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The Effects of Psychological Techniques on the Performance of High School Varsity Tennis Players

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ABSTRACT

Positive psychological techniques have been researched and implemented within professional sports as well as collegiate programs throughout the country. The effectiveness of audio/visual stimuli on high school aged athletes and their athletic performance, however, has not been previously evaluated. An experiment was performed on varsity high school tennis players where their serving accuracy was measured before and after being introduced to an audio/visual stimuli. 8 female and 9 male participants participated in the trails, where they would serve 10 times on each side of the court (20 total serves). Players additionally completed a survey regarding their mindset and positivity before participation. Results were measured both days of experiments and compared. Findings concluded that the male participants decreased their accuracy 16% after watching the video and females increased accuracy by 20%. Due to the higher number of males that were self reported to have a "negative" mindset, that was deduced to likely cause the decrease in performance along with the female-centered stimuli. These findings show a need for an appealing stimuli to males in the high school age group and demonstrate that emotional, female-focused stimuli helps to improve the performance of female high school athletes.

Introduction

Research in sport psychology began in the late 19th century, furthered by the work of such psychologists as Norman Triplett, who in 1898 found that cyclists who rode with others performed better, thanks to the social and competitive aspects of groups. (Joyce 1). Sport psychology is a proficiency that uses psychological knowledge and skills to address optimal performance and well-being of athletes, developmental and social aspects of sports participation, and systemic issues associated with sports settings and organizations (American Psychological Association). The field of sports psychology gradually gained popularity after the publishing of *Psychologie des sports*, a novel written in 1927 by German psychologist, Alfred Peters. After the book was published, more studies and experiments pertaining to sports psychology were conducted, intending to dissect the personalities of athletes and how aggression correlated with performance. In 1965, the International Society of Sports Psychology was formed as a result of the increasing amount of interest. For decades, psychologists attempted to identify personality traits that distinguished athletes in one sport from those in another (and from nonathletes) (Britannica). Using American psychologist Raymond Cattell's Personality Factor Questionnaire and a battery of other paper-and-pencil inventories, researchers came to contradictory results (Britannica). The differences between athletes on a team and athletes competing individually was also examined. Eventually, the idea of a specific personality for athletes was disproven and no correlation was found, although several studies demonstrated qualities that a variety of successful athletes had in common.

Modern sports psychology research builds upon the research conducted during the 20th century, focusing on how the performance of athletes can be maximized. With the knowledge of athletes personalities, gained during the 1900's, sports psychologists today can help to improve the performance of athletes from the high school level to the professional level. Several techniques are utilized by sports psychologists to assist athletes and enhance their abilities.

Cognitive and behavioral skills training, which includes goal setting, imagery and performance planning, concentration and attention control strategies, and development of self-confidence is a commonly used technique (APA). Additionally, counseling and therapy are also used by sports psychologists to assist athletes. Unlike cognitive and behavioral skills training, however, counseling and therapies are often used to treat existing problems and are not preventative.

Even in the case of professional athletes, who are arguably masters of their sport, can benefit from working with a sports psychologist and implementing psychological techniques into their routines. Benefits from psychological techniques include development of self-confidence, self-esteem and competence in sports; cognitive-behavioral self-regulation techniques; emotion management, sportsmanship and leadership skills (APA). The potential advantages of increased athletic performance as a result of psychological intervention has been researched prior to this study, but does not include athletes of this study's age group that play tennis and are under high levels of academic pressure. This poses the question: How does incorporating sports psychology affect the overall athletic performance of a varsity tennis team in the Texas Hill Country? The purpose of this experiment is to determine whether the implementation of sports psychology and motivational techniques into the warm up of varsity tennis players influence their overall performance.

Literature Review

Preexisting research and studies demonstrates the influence of sports psychology on athletes. Sports psychology's essential purpose is to enhance the performance of athletes, allowing for mental and physical growth and development, and can be applied to athletes ranging from early childhood aged children to professional athletes. The practice of sport psychology includes several approaches in order to assist athletes. Specialized knowledge includes theory and research in social, historical, cultural and developmental foundations of sport psychology, issues and techniques of sport specific psychological assessment and mental skills training for performance enhancement and participation satisfaction, clinical and counseling issues with athletes, organizational and systemic aspects of sport consulting, developmental and social issues related to sport participation, and biobehavioral bases of sport and exercise (American Psychological Association).

Different methods are utilized by sports psychologists, and depending on the circumstances of the individual, a treatment method can be imposed by a sports psychologist in order to help them achieve athletic goals. Anxiety and energy management, attention and concentration control, goal setting, communication, imagery/visualization/mental practice, self-talk, team building, and time management and organization are techniques frequently used by sport psychologists (Association for Applied Sports Psychology). These techniques help athletes to optimize their overall performance through treatment. In a study conducted by sports psychologists, they each reviewed the same case and produced individual treatment plans. Four different cognitive-behavioral approaches are outlined: rational emotive behavior therapy, cognitive therapy, schema therapy, and acceptance and commitment therapy (Turner 1). Each practitioner outlines the particular approach and proceeds to address the case by covering assessment, intervention, and evaluation strategies that are specific to it (1). Similarities and differences across the approaches are discussed, and implications for practice are put forth (1). By incorporating these measures into the routines of athletes, it allows for mental and emotional growth that has drastic effects on athletic performance and results by focusing on efficiency, mental health, and managing stress both associated with an athletes' personal life and their athletic environment. Positivity and optimistic thinking plays an important role in shaping an athletes success. Sports psychologists work with athletes to combat the stresses that come with playing their sport, teaching important skills like positive self-talk, relaxation, life skills planning, and imagery (Oklahoma Wesleyan University). They may also provide counseling, treating the overall mental health of the athlete and addressing any mental issues that come up along the way (Oklahoma Wesleyan University). The mindset and mental state of an athlete play as large of a role as physical ability does on the level at which a player can perform. Without the mental and emotional component of an athlete's game, having long term success in their sport is unachievable, with goals that they have set unattainable.

Experimentation has been performed in the past to determine whether or not sports psychology affects the performance of athletes, some of which with positive results. In an experiment conducted in Hungary with preteen-aged handball players, a correlation was found between motivation and positive sports psychology and higher-level athletes. A questionnaire was sent to participants - 60 handball players in Hungary from the ages of 10-12- which asked questions pertaining to each athlete's skill level, mindset, and perception of the value of sports. The hypothesis is confirmed, emphasising that motivated sportspeople, aware of their reasons for doing a certain sport, will rank among the performers, their victories being strongly supported, both affectively and motivationally (Ferent 5). Self motivation is crucial for athletes, as a player with a positive mindset is more likely to perform at a higher level. A player's emotional state and confidence in their abilities as an athlete contributes greatly to their overall performance. Although, this study can be affected by the truthfulness of the participants, with untrue answers affecting the data collected.

In another study, an experiment conducted by professors and students of psychology at the Tehran Institute of Psychiatry in Iran is discussed. The purpose of the experiment aimed to improve the athletic performance of 31 female basketball players by putting the experimental group through psychological protocol that lasted eight sessions. The protocol (Mindfulness-Acceptance-Commitment) used positive psychological methods in an attempt to remedy stress placed upon athletes and reduce their sports anxiety. With fifteen basketball players in the experimental group and sixteen in the control group, which were not exposed to any psychological treatment, the performed experiment show that the Mindfulness-Acceptance-Commitment protocol significantly decreased anxiety and stress for the subjects of the experimental group, as well as improving the athletes performance. The results of the study indicated that the MAC approach increases significantly the performance of basketball playing athletes ($p<0.05$). Furthermore, the MAC approach decreases significantly experiential avoidance and sports anxiety in athletes (Dehghani 7). By decreasing sports anxiety, athletes are able to fully perform without mental blocks withholding their talent. Though the results of the study show that the MAC approach improved performance, the placebo effect could also sway the athletes' reactions and performance.

In addition, another study details trials to reduce and buffer the sports anxiety and stress of 117 professional golfers. Using a strategy called "stress buffering", which is the application of positive sports psychology in response to an athlete's stress levels, researchers from the University of Exeter designed an experiment that included the professional golfers completing tests revealing their stress levels before, during, and after a golf competition and their results were recorded. On another day, the golfers stress levels was measured, but the golfers also received positive psychological motivation and again there results were recorded after a golf competition. Moderated hierarchical regression analyses revealed significant ($P < 0.05$) main effects for stressors upon performance in 8 of the 11 models tested ($R\ 2 = 0.08 – 0.21$). Over and above the variance accounted for by stressors, there were significant ($P < 0.05$) main effects for social support upon performance in all models tested (Rees 5).

Additionally, an experiment conducted by professors at Leipzig University evaluated the effectiveness of self talk (ST) on junior sub-elite athletes. 117 athletes were sorted into one of three groups, two of which were separate experimental groups and one that was the control group. One experimental group received self talk treatment for six weeks and the other for eight weeks, while the control group was not treated with the self talk technique (Walter 1). Self-talk (ST) is a cognitive technique that is used by athletes as the result of, or as a means of, influencing thoughts, feelings, and behaviors (1). Similar to aforementioned techniques, self talk treatment utilizes positive psychology in attempt to heighten an athlete's performance. As expected, ST training led to less somatic state anxiety and higher state self-confidence, self-optimization, self-efficacy, and performance (1). Targeted ST interventions may help to improve junior athletes' psychological states and performance (1). The incorporation of self talk into an athletes' regiment could potentially enhance an athlete's abilities, bringing the athlete confidence and allowing for a positive mindset. These studies demonstrate the value of positive sports psychology and its techniques on improving the overall performance of athletes.

In order to observe different aspects of how mindset, positive thinking, and psychological techniques affect the overall performance of athletes, other sources with opposing outcomes need to be considered. Although several

studies have shown positive results and shown a correlation between sports psychology and performance enhancement, multiple sources and experiments have resulted in just the opposite. For example, researches at the University of Calgary performed experiment to evaluate the effects of a variety of procedures called feedback trainers, sensorimotor rhythm (SMR) and neurofeedback training (NFT) and biofeedback training (BFT), are on the performance of athletes (Christie 1). Ice hockey player's shooting accuracy was recorded on one day and recorded as the control group. The athletes then were exposed to sensorimotor rhythm, neurofeedback training, and biofeedback training, and once again their shooting accuracy was recorded and compared to those of the control data. The researchers were able to determine that sensorimotor rhythm, neurofeedback training, and biofeedback training helped the ice hockey players overall mental health and stress, but the researchers did not notice a significant increase in shooting accuracy. Participants in the SMR-NFT/BFT group demonstrated the ability to significantly increase SMR power from pre- to postintervention in the lab (1). However, no significant changes in SMR power were found during shooting performance (1). The data and results of this experiment suggest that the parts of the brain associated with SMR-NFT and BFT are not associated with fine motor activity.

Gap Within Prior Research

Though several of the previously mentioned studies follow similar protocols and methods to those of the following experiment, gaps in previous research are addressed within the data collected including the sport, age group, and the stress levels of the players due to academics. Little research has been done specifically focusing on high achieving high school students in affluent, rural small towns that routinely perform at a high academic and high athletic level, which is found in the town and high school studied. The town of Boerne has a population of around 15,000 people, median age of 38.5 and a median household income of $63,420 (Data USA). When comparing this to the data of the state of Texas, Boerne has a higher household income as well as a higher medium age. Texas had a median age of 34.9 and a median household income of $60,629 (Data USA). The 5 largest ethnic groups in Boerne, TX are White (Non-Hispanic) (70.6%), White (Hispanic) (18.4%), Other (Hispanic) (6.33%), Two+ (Hispanic) (1.68%), and Two+ (Non-Hispanic) (1.22%) (Data USA). The advanced athletes on the tennis team and their success both academically and athletically can likely be attributed to the upscale practice centers and professional coaches that players have access to as a result of the relative wealth of the town. Unlike the aforementioned studies, varsity tennis players from the Texas Hill Country are examined during the experiment. In addition, the methods utilized in the experiment differ slightly from prior experimentation, though the design of the experiment expands on collected sources and studies.

Methods

Participants

Members of the team observed are not only competing athletically at a high athletic caliber, but also at a high academic caliber, with 100% of the seniors on the team in the top 10% of their academic class and 66% of juniors being in the the top 10% of their academic class, in this region. The team being studied additionally has won a state title and two regional titles within the past three team tennis seasons from 2018 to 2020. The Hill Country town with the tennis team being examined is a predominantly white, Christian, and wealthy area of Texas. The graduation rate of the 4A high school located in the Texas Hill Country is 98%, falling in the top section in the state of Texas (5%) and is ranked in the top 10% of high schools in the state (Public School Review). The Boerne ISD in-house institutional review board approved the experimental procedure as well as the head coach of the tennis program at the high school where the experiment was conducted. Additionally, the tennis players involved in the experiment signed waivers to give written consent and were completely informed of all procedures in the experiment. Before any testing occurred, each player completed the Player Analysis Survey, consisting of seven questions pertaining to the player's overall mindset

and weekly tennis routine. The researcher obtained each player's email address and sent the survey electronically The participants consisted of 8 female players and 9 male players. All participants were familiar with the warm up completed on the first day prior to the day the experiment was conducted, as well as the action (serves) that participants were asked to perform. Players were asked to refrain from consuming caffeine and engaging in extremely arduous exercise within 12 hours of participating in the experimental trials as to collect data that was correct and representative of what was being observed.

Experimental Design

Before any the experimental trials began, the individual emails of the participants were collected by the researcher to distribute the Player Analysis Survey digitally (Appendix A). Questions on the survey consisted of internal reflection of the player's attitude while playing tennis, an estimate of how often each player engages in the sport, and additional reflection questions that analyzed the mindset of the player. It was hypothesized that players with a self assessed "open mindset" would increase their accuracy the most. Similarly to the Player Analysis Survey, the questionnaire utilized by researchers in a study conducted on high-school aged handball players asked players to self-assess their mental game. The questionnaire for handball players aged 10-12 contains 9 items (excluding the socio-demographic data) which concern the following: sportspeople's perception of the reason which determined them to take up this sport and the perception of junior handball players of the changes brought by sport to their lifestyle (Ferent 3).

Players would serve 10 times from the baseline of the tennis court from both the add (left) and duce (right) side of the court after their regular warm up. On another day, a motivational video (The Nike Commercial 'US Open" featuring Serena Williams) will be incorporated into the regular warm up of the players. A study conducted by researchers at the University of Portsmouth were able to find a correlation between visual stimuli and improved performance. This study showed that a combined music and video intervention has a beneficial effect on exercise of high intensity in conditions that may induce premature fatigue (Barwood). In the study conducted by researchers at the University of Portsmouth, rugby players were asked to run on a treadmill on the first day of experiments, then asked to run after being exposed to music and video stimulation on a treadmill and their blood lactase levels were recorded on each day of the trials. Results were then recorded, yet researchers found that their results were limited by the varying energy levels of participants on different days of the conducted trials. The results of the serving accuracy was recorded after each day of trials. Before each trial, players were asked to give their upmost effort and were kept apart until it was their turn to serve. Participants that chose to wear hats during the first day of trials were asked to again wear hats on the second day of trials. The trials were conducted over the course of a week, allowing for participant's muscles to not overexert. Additionally, the trials were conducted at roughly the same time of day as to best minimize any errors such as sun exposure and lighting. The varying brightness of the sun and wind conditions as well as varying levels of energy from the first and second day were considered limitations and possibly caused error in the player's performance and overall accuracy.

Procedure

The participants came to the location of the facility that the experiment was performed during their designated varsity tennis class period. Player would then change into appropriate tennis attire, consisting of an athletic shirt and shorts, as well as tennis court shoes and players were asked to wear similar clothing on both days of trials as to eliminate error and variation in the experiment's results. Players were separated from each other, with only one player being tested at a certain time and remaining players were sent to other courts. The players were given new tennis balls for the trials so that varying levels of air in the tennis balls would not affect the accuracy of serves.

The first day of trials, player were instructed to do their regular stretching and conditioning warm up. This warm up consisted of knee pulls, quad stretches, walking lunges, butt-kicks, high- knees, as well as several sprinting exercises. Players did not warm up individual strokes, including serves before the testing began. Players were assigned a number in order to maintain personal privacy. Afterward, players were asked to serve twenty times, ten times on the add (left) side and ten times on the duce (right) side. Players must make the ball in the service box on the opposite side of the net for the ball to be considered in-bounds. The serving accuracy of the players were recorded with a letter

I (standing for in), O (standing for out), and L, (standing for let- when the ball bounces off of the top of the net and in-bounds) with their assigned number. The following day there was no testing.

On the second day of testing, players conducted their regular warm up once again, consisting of knee pulls, quad stretches, walking lunches, butt-kicks, high- knees, as well as several sprinting exercises. Individual strokes, including serves, were not practiced prior to testing. Afterwards players watched the Nike promotional video for the US Open in 2018 featuring Serena Williams as a group. Players were then instructed to serve twenty times, ten times on the add side and ten times on the duce side. Their accuracy was recorded with their appropriate number with the same letter symbols. The multiple days of testing mirrored the design concept from an aforementioned study by researchers at the University of Portsmouth. The participants were required to visit the laboratory on 3 occasions (Barwood 7).

Results

Experiment Data

The data table below (Figure 1) shows the collected information from Day 1 of the experiment for the male participants, with each player and their corresponding serves (10 on each side of the court). As aforementioned in the methods section, serves in-bounds are marked with “I”, serves out of bounds marked with “O”, and serves considered lets marked with “L”. The serves made in-bounds ranged between 1 and 10.

Figure 1.

Player 1	I	I	I	O	I	I	I	O	I	I	I	I	I	O	I	I	O	I	I	O
Player 2	O	O	O	I	O	L	I	O	O	O	O	O	I	O	O	I	I	I	O	I
Player 3	I	O	O	O	I	I	O	O	I	O	I	O	O	O	I	I	I	I	O	O
Player 4	I	I	O	I	O	O	I	O	I	I	O	I	O	I	I	O	I	I	O	I
Player 5	O	I	I	O	O	O	I	I	O	I	I	I	I	I	I	I	I	O	I	I
Player 6	I	I	I	I	I	I	I	I	I	I	O	I	`I	O	I	I	I	I	I	I
Player 7	O	O	I	O	I	O	O	O	I	I	O	O	I	I	I	I	O	O	O	I
Player 8	I	I	I	O	O	O	I	O	O	I	I	I	O	O	O	O	O	O	I	O
Player 9	O	O	O	O	O	I	O	O	O	O	O	O	I	O	I	I	I	O	I	I

The following (Figure 2) demonstrates the collected data from the second day of trials for the male participants with their corresponding serves (10 on each side of the court). The range of serves made in-bounds ranged between 1 and 9.

Figure 2.

Player 1	O	I	I	I	O	I	I	I	I	I	O	O	I	I	I	I	I	I	I	I
Player 2	I	I	O	I	O	I	I	I	O	O	O	I	I	I	O	O	O	O	I	I
Player 3	O	O	O	O	I	I	I	O	I	O	I	O	O	I	O	O	I	O	I	O
Player 4	I	O	I	O	I	O	I	O	O	I	O	I	I	I	I	O	O	O	O	I
Player 5	O	O	O	O	I	I	I	O	O	O	I	I	O	O	I	O	I	I	O	O
Player 6	O	I	I	O	O	I	I	O	I	I	I	O	I	O	O	O	O	I	O	O
Player 7	I	O	I	I	I	I	I	O	O	I	O	O	O	I	I	I	I	I	I	I
Player 8	I	I	O	O	O	O	O	I	I	I	O	O	O	O	O	O	I	O	O	O
Player 9	I	I	O	O	O	O	O	O	O	O	I	I	O	I	O	O	I	I	O	O

This data table (Figure 3) displays the results for the female participants on the first day of trials as well as their corresponding serves (10 on each side of the court). The number of serves made in-bounds ranged between 3 and 9.

Figure 3.

Player 10	I	I	I	O	I	I	I	O	O	O	O	O	O	O	I	I	I	I	I	I
Player 11	I	I	O	I	O	I	I	O	I	I	I	O	I	O	I	I	I	O	O	I
Player 12	O	O	O	I	I	I	I	O	O	I	I	O	I	O	I	I	I	I	I	I
Player 13	I	O	O	O	I	O	O	O	O	I	I	I	O	I	I	I	O	I	O	O
Player 14	I	I	I	I	I	I	I	O	I	I	O	I	O	I	I	I	I	O	I	I
Player 15	I	I	`O	O	O	I	L	I	I	I	I	I	O	I	I	I	I	O	O	O
Player 16	O	I	I	I	O	I	I	I	I	I	O	O	O	O	I	I	I	I	I	I
Player 17	I	O	O	I	O	O	O	O	I	O	I	I	I	O	O	I	O	O	I	I

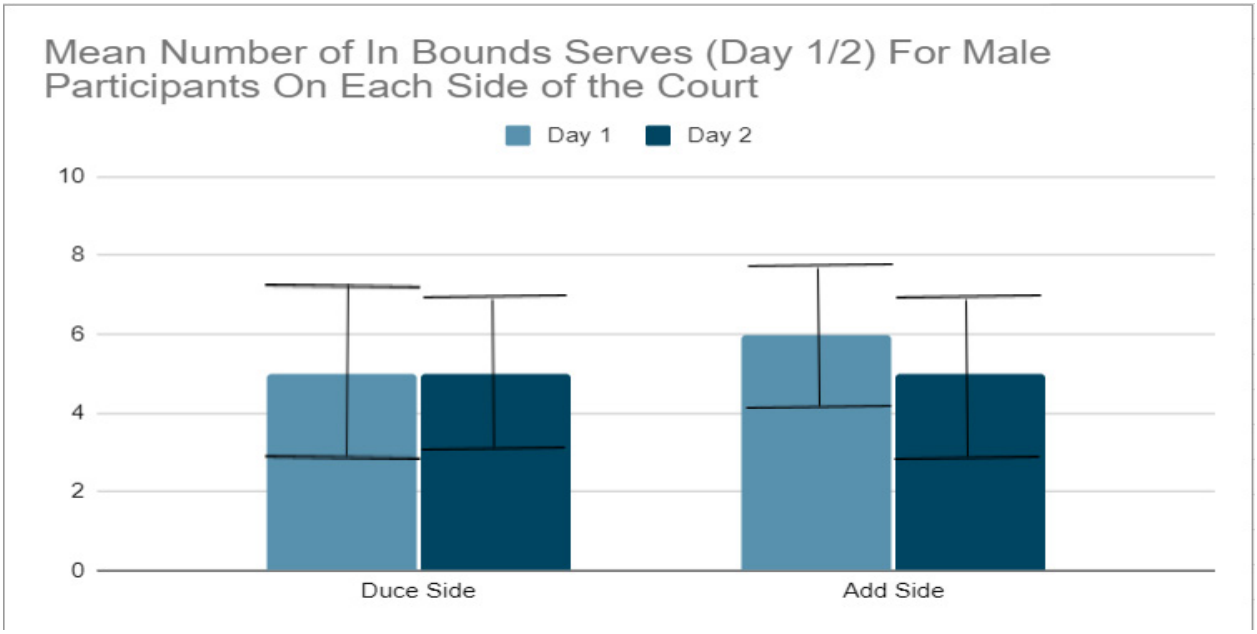
This data table (Figure 4) depicts the results for the female participants on the second day of trials as well as their corresponding serves (10 on each side of the court). The number of serves made in-bounds ranges from 4 to 10.

Figure 4.

Player 10	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	O	I	I	I
Player 11	O	I	O	I	I	I	I	I	I	I	I	I	I	I	I	I	I	O	I	I
Player 12	I	O	I	I	I	I	I	O	O	O	O	I	O	I	I	O	I	I	I	I
Player 13	I	I	O	O	O	I	O	I	O	O	O	I	I	O	I	I	I	O	I	O
Player 14	I	O	I	I	I	I	I	I	I	I	I	O	I	I	O	I	I	I	I	I
Player 15	O	O	I	I	I	I	I	I	I	I	I	I	I	I	I	O	O	I	I	I
Player 16	I	I	I	I	I	I	O	I	I	I	I	I	I	I	O	I	I	I	I	I
Player 17	I	I	I	I	I	O	I	I	O	I	I	I	O	I	O	I	O	I	I	I

The following chart (Figure 5) depicts the mean number of serves hit in-bounds on both sides of the court for the male participants in the study over both days of trials. The standard deviation of the duce side for Day 1 is 1.92 and the standard deviation of the duce side for Day 2 is 1.88. The standard deviation for the add side for Day 1 is 1.73 and Day 2 is 1.94.

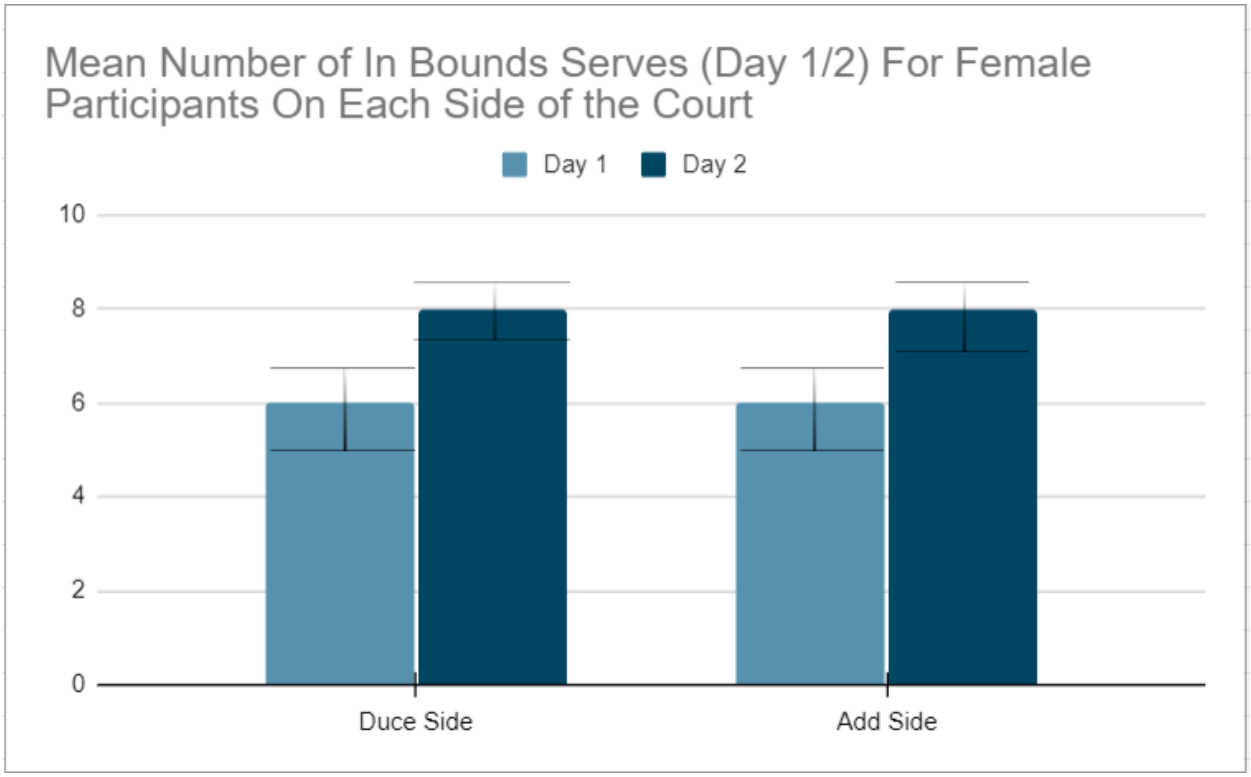
Figure 5.



The following chart (Figure 6) depicts the mean number of serves hit in-bounds on both sides of the court for the female participants in the study over both days for trials. The standard deviation of the duce side for Day 1 is 1.04 and

Day 2 was 0.59. The standard deviation for the add side for Day 1 was 1.18 and the standard deviation for the add side for Day 2 was 0.88.

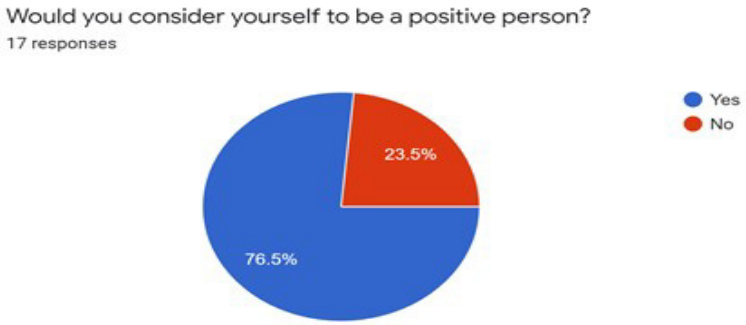
Figure 6.



Player Analysis Survey Data

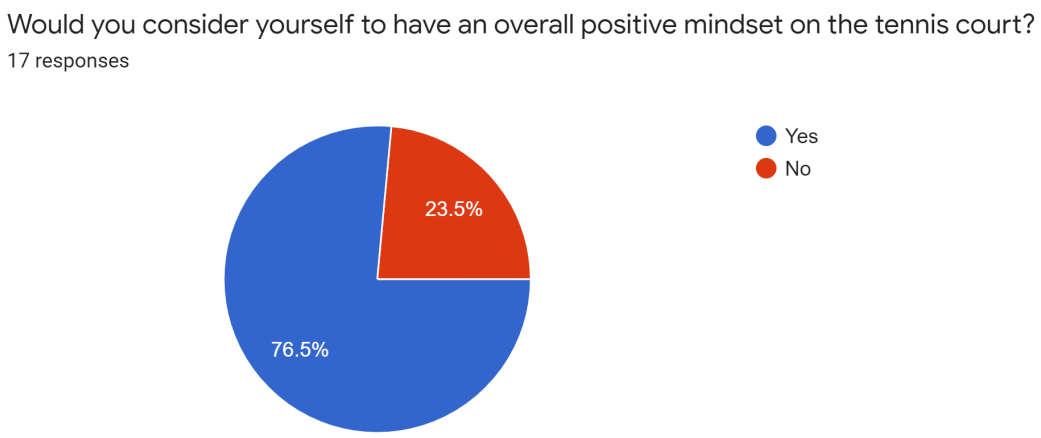
The following graph (Figure 7) shows the second question on the Player Analysis Survey. 5.8% of participants that answered “No” were female and the other 17.7% that answered “No” were male.

Figure 7.



The following (Figure 8) shows the third question on the Player Analysis Survey. Of the 4 players that answered “No”, 3 (17.7% of total responses) were male and 1 (5.8% of total responses) were female.

Figure 8.



Discussion

This experiment consisted of determining the effectiveness of implementing positive psychological stimuli into the warm up of high achieving (academically and athletically) varsity tennis players in the Texas Hill Country and examining the results of the change on the accuracy of the players serves. Prior to the experimental trials, it was hypothesized that layer that self-assessed and reported their mindset as positive (findings in Figure 8 of the Results section) would have significant accuracy improvements when compared to other players. The findings supported the hypothesis. The mean of in-bounds serves for females on the first day of trials was 6 on both sides of the court and increased 33% (to 8 serves on both sides). This increase was considered significant as the standard deviations did not overlap. When considering that only one female participant reported a negative mindset (as displayed in Figure 8), the hypothesis that the stimuli would increase the serves made in-bounds for players with a self-assessed positive mindset was supported. However, for male participants, of which a third had a self-reported "negative" mindset, the mean of in-bounds serves was 5 on the duce and add sides of the court. On the second day, the mean of serves made in-bounds remained at a total of 5 serves on the duce side and decreased 16% (from 6 serves made in-bounds to 5) on the add side. Because of overlapping standard deviations, the difference is not considered a significant decrease, but a lack of growth and overall decrease in the mean of the serves made in-bounds on the add side poses several questions.

The provided stimulus is likely the root of the differences between the male and female's observed performance. The audio/visual stimulus utilized in the second day of the study was a two minute advertisement from 2018 directed by Nike Inc. entitled "Voice of Belief" which featured Serena Williams, 23-time Grand Slam champion, and included clips from her childhood combined with clips of her most iconic victories. The "Voice of Belief" advertisement was effective as it relied largely on impacting viewers emotionally, which could contribute to varying results between genders studied. In a 2009 study conducted by researchers from the Medical School of Aristotle University of of Thessaloniki, they were able to conclude that results suggest a difference in the way emotional stimuli are processed by genders (Lithari 1). It was determined that women reacted to emotional stimuli than more than males (Lithari 4). As supported by the findings of the researchers from Aristotle University of Thessaloniki, it can be reasonably implied that the significant increase in the female's serving accuracy was due to the emotional intensity of the Nike advertisement. Additionally, the advertisement centered around the success and personal growth of a female athlete, Serena Williams, which also could have impacted the results of the experiment. It can be deduced the male

participants did not respond to the stimuli as it was focused on a female subject and utilized emotional strategies to engage viewers.

Conclusion

As determined by the qualitative and quantitative data collected within the experiment, this study showed that audio/visual stimuli does, in fact, have an effect on athletes although is inconsistent between genders. In order for audio/visual stimuli to be implemented into the routine of high school athletes, a stimuli that benefits males would need to be evaluated. In a future study, a male-focused positive psychological audio/visual stimuli should be utilized in a similarly structured experiment that has male and female participants. The accuracy of their serves can be recorded and, according to this studies findings, the results would likely be as followed: the male participants serving accuracies would likely improve from the first and second days roughly 20% and the female participants serving accuracies would likely remain stagnant or possibly decrease. Once the effectiveness of male-centered stimuli can be evaluated and supported, the incorporation of gender-specific audio/visual stimuli into the training of high school athletes can be executed, potentially revolutionizing competitive high school sports.

Limitations

Several external factors could have potentially impacted the athletes performance. Weather- including the brightness of the sun, cloud coverage, and temperature (which affects ball density)- could have affected the participants and skewed the results. Additionally, though participants were asked to wear similar clothing, limit caffeine intake, and receive appropriate amounts of sleep on days that the trials were conducted in order to reduce error, it is possible that participants may have disregarded these requirements. This could also a ffect the data collected.

The decreased serving accuracy for the males in the survey between the first and second days of trials was likely due to the emotional nature of the audio and visual stimuli. As shown by the data collected and supported by prior research, women tend to react more, or in this case, feel more inspired and confident because of emotionally-charged stimuli whereas men tend to be impacted far less. Also, the fact that a third of male participants had a self-assessed “negative mindset” cannot be overlooked (as shown in Figure 8). This could also have impacted the decrease in serving accuracy for the male participants.

Implications

The results of this study propose several new questions and different areas of research. The data collected helps to confirm prior studies and the hypothesis that females with a self-assessed “positive” mindset would be impacted significantly by the incorporated stimuli in terms of serving accuracy. Finding either another positive psychological audio and visual stimuli that would help male participants to improve their performance would be the next step for researchers, and could possibly include branching into different types of psychological techniques. Another topic to be explored would include ways to improve players self-assessed mindset. As displayed in figure 8 in the results section, 33% of male participants (3 of 9) and 12.5% (1 of 8) of female participants responded that they had a “negative” mindset on the Player Analysis Survey. Researching ways to improve the mindset of high school age athletes would greatly benefit programs across the country, helping individuals to achieve their personal best without self deprecating feelings and doubt corrupt their athletic performance.

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