents, recreate realistic game conditions, and sharpen their decision-making skills (Chen, Jin, & Li, 2020). Also, by giving athletes an immersive environment to reclaim their confidence and enhance their motor abilities, VR has been used for injury prevention and rehabilitation (Wang, Ruan, Zeng, & Tang, 2022).

VR can be used in sports to improve training and performance. The use of virtual reality (VR) can offer athletes a secure and regulated environment to hone particular abilities, such free throws in basketball or penalty kicks in soccer (Chen et al., 2020). In a low-stress setting, this enables athletes to hone their talents and apply them in actual game scenarios. Furthermore, athletes can make modifications and enhance their technique thanks to VR's fast feedback on performance. VR can also be used in sports





to improve players' pregame planning and decision-making skills. VR simulations can be used to simulate game scenarios and teach athletes how to react quickly and accurately (Chen et al., 2020). This can enhance gaming performance and lower the probability of mistakes and bad choices.

1.3 Problem Statement

The tennis mental game consists of physical strength and mental fitness. No matter how skilful a player is, physically winning a tennis match can still be out of your reach if the mind is not conditioned. Mental tennis strength is a crucial attribute to be a winning tennis player. Not only does a player require the skills and necessary technique, but winners must also possess mental tennis ability. Developing the mental strength is very important in every tennis match. No matter how good a player is in every physical attribute in a match, the chances of winning matches are limited if the mental strength is weak. Mental strength means the ability to focus on every single match and every single point without a lapse. Hence every player must train themselves accordingly for the tennis mental game.

The investigation into the effect of mental imagery on anxiety and kick serve performance among tennis players represents a noteworthy research gap in the field of sports psychology. While there is literature on the broader applications of mental imagery in sports performance, the specific inquiry into its influence on anxiety levels and the execution of a specialized tennis skill like the kick serve is limited.





Cumming et al. (2017) investigates the effects of imagery on motor skill performance in sports, but the focus may not be on the kick serve in tennis or its relationship with anxiety. These references highlight the need for more targeted research examining how mental imagery interventions can be strategically employed to alleviate anxiety and enhance kick serve performance among tennis players. In sports, mental toughness refers to an athlete's capacity to maintain composure, self-assurance, and fortitude in the face of stress or hardship, allowing them to continually perform at their peak. This psychological trait has been discovered to be extremely important in predicting a sportsperson's performance (Jones et al., 2019). Self-belief, emotional restraint, motivation, and resilience are just a few examples of the many elements that make up mental toughness (Gucciardi et al., 2020). High mental toughness athletes are better able to endure challenging circumstances and disappointments, have an optimistic outlook, and stay focused on their objectives.



Based on the acknowledgement of such problem and gap, a pilot test was done to measure the psychological state of Sabah Single Tennis players in Sabah Saga Games 2019 Tournament which held in Keningau Sabah from 10th – 14th December 2019. The researcher has used Competitive State Anxiety-2R (CSAI-2R) (sig.041) which was translated into Bahasa Melayu. Existing literature highlights a notable gap in research that comprehensively addresses the combined impact of relaxation, video modelling, mental imagery, and VR technology on anxiety and tennis performance, especially focusing on the kick serve. While individual studies have explored the efficacy of these interventions in isolation, few have delved into their combined effects, and fewer still have considered the kick serve as a specific performance outcome. Research often lacks a holistic approach, neglecting the integration of these components in a tennis-specific





context. Moreover, the use of VR technology in sports psychology interventions is a relatively novel area, and its potential in enhancing relaxation, modelling, and imagery for performance improvement has not been extensively explored.

The literature gap also extends to the scarcity of studies that cater to the unique needs and challenges faced by male tennis players in Sabah, Malaysia. Regional and cultural differences can significantly influence athletes' psychological responses and training effectiveness. The lack of research in this specific context highlights the need for a study that not only addresses the overarching gaps in the literature regarding integrated interventions but also tailors these interventions to the specific requirements of the target population. By conducting a comprehensive study that combines relaxation techniques, video modelling, and mental imagery within a VR framework, the research aims to bridge these gaps in the literature. Additionally, by focusing on Sabah MSSM male tennis players, the study aims to provide insights that are not only academically relevant but also practically applicable to the local sporting community. This research has the potential to contribute significantly to sports science, psychology, and coaching methodologies, offering evidence-based strategies for enhancing anxiety management and kick serve performance in a real-world setting.





1.4 Research Objective

Based on the problem statement below are the research objectives:

1. To determine the needs for a develop a psychological skill training video modelling (relaxation and mental imagery) based on VR to measure kick serve performance among Sabah MSSM male tennis single male players.
2. To acquire expert references psychological skill training VR video modelling (relaxation and mental imagery) content to measure kick serve performance among Sabah MSSM male single tennis single male players
3. To compare the Mental Imagery Ability Training based on VR on kick serve performance, relaxation and anxiety between Intervention group and control



1.5 Research Questions

Based on the objectives below are the research question:

1. Is there any requirement to develop a VR based psychological skill training on video modelling (relaxation and mental imagery) to measure kick serve performance among Sabah MSSM tennis single male players?
2. What is the expert validity references VR based psychological mental training assessment in measuring anxiety level among Sabah MSSM tennis single male players?



3. Are there effects of mental imagery ability training based on VR on serve performances, relaxation and anxiety among Sabah MSSM male single tennis players who employed VR approach?

3.1 Is there a significance difference score between the pre-test and post-test of the mental imagery ability between the Control Group and Intervention Group of Sabah MSSM single male tennis players who employed a VR approach?

3.2 Is there a significance difference between the pre-test and post-test of the score of Kick serve performances between the Control Group and Intervention Group of Sabah MSSM single male tennis players who employed a VR approach?

3.3 Is there a significance difference between the pre-test and post-test of the anxiety level with Control Group and Intervention Group Sabah MSSM single male tennis players who employed a VR approach?

3.4 Is there a significance difference between the pre-test and post-test of the relaxation level with Control Group and Intervention Group Sabah MSSM single male tennis players who employed a VR approach?

1.6 Research Significance

Tennis is an extremely physically demanding sport that calls for outstanding speed, agility, and endurance. But success in tennis also requires a certain level of mental toughness. A strategy called psychological mental training (PMT) aims to enhance mental capabilities and fortify the mental component of tennis performance. Research



demonstrates that PMT offers various advantages for tennis players and coaches, which has contributed to its recent rise in popularity. The research on the effect of relaxation, video modelling, and mental imagery, utilizing virtual reality (VR) headsets, on anxiety and kick serve performance among Sabah MSSM (Malaysian Schools Sports Council) male tennis players is significant for several reasons. First and foremost, the study addresses a specific population Sabah MSSM male tennis player which allows for a more targeted understanding of how psychological interventions impact a unique group of athletes. The inclusion of a specific demographic enhances the applicability of the findings to the context of school-level sports in Sabah.

Secondly, incorporating relaxation, video modelling, and mental imagery techniques through virtual reality headsets is an innovative approach. The use of VR technology in sports psychology research is relatively novel, and exploring its effectiveness in enhancing the kick serve performance while reducing anxiety presents an opportunity to contribute to both the sports psychology and technology integration fields. This approach provides a more immersive and potentially impactful method for athletes to engage in mental preparation. Furthermore, the study addresses the intricate relationship between anxiety and performance, particularly in the context of a specialized tennis skill like the kick serve. Tennis is a sport that requires a delicate balance of physical skill and mental composure. Investigating how these psychological interventions influence anxiety levels and kick serve performance sheds light on the complex interplay between the mind and body in sports.

The research also holds practical implications for coaches and sports psychologists working with young male tennis players in Sabah MSSM. If proven





effective, these interventions could be integrated into training programs, offering a holistic approach to skill development and mental well-being. Such an approach aligns with the growing recognition of the importance of mental skills training in youth sports to foster both athletic success and psychological resilience. Moreover, the study's focus on male tennis players contributes to gender-specific insights in sports psychology. Gender can play a role in how athletes respond to psychological interventions, and understanding these dynamics is crucial for tailoring effective strategies. By focusing on male players, the research adds nuance to the broader conversation on gender considerations in sports psychology.

Additionally, the use of virtual reality headsets introduces an element of ecological validity, simulating real-world scenarios more closely than traditional psychological interventions. This enhances the generalizability of the findings to the actual tennis court environment, potentially making the interventions more transferable to real-game situations. Furthermore, the research contributes to the growing body of literature on the application of technology in sports psychology. As VR technology becomes more accessible, understanding its potential benefits in sports training and performance enhancement is crucial for staying at the forefront of sports science. In conclusion, the significance of this research lies in its targeted focus on Sabah MSSM male tennis players, the innovative use of virtual reality headsets, and the exploration of the nuanced relationship between psychological interventions, anxiety, and kick serve performance. The findings have the potential to inform coaching practices, advance the understanding of mental skills training in youth sports, and contribute to the broader conversation on the integration of technology in sports psychology.





Progressive Mental Training (PMT) offers numerous benefits, one of the most significant being enhanced self-confidence. According to research by Du (2019), PMT interventions led to a substantial increase in tennis players' self-confidence. This boost in confidence, in turn, contributed to improved overall performance and a greater ability to manage pressure effectively. PMT is advantageous for instructors as well as tennis players. Coaches who include PMT into their practises can aid their players in improving their performance and mental toughness. Also, coaches who receive PMT training gain stronger communication skills and a deeper comprehension of the psychological conditions of their athletes. This will be able to provide and contribute towards enhancement of sports psychological mental skills among Sabah tennis players. This study also enables the Sabah Tennis Association and registered tennis academy coaches to understand the importance of PMT programs along with skills and physical fitness among tennis players.



Psychology is the study of the mind while Sports Psychology is the scientific study of people and their behaviours in sports. Mental strength is an important factor for improving performance for all competitive athletes. Many coaches are aware of this importance but they hardly know how to apply these mental training skills during trainings for their players. It's a great hope this study will bring great improvement in uplifting the mental strength among tennis players. Since the coaches have been training the players well for skills and physical fitness, the mental training will be added advantage to balance the players mentally and physically. Subsequently, this study will be done at major tennis academies in state of Sabah, I believe even the school coaches will benefit from this research. The mental preparation in tennis is very much needed for this current situation to improve the performance of the players. Despite training





hard and playing competitive tennis, continuous losing at national level MSSM tournament will lead players to burn out mentally. It's the right time to impose the mental preparation with proven sports psychological skills by the coaches for the Sabah Tennis elite players in enhancing their performance while overcoming the anxieties'.

1.7 Limitation of The Study

This research investigates the impact of relaxation techniques, video modeling, and mental imagery using Virtual Reality (VR) technology on anxiety levels and kick serve performance among male tennis players in Sabah, Malaysia. The study aims to explore how psychological skill training can be integrated into competitive sports, particularly in tennis, where mental resilience is crucial for success. By utilizing VR-based training, the research seeks to demonstrate how psychological interventions can effectively reduce anxiety and enhance skill execution in young athletes.

The study focuses on assessing the effectiveness of psychological skill training through VR technology. Specifically, it examines how relaxation and mental imagery techniques, when delivered through an immersive VR experience, can aid tennis players in managing anxiety and improving their kick serve performance. Additionally, it explores the role of video modeling in refining complex tennis techniques by offering structured and interactive learning opportunities. However, the study does not extend to other tennis skills, such as footwork or groundstrokes, nor does it include female players or athletes from other sports. This targeted approach ensures that the findings remain applicable to male tennis players competing at the school sports level in Sabah.





A carefully selected group of respondents was involved in this research to ensure the study's objectives were met. The sample consisted of 40 male tennis players, aged 14 to 16 years, from four leading tennis academies in Sabah. The academies are Keningau, Kota Kinabalu, Tawau and Sandakan. These players were chosen due to their active participation in Majlis Sukan Sekolah Malaysia (MSSM) tournaments and their representation of Sabah at the national level competitions. Their selection was based on their prior competitive experience and skill level, which made them suitable candidates for psychological training interventions. Additionally, 30 tennis coaches participated in a needs analysis survey, providing insights into the practicality of implementing VR-based psychological training in coaching. Moreover, 10 experts in sports psychology, motor behavior, and coaching were consulted to validate the VR-based mental training assessment. This group comprised university sports science lecturers, teacher training institution educators, and professional tennis coaches with 9 to 15 years of experience. Their expertise played a vital role in ensuring the credibility and effectiveness of the psychological training methods used in the study.

The research was conducted at four prominent tennis training centers in Sabah, Malaysia, which were selected based on their active role in developing young competitive players and their engagement in national tournaments. Sabah was chosen as the study location due to the unique challenges its players face in national competitions. Reports from the Sabah MSSM Technical Officer highlighted that despite being physically well-trained, many players struggled to progress in national tournaments due to a lack of psychological preparation. Performance anxiety and inconsistency in executing high-pressure skills like the kick serve were identified as key challenges. By conducting the study in these tennis academies, the research aims





to provide practical, real-world solutions that can be directly applied in training environments to enhance player performance.

This study is confined to male tennis players aged 14 to 16 years in Sabah who compete in MSSM tournaments. It specifically examines the impact of VR-based psychological training on anxiety and kick serve performance, without addressing other tennis skills or including female players. The inclusion of experienced athletes, coaches, and sports psychology experts ensures a comprehensive approach to evaluating the effectiveness of VR-based interventions in sports. Conducting the research within Sabah's leading tennis academies allows the findings to be directly applicable to the local tennis community, offering valuable insights into how psychological training can be integrated into coaching practices to improve competitive



1.8 Operational Definition

The researcher is aiming in measuring the effects of relaxation, video modelling and imagery among Sabah among MSSM single tennis players on kick serve performance.

Since this study often employs terminologies inconsistently, definitions of some key terms used in this study are deemed important.





1.8.1 Sabah MSSM Male Single Tennis Players

The Sabah MSSM player mentioned in this study refers to individual tennis players who represent four tennis sports academies operating in the state of Sabah. These singles players are among players aged 14 to 16 years.

1.8.2 Mental Imagery

According to Jiang.T and R.White (2023) Mental imagery involves the mental simulation of movement without any physical action, engaging neural pathways that mirror those activated during real movement.



1.8.3 Anxiety

Anxiety is defined as an organism's response to a real or imagined threat, activating physical symptoms like increased heart rate and muscle tension. According to Dr. Murray Bowen, all living beings experience anxiety, often using the term interchangeably with emotional reactivity (Bowen, 2023) (Vermont Centre for Family Studies) (Atlantic International University) (MDPI) (Atlantic International University).





1.8.4 Relaxation

According to Gardner and Moore (2019) Relaxation techniques typically encompass methods like deep breathing, progressive muscle relaxation, guided imagery, meditation, and mindfulness. These practices aim to help individuals manage stress, alleviate anxiety, and improve overall well-being. Study by Hut and Minkler (2023) indicated that mindfulness techniques led to greater improvements in both mental health and sport performance.

1.8.5 Virtual Reality (VR)

Sports are rapidly utilising virtual reality (VR) technology to improve performance, training, and recovery. According to Chen Jin and Li (2020) athletes can practise particular talents and develop decision-making skills while simulating realistic game circumstances. It provides athletes an immersive environment to reclaim their confidence and develop their motor abilities. Wang and Ruan, Zeng, & Tang (2022) stated that VR has been used for injury prevention and rehabilitation.

1.8.6 Kick Serve Performance

Kick serve performance embodies a synthesis of physics, technique, and tactical acumen. Mastery of the kick serve involves generating high spin rates through precise ball tosses, optimal grip choices, and disciplined body positioning. Its high bounce and





lateral movement provide strategic advantages by disrupting an opponent's return rhythm and by reducing the likelihood of service errors. With rigorous practice and attention to both the physical and technical aspects of the stroke, players can transform the kick serve into a consistent, game-changing weapon.

Successful execution of a kick serve is influenced by several technical factors. First, the ball toss must be precise; ideally, the ball is tossed slightly above the head to allow for an aggressive upward swing. Second, grip plays a pivotal role; many coaches recommend an Eastern backhand or a Continental grip to promote the necessary wrist and forearm movement during the serve. As noted by Euro School of Tennis (2021), a well-practiced kick serve requires a "brushing" motion that starts from the inside of the ball and ends over its top, which not only produces the desired spin but also ensures



Furthermore, body alignment is crucial. Maintaining a relatively sideways stance at the moment of impact facilitates the correct swing path, enabling the player to generate both the power and spin required for an effective serve. New York Tennis Magazine (2018) emphasizes that players must resist the common tendency to open the shoulders too early, as this can compromise both spin production and overall consistency.

