Mental Imagery and Perceived Levels of Mental Strength in Collegiate Swimmers

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Abstract

The purpose of this study is to determine the effectiveness of mental imagery on the mental strength of collegiate athletes during practice and competition. The measurement tool was the Sport Psychology Questionnaire for Swimmers, which assessed the levels of existing mental strength for each athlete at the beginning of mental imagery implementation and again at the end of the six-week period. No statistically significant findings on any of the questions on the survey were found and the null hypothesis was retained. Research in this area should continue, as there is very little information available regarding mental imagery and its quantifiable effects on the mental states of athletes.

CHAPTER I

INTRODUCTION

In the world of sports there are a vast number of stresses placed on athletes. The most typical stress experienced by athletes is physical stress. An athlete achieves success in his or her sport by training and practicing the physical skills necessary to perform. Although athletic performance depends heavily on physical conditioning and coordination, there is an equal importance placed on the mental and psychological skills of the individual. Mental strength is occasionally neglected during the training or competition portion of an athlete's season. If an athlete arrives at a competition without mental preparation then his or her chance at a successful athletic performance can be greatly diminished, no matter the amount of physical training done in preparation. On the collegiate level, athletes are challenged with a fair share of physical demands, but are also confronted with a multitude of psychological stressors. This stress can be a by-product of the sport, but can also be a result of occurrences in other areas of their lives such as academic, social, or family life. Some collegiate programs disregard or under utilize the mental component of training, sacrificing practice time to concentrate only on the physical training. More direct attention given to the mental preparation of collegiate athletes could result in more efficient, aware, and mindful athletic performances.

Statement of the Problem

The purpose of this study is to determine the effectiveness of mental imagery on the mental strength of collegiate athletes during practice and competition.

Statement of Research Hypothesis

The collegiate athletes, especially swimmers, exposed to mental imagery will show no difference in their mental strength during practice and competition.

Operational Definitions

The independent variable for this study is the mental imagery. Mental imagery is a forty-five minute audio program played for the swimmers prior to water practice that focuses on relaxation, breathing schemes, and mental strategies for swimming races. The dependent variable of this study is the swimmers' mental strength, as measured by the Sport Psychology Questionnaire for Swimmers.

CHAPTER II

REVIEW OF THE LITERATURE

This literature review explores the psychological demands of athletes during competition and the interventions used to help them master the mental component of sports, therefore resulting in better performances. Section one provides an overview of psychological circumstances that affect athletic performance, in particular the psychological demands of swimmers. Section two explores psychological interventions used to enhance athletic performance. Section three explores mental imagery specifically as an intervention and its application to college swimmers.

Psychological Demands of Athletes during Competition

The mind can be a dangerous place for an athlete. Psychological stressors are a constant threat to an athlete's ability to physically perform. Research in many fields has been conducted to study the effects of various psychological stressors and how they affect athletic performance on almost every level (Lane, Thelwell, Lowther, & Devonport, 2009; Nicholls, Polman, Levy, & Blackhouse, 2008; Weinberg, 2008). Athletes' performance can be altered by external factors such as weather conditions, facility conditions, physical injury, recovery time, exhaustion, changes in schedules, adaptation to training changes, and countless other factors which they cannot control (Lu, Hsu, Chan, Cheen, & Kao, 2012). Athletic performance can also be influenced by a number of internal pressures as well. Internal pressures compiled in the literature include anxiety, arousal level, doubt, negative thoughts, levels of self-confidence as well confidence in one's team, and even personal relationships with teammates, competitors, and coaches.

Among the most discussed psychological stressors in the literature are anxiety and nervousness. Elite athletes have to be able to handle the pressure and anxiety that inevitably come with intense levels of competition and demanding stages of physical training (Lane, *et al.*, 2009; Weinberg, 2008; Jones & Stuth, 1997). Prior to competition, athletes often experience feelings of nervousness, anxiety, and doubt (Jedlic, Hall, Munroe-Chandler, & Hall, 2007). All of these stressors have the capability to cause athletes to lose focus and jeopardize the level of their performance. Anxiety and doubt can cause any premier athlete to falter if they cannot gain control over their emotions. Athletes tend to handle anxiety in different ways. Cumming, her associate Hall (2002), and other field experts observed that when exposed to similar anxiety intensity levels, non-elite athletes find their anxiety symptoms debilitative and paralyzing, while elite athletes tend to classify their anxiety as helpful. These elite athletes compare the anxious feelings they have to the nerves they experienced during competition. It is the ability to control perceptions of obstacles, such as anxiety, that set the great athletes apart from the rest.

Another commonly discussed psychological hurdle for all athletes is the issue of confidence. Self-confidence is defined as a person's overall evaluation of themselves, their capabilities, and their self-worth (Lane *et al.*, 2009). There are certain professional athletes that exude an air of absolute certainty when they take the field or step on the court. While these superstars may come off as overly confident, it is their continuous success that actually helps them remain dominant in their particular sport. Most of the literature on athletic performance and psychological interventions agrees that successful athletes tend to posses high levels of self-confidence and self-efficacy (Weinberg, 2008; Jones & Stuth, 1997; Hall & Fishburne, 2010; Jedlic *et al.,* 2007). On an individual level " . . . it is generally believed that athletes need to possess a high degree of self-confidence," and is agreed as, " . . . being a salient characteristic in

athletic achievement" (Levy, Nicholls, & Polman, 2011, p. 723). Self-confidence causes the athletes to generate feelings of competence, success, and mastery. Confidence is a characteristic that increases as an athlete receives reinforcement from consistently executing skills successfully. As athletes encounter more success, their self-confidence increases and they have more faith in their own abilities and skills. Increasing self-confidence increases over-all moral, mental state, and the over-all status of the person (Neck & Manz, 1992). On the other hand if athletes lose their confidence because of injury, aging, or just better competition, they are at risk of losing it for long term. Athletes can use self-confidence to calm nerves and as a way to deal with anxiety. Once athletes have control of their anxiety they can concentrate on what is important, performing well.

Specific Demands of Collegiate Swimming

The difference between professional athletes and college student-athletes is that professionals are just that, professional athletes. Their jobs depend on their physical fitness, knowledge of their sport, mental determination, talent, and their personalities or stage presence. Some college athletes are motivated and bound to their sport by scholarships, while many other athletes voluntarily committed to their sport or sports (Lu *et al.*, 2012). College athletes deal with all of the pressures of a full academic workload, the development of a balanced social atmosphere, the consequences of poorly made decisions, and the development and upkeep of relationships, all in addition to the mental hardships of being a competitive athlete (Etzel, 2009; Fletcher & Hanton, 2003; Huchting, Lac, Hummer, & LaBrie, 2011). The College Student-Athletes' Life Stress Scale (CSALSS) was created to identify the different causes of stress in college athletes' lives. The developing studies polled collegiate student athletes about the stress created from sports injuries, performance demands, Athlete-Coach relationships, training

adaptation, interpersonal relationships, romantic relationships, family relationships, and academic requirements. All of these external influences can be the cause of additional stress in the lives of college athletes.

The combination of all the psychological stressors in a collegiate athlete's life creates the demand of a college student athlete to be mentally tough and committed. Mental toughness can be defined as persistence or as commitment, but it is more than those two words (Howland, 2006). Mental toughness is " . . . the ability of a person to cope with the demands of training and competition, increased determination, focus, confidence, and maintaining control under pressure" (Nicholls *et al.*, 2008, p. 1184). The psychological demands placed on college athletes can be applied to the specific demands of college swimmers

Out of the all the collegiate athletes, swimmers are some of the most mentally tough and dedicated athletes. Swimming is a multifactorial sport that revolves around an aerobic activity, in a medium that makes it difficult to take in oxygen when needed (Garrido Marinho, Reis, & van den Tillaar, 2010). College swimming programs also add weight training and circuit workouts known as dryland to their water practices, which increase the difficulty of the training (Thiese & Huddleton, 1999; Lebon, Collet, & Guillot., 2010). While strength, speed, and technique are all key components to a good race, sheer will-power and mental strength are just as important in determining how an athlete is going to perform. Even if an athlete is in the best physical shape of his/her life, if he/she is not mentally strong his/her opponents will take advantage of his/her weakness (Lane, *et al.,* 2009; Lines & Schwartzman, 1999). The psychological demands of college swimmers incorporate all of the stressors of attending college and stressors of competing and training in one of the most demanding sports.

Psychological Interventions Used to Enhance Athletic Performance

The different psychological skills acquired and refined by athletes encompass mental control, awareness, and focused. Psychological interventions include self-talk, relaxation, 'psyching-up', anxiety management, decrease physiological arousal, focus and centering techniques, injury rehabilitation, self-confidence enhancement, pain control, goal setting, team building, and mental imagery (Callow, Roberts, Bringer, & Langan, 2010; Cummings & Hall, 2002; Gregg & Hall, 2006; Howland, 2006; Jedlic *et al.*, 2007; Lane *et al.,* 1997; Munroe, Hall, Simms & Weinberg, 1998; Neck & Manz, 1992; Nicholls *et al.*, 2008). Cummings and Hall emphasize that " . . . elite athletes engage in more extensive use of goal-setting, focusing, refocusing, competition, planning, and imagery than their non-elite counterparts" (p. 143). As each athlete continues to develop and master their sport they also have to develop the mental skills that are best suited for their situation and their personality. Even though each of the listed interventions is different, they can all be used in various combinations to create more effective cognitive strategies.

One common intervention is the use of self-talk. Self-talk is classified as the dialogue one has, either internally or externally, with oneself to guide and enable the individual to accomplish a goal or specific skill (Neck & Manz, 1992). Self-talk is just as simple as it sounds. It is a person convincing him/herself to achieve a goal or improve efficacy. It is similar to giving oneself a pep talk or getting psyched-up prior to competition. Another aspect of self-talk that is very important is that it can serve as the turning point from a negative mentality to a positive mentality (Lane, *et al.,* 2009). Lane *et al.* affirmed that mental practice, such as self-talk are able to " . . . act as a buffer between thoughts, feelings and behaviors, as the individual replaces negative thoughts with positive ones producing a positive change in emotion" (p. 200). It is the

change in the emotional state of the athlete that places his/her in the best state of mind for competition. The athletes are no longer distracted, they are no longer consumed with destructive thoughts that could cloud their judgment, and they are focused on what they want to achieve.

Another important form of psychological intervention is the practice of relaxation. Relaxation is the ability to harness and diminish the emotions that tend to have negative effects on the athlete's psychological state prior to competition (Etzel, 2009). Relaxation decreases arousal and reduces feelings of stress and anxiety (Jones & Stuth, 1997). Through the elimination of psychological stressors, the athlete is able to develop productive thoughts, clear mental images, and make self-assessments. Relaxation helps bring attention and focus to the mind of the athlete and eliminate distractions. Howland (2007) described attention as alertness, limited capacity, and selectivity. As a part of relaxation, the athlete focuses their attention or alertness to obtain optimal readiness to respond with the necessary actions required. Focused limited capacity entails that the athlete is prepared to give their undivided attention to their performance; because once their attention is divided there is evidence that they will not be as effective. In addition to giving athletes the ability to zone in on the present, relaxation and attention also allow for athletes to draw on their experiences of past performances and use them as tools to apply in their current situation. Howland explains " . . . that as an athlete experiences something, the increased ability use the information to improve follows suit" (p. 53). Athletes have to pay special attention to the actions they are experiencing and determine if they are new or if they can anticipate their next move. Relaxation allows for athletes to prime their bodies and minds for their competition.

The combinations of psychological interventions are called multimodal interventions (Jones & Stuth, 1997; Callow *et al*., 2010; Weinberg, 2008). Most of these individual mental

strategies complement one another and result in positive athletic outcomes if used together. Multimodal efficacy has been researched by both empirical and case-study studies. Both preliminary and recent studies have found that multimodal interventions enhance athletic performance (Lane *et al.*, 2009; Gregg, Hall, McGowan, & Hall, 2006). While different mental strategies should be used for different tasks, these multimodal combinations tend to work better together rather than if they were implemented separately. For example, relaxation and mental imagery are classified as reciprocals. Previous research supports that the implementation of mental imagery facilitates relaxation, while it is also proven that relaxation can enhance imagery and the benefits of its cognitive and motivational functions. Each psychological skill has the capability to positively enhance athletic performance, but like calling the right play at the end of a game, the correct intervention must be applied to the situation at hand. All of these mental interventions have obvious benefits and they all have something in common; they are all used together with mental imagery at one point or another during an athlete's career.

Mental Imagery as an Intervention for College Swimmers

Mental imagery is a popular psychological intervention used by athletes of all skill levels throughout the world. Mental imagery is defined as " . . . using all the sense to create or re-create an experience in the mind" (Weinberg, 2008, p. 2). The more practical application of mental imagery refers to the visualization of a successful performance of a task or skill before it has actually been completed (Neck & Manz, 1992). Mental imagery is used to enhance athletic performance and patterns in research suggest " . . . a positive relationship between the use of mental imagery and more successful athletic performance in competitive situations" (Jones & Stuth, 1997, p. 103). Paivio wrote the original analytical framework for mental imagery in 1985 and his works influences all literature about mental imagery. Paivio suggested that mental

imagery is split into two types of functions, cognitive and motivational, which are broken down into further subgroups.

The two levels of imagery, cognitive and motivational functions, are divided into either a specific or general level. For the cognitive functions of imagery there is cognitive general (CG) or cognitive specific (CS) (Gregg & Hall, 2006; Paivio, 1985). CG deals with visualizing strategies, game plans, and routines, while CS encompasses imaging the specific motor skill of a particular sport (Weinberg, 2008). For the motivational functions there is a motivational general (MG) and a motivational specific (MS). MG involves visualizing physiological arousal levels and emotions and can be broken down into two more division. Motivational general-arousal (MG-A) function revolves around imagery that involves arousal and stress, and a motivational general-mastery (MG-M) function is the division that is associated with mental toughness, control, and self-confidence. Motivational specific (MS) function entails imaging individual goals. Each function is used to help cope with a certain psychological demand.

When discussing mental imagery in relation to sports there are four fundamental questions used to help investigate athletes' use imagery. The " . . . four W's of imagery use" (Munroe *et al.*, 2000, p. 441) are where and when do athletes use imagery, what do athletes imagine, and finally why athletes use imagery. Each question helps frame mental imagery and how athletes utilize it.

The first two questions are where and when is imagery used? The most common answer for these questions is immediately prior to competition (Weinberg, 2008; Jones & Stuth, 1997). Athletes tend to get the most from mental imagery prior to competition when they are about to perform and they need control of all of their mental facilities. Another place imagery is often used by athletes is " . . . when it comes to practice of skills, imagery is most easily applied and

seen as most valuable during practice" (Hall & Fishburne, 2010, p. 6). Visualizing correct execution of skills can be very helpful during practice when athletes are given the opportunity to execute them mentally and physically. Research shows that athletes do not tend to use mental imagery after competition or after practice, but have been known to use it in other aspects of their lives, such as at work, home, or at school (Callow *et al.*, 2010). Athletes continue to exercise their mental skills in other aspects of their lives, ensuring that they are keeping their mental game sharp for competition. The best time to use imagery is depends heavily on the specific sport and the type of skill being taught or practiced. In addition different sports, skill levels, and type of athletes utilizing the imagery dictate the frequency of its use.

The third question asked is why do athletes use mental imagery? The answers vary depending on which function the athletes desire when implementing imagery. First the cognitive functions are used to rehearse a specific motor skill (CS) or to visualize a game plan, strategy, or routine (CG) (Hall & Fishburne, 2010; Gregg & Hall, 2006). CS would be used to fix mistakes in technique or learning a new skill. CG would be used to plan out execution of a performance. Motivational functions are used to set goals (MS), either an outcome goal, which would be winning a game or race, or a performance goal, which is the training required to achieve the outcome goals. Motivational functions are also used to quell or control anxiety and stress (MG-A), or to focus, build confidence, or to call on mental toughness (MG-M). Most athletes use MG-M or mental toughness/confidence when they say they are using mental imagery. Research shows that " . . . athletes use imagery more for performance enhancement and skill execution than skill learning" (Jedlic *et al.,* 2007, p. 351). This mental function can improve the confidence of athletes and effect athletic performance. Whether athletes and coaches are aware of the

specific use of each function is still debated, but the different functions of imagery have been determined and should be used accordingly.

The fourth and final question is what are athletes imagining? The visual perspective the athlete is using is the answer to this question. Visual perspective can either be internal or external. When imaging a physical performance an internal perspective requires " . . . an approximation of the real-life phenomenology such that the person actually imagines being inside his or her body and experiences those sensations which might be expected in the actual situation" (Weinberg, 2008, p.9). Internal perspective is used to practice and refine motor skills as if the person was there first hand. For external perspectives, " . . . a person views himself of herself from the perspective of an external observer" (p.9). External perspectives are used more for people who need to observe the body's form during an action or who are just starting to perform these skills. Perspective can also be individualized depending on the athlete and their preferences.

Mental imagery is a dominant topic in psychological interventions for athletes and has been utilized by swimmers for years. The study conducted by Thiese and Huddleston (1999) determined that " . . . swimmers in the study indicated that goal setting, positive self-talk, and music were skills to be utilized 'almost always' on a Likert scale " (p. 609). These psychological interventions are healthy ways for swimmers to deal with the psychological demands of their sport. The study also stated that many swimmers indicated that they never used certain psychological interventions because they had never heard of them. In hindsight it can be argued that these swimmers did in fact practice these psychological interventions, but did not know they were practicing them (Lines & Schwartzman, 1999). Athletes, especially swimmers, have been exposed to mental imagery sometime in their careers, whether they are aware of it or not.

Coaches use mental imagery to help teach technique and pair it with physical practice to create a stronger connection for the swimmer.

Mental imagery is important for college swimmers to utilize because of the research conducted that suggests it does help athletic performance. One study states that " . . . the meta-analysis provides significant support for the positive relationship between mental imagery and successful performance across a wide range of tasks and performance conditions" (Neck & Manz, 1992, p. 685). Mental imagery covers many aspects of psychological skills and can be used by a wide variety of people. Even in the Thiese and Huddleston (1999) study they did not find a significant difference between the sprinter group and the distance group regarding imagery use. Therefore it can be applied to a group that varies in skill type and practice distance, but still have similar affects. Mental imagery will also benefit those athletes that practice all distances and stroke type. All swimmers, despite their specialties, would benefit from properly implementing mental imagery into their practice routine.

Another application of mental imagery for college swimmers is changing mental status from negative to positive. Multiple studies believe that "It is important for athletes to be able to change their thoughts and feelings, including the feeling's tone, quality, frequency pattern of use, and type of cognitions" (Jones & Stuth, 1997, pg. 107). Mental imagery has been found to have a positive effect on these uses and this is a crucial skill to possess prior to competition (Hall & Fishburne, 2010; Lebon *et al.*, 2010). Emotional control allows for the athlete to concentrate on the athletic performance and " . . . individuals who can manage their emotions successfully can use emotions experienced during competition to assist performance" (Lane *et al.*, 2009, p. 196). The ability to draw from previous experiences gives athletes an advantage and the ability to use intuition to outsmart their opponent.

Summary

Swimming is a very individualized team sport and every individual performance affects the outcome of the team's performance. Therefore, swimmers need to posses the ability to change or buffer negative thoughts prior to competition to put forth their best effort. Mental imagery applies to the psychological demands placed on college swimmers and provides athletes with the tools to enhance another aspect of their performance during competition.

CHAPTER III

METHODS

The purpose of this study is to determine if the implementation of mental imagery by Division III swimmers affects the self-reported levels of mental strength during practices and competitions.

Design

The study is a quasi-experimental design using two measures (pre- and post- surveys) throughout the six-week duration of the experiment. A survey was used to assess the existing levels of perceived mental strength of the athletes at the beginning of the study. After the initial survey the participants were exposed to the forty-five minute long audio program of mental imagery every two weeks for three cycles. After the last imagery session the participants were given the same survey again to render any fluctuation in mental strength.

Participants

For this study, 31 NCAA Division III swimmers participated. Of those 31 swimmers, 15 were females and 16 were males. All of the subjects were of college age, between 17 and 23 years old. The researcher selected these subjects because they were all on the team she coached and had full access to throughout the season.

Instrument

The instrument used for data collection in this study was the Sport Psychology Questionnaire for Swimmers, which assessed the levels of existing mental strength for each athlete at the beginning of mental imagery implementation and again at the end of the six-week period.

Procedure

The study was conducted over the course of six weeks from the middle of October until the end of November, corresponding with the length of the fall portion of the team's competition schedule. First the students were asked to complete the questionnaire at the beginning of practice. The swimmers were instructed by the head coach and the researcher to answer the questionnaire as truthfully as possible to help each individual identify areas in which they would like some help and/or need to improve. They were told that all of their information would be kept confidential and to ask any clarification questions if necessary. Once the pre-test surveys were collected the entire team was introduced to the forty-five minute long mental imagery audio exercise prior to the schedule practice time allotted for the water. The exercise focused on meditation, breathing patterns, kinetic awareness, relaxation, race strategies, and detailed visualization. Every two weeks the athletes, as a team, participated in the mental imagery exercise prior to getting in the pool for practice. At the end of the six weeks the questionnaire was handed out after the mental imagery session to determine whether or not the student athletes' level of mental strength increased.

CHAPTER IV

RESULTS

The study examines how collegiate athletes, especially swimmers, exposed to mental imagery will affect their mental strength during practice and competition. Data were gathered on a pre and post survey administered to 31 co-ed NCAA Division III swimmers. The survey instrument can be found in Appendix A. Pre to post differences were analyzed via the chi square statistic in a series of analyses utilizing SPSS. No statistically significant findings on any of the questions on the survey were found. Table 1 below shows question 1 of the competition survey as a sample. The remaining tables for the competition questions 2 through 19 are placed in Appendix B. Table 2 is for question 1 of the training survey and shows a sample analysis. The remaining tables for the training questions 2 through 17 are placed in Appendix C.

Table 1

Chi Square Analysis of Question 1

		1. Thinking Positive Thoughts?					
		1	2	3	4	5	Total
Competition:	pre_Survey_Measure	3	6	11	3	2	25
	post_Survey_Measure	2	8	11	4	0	25
Total		5	14	22	7	2	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.629[a]	4	.622

Table 2

Chi Square Analysis of Training Question 1

		Training		
		1	2	Total
1. Setting specific physical, technical, tactical, and mental goals for every practice?	1	2	3	5
	2	6	9	15
	3	9	11	20
	4	5	1	6
	5	3	1	4
Total		25	25	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.667[a]	4	.323

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is 2.00.

CHAPTER V

DISCUSSION

This study was conducted to develop a better understanding of mental imagery and its effects on the mental strength of collegiate athletes during practice and competition. Statistical analyses reported in Chapter IV result in the retention of the null hypothesis. The original hypothesis stated that the collegiate athletes, especially swimmers, exposed to mental imagery would show no difference in their mental strength during practice and competition. Data collected from the pre- and post-test questionnaires given to the participants during the experiment did not show any significant differences. This lack of statistical change indicates that the implementation of mental imagery did not have an effect on the mental strength of the student athletes during practice or competition.

Discussion of Results

The original hypothesis stated that the exposure of mental imagery to collegiate athletes, in particular swimmers, would have no effect on the measurement of their mental strength. The researcher attempted to implement an intervention and collect data that would reject this null hypothesis. Statistically significant differences in the data would have given the researcher reason to reject the theory that there is no connection between changes in mental strength and the exposure to mental imagery. If the chi-square testing on any of the 36 survey questions had indicated a notable difference between the pre-test and post-test answers, the researcher could argue that the mental imagery was the reason for the change in mental health. However, as previously stated, the results in Chapter IV provide no statistically significant findings and the null hypothesis is retained. More research must be conducted in order to determine if mental imagery effects mental strength of Division III swimmers on any level.

Threats to Validity

All experiments contain threats to external and internal validity. An external threat to validity is the small sample size used for the experiment because it was a convenience sample. The participants in the survey were all from the same school, same sport, and same team. Due to the type of sample in this experiment, the small number of participants and their common background pose a treat to the validity of generalizing the results for the entire population. If the survey had been given to multiple teams, then one group could have been used as a control group. If the experiment had been implemented on a larger team or multiple swim teams then the results could have been different, illustrating different trends among a larger population. Also there is the possibility that mental imagery could affect teams of different sports in different ways, thus potentially impacting the mental strength of student athletes and the significance of the study.

Threats to the internal validity depend on the research design of the experiment. In order for an experiment to have a true experimental design, there needs to be the manipulation of one or more variables, the random assignment of subjects to groups, and the control of extraneous variables by control groups. This experiment is classified as a quasi-experimental design because it does not have the random assignment of subjects to groups and does not use a control group. The limitations of no control group and non-randomly assigned subjects is that differences between the pre-test and the post-test could be due to many factors in addition to initial intervention. Natural developments, life events, or even unexpected situations that occur between the pre-test and the post-test could contribute to the differences, or lack of differences, seen in the results. In this experiment, these additional variables were reduced as much as possible by giving the tests within a smaller time frame, focusing on one portion of the season, as compared

to a longer period of time. The validity would be additionally compromised if the pre-test was given at the beginning of a swimmers college career and then the post-test given at the end of the participants senior year season. The more time that elapses between tests allows for more outside variables to become a factor when there is no control group or randomly assigned subjects.

Another internal threat to validity is the way in which the swimmers answered the survey questions. There are various reasons that might affect the way the participants answered the questions and whether or not the swimmers answered the questions truthfully. For example, the team was instructed to think about the questions and answer them honestly, but many of the swimmers were going through midterms during the initial week of the first survey. No swimmer openly admitted to the impact of midterms or school on the validity of his or her answers to the survey, but academic distractions could have impacted the way the athlete answered certain questions. The student athletes knew the requirements of the survey and the context of the questions as they applied to practice/training and to competition, but because the athletes were relatively removed from those two environments their thoughts could have been distracted. The student athletes could have also with held their real answers because of the mistrust in the proctor, survey, or reactions of the coach, thus, threatening the validity of the study.

Connections to Previous Research

As previously stated in Chapter II, mental imagery is a popular psychological intervention used by athletes of all skill levels throughout the world. Many athletes use mental imagery to achieve and enhance a wide array of functions. Literature suggests that there is support for " . . . the positive relationship between mental imagery and successful performance across a wide range of tasks and performance conditions" (Neck & Manz, 1992, p. 685). This study attempted to determine mental strength during the different conditions of practice and

competition after implementing mental imagery. The researcher observed that the participants were more adept at applying the functions of mental imagery to their practice habits during the time that directly followed the mental imagery exercise. The participants were less likely to demonstrate signs of mental imagery use prior or during competition.

Mental imagery is an attractive tool for coaches and athletes because it can be used by all types of athletes and can be curtailed by the individual. Research shows that mental imagery can work cognitive functions as well as motivational functions (Gregg & Hall, 2006; Paivio, 1985). The cognitive areas mental imagery can enhance include visualizing strategies, routines and specific motor skills (Weinberg, 2008). The motivational functions of mental imagery range from mimicking arousal and stress levels felt by athletes to mental toughness, control, and self-confidence. All of these functions were explored and provided in the mental imagery audio exercise implemented in this experiment. Unfortunately it was observed that many of the participants in this study lacked the concentration necessary to truly internalize the practices provided by the mental imagery exercise. Multiple participants were observed sleeping during the exercise or concerned with the next responsibility of the day. The researcher also witnessed participants thoughtlessly answering the questionnaires, taking little time to reflect on what each question was asking. Many of the survey questions are complex and require the participant to take time to reflect and accurately assess his or her true position. Therefore, it is reasonable to assume that the swimmers who neglected to fully participate in the exercise or did not take their time answering the questions did not give the most accurate answers.

One similarity seen between the literature and this study is the observation that athletes may not realize they are implementing mental imagery. In the study conducted by Thiese and Huddleston (1999), the swimmers reported use of behaviors such as goal-setting, positive self-

talk, and even focus and heightened arousal through listening to music before competition. The swimmers also indicated that they had never used certain psychological interventions because they had never heard of them, when in reality the swimmers were naturally practicing these interventions unknowingly (Lines *et al.*, 1999). During this experiment, the researcher witnessed swimmers partaking in exercises that could be considered mental imagery. Individuals would put their headphones on and focus before a race, they would talk about their races and where they went wrong or how they plan to fix it, and they came in early and practiced certain skills. Similar to the literature, these swimmers practice mental imagery behaviors without realizing the connection between the action and its classification.

Conclusions and Suggestions for Future Research

In conclusion, this study was unable to provide evidence to refute the null hypothesis. The null hypothesis remains that exposure of mental imagery to collegiate athletes, especially swimmers, will not affect their mental strength during practice or competition. While the results do not provide any clear data to disprove this hypothesis, there are threats to the validity of the results. As mental imagery and other psychological interventions were found to be impactful on the mental strength of athletes in past studies, the researcher intended to find out the effects of mental imagery on swimmers to aid them in training and competition. It was found that both males and female swimmers struggle with issues such as focus, positive thoughts, anxiety, adapting as situations occur, injury recovery, and mindful execution of repetitive skills. Patterns as to what causes individuals to feel weaker in certain areas compared to others were not discovered in this experiment but could be further investigated if research continues on this topic. The researcher intended to find an intervention that would aid the student-athletes in

mental preparation both for training purposes and competition purpose to ultimately improve their performance.

If research were to continue on this subject, many alterations could be made to the experiment to produce more accurate and reliable results. The first change would be to make the experiment design more of a true experimental design rather than a quasi-experiment. The first change would be to use a larger sample size. The study could expand to include other swim teams from the immediate conference, competing conferences, or even all of the teams from the Division III level. Increasing the number of teams involved in the study would allow for a control group to be added as well as allow the researcher to randomly assign participants As a result, the data collected could be analyzed and compared with one group as the baseline and the other the dependent variable. Comparisons could be made between teams from all different regions. In addition to using more teams, the type of sports teams used could be expanded to enhance the study. Specifically, sports that have both men's and women's teams could provide comparable data to the current study. In addition, the intervention could be performed throughout the entire season, instead of just during one portion of the competitive season. Finally, a different physiological intervention, besides mental imagery, that focuses on more on mental strength as opposed to visualization could also be used. In essence, all suggestions could help provide more positive and effective results.

APPENDIX A

Sport Psychology Questionnaire for Swimmers

From "Behavioral Assessment Forms for Sport Psychology Consulting" by Garry L. Martin, S. Adrienne Toogood, & Gregg A Tkachuck, 1997, pp. 80-81. Winnipeg, MB, Canada. Sport Science Press.

This questionnaire was designed to help you to identify areas in which you would like some help and/or need to improve. All the information will be kept confidential.

Name: _____ Date: _____ Year : _____

Competition: **Would you say that, just before or during a meet, you need to improve at:**	Not Sure	Definitely Do not need to improve		Somewhat		Definitely need to improve	Check here if you would like help to improve
1. Thinking positive thoughts? (*e.g. "I know I can hit the splits I'm going for", "I'm going for a best time", etc.*)		1	2	3	4	5	
2. Tuning out negative thoughts? *(e.g. "I hope I don't come in last", "These swimmers are really fast", etc.)*		1	2	3	4	5	
3. Staying loose and not getting too nervous: a) just before a race? b) in pressure situations?		1	2	3	4	5	
4. Maintaining/regaining your confidence in difficult situations? (*e.g., you have a bad start/split, you're behind, you feel really nervous, etc.*)		1	2	3	4	5	
5. Maintaining your concentration during a race? (*e.g. focusing on technique, concentrating on turns, etc.*)		1	2	3	4	5	
6. Blocking out distractors over which you have no control? (*e.g., the time of day your race, who you're competing against, etc.*)		1	2	3	4	5	
7. Blocking out what people might		1	2	3	4	5	

say if you don't perform well? *(e.g. comments from your parents, coach, friends, or spectators)* Others?_____							
8. Blocking out distractors that don't involve swimming? *(e.g., school, family, or relationship problems)* Others?_____		1	2	3	4	5	
9. Refocusing after you get distracted for any reason? (*e.g. while waiting behind the blocks during the heat before yours, a competitor invades your space, etc.)*		1	2	3	4	5	
10. Staying energized in difficult situations? *(e.g., when you feel fatigued or ill, your opponents have much faster entry times, etc.)*		1	2	3	4	5	
11. Making adjustments as the race progresses? *(e.g., to deal with an opponent's tactics, etc.)*		1	2	3	4	5	
12. Staying positive throughout a race? *(e.g. you're feeling pain, you're falling behind, etc.)*		1	2	3	4	5	
13. Managing troublesome emotions? *(e.g., excitement, anger, disappointment, etc.)*		1	2	3	4	5	
14. Giving 100% effort when there are excuses not to? *(e.g., you are swimming against people you have swum against several times, you are placing poorly in a race, you begin to feel fatigued, etc.)*		1	2	3	4	5	
15. Setting challenging yet attainable goals for each meet?		1	2	3	4	5	
16. Having a better health management plan before and during a meet? *(e.g., getting enough sleep, drinking enough water, eating properly, etc.)*		1	2	3	4	5	
17. Preparing and following a detailed precompetition and competition plan?		1	2	3	4	5	
18. Communicating your precompeition needs to others? *(e.g., parent(s), coach, teammates, and friends, etc.)*		1	2	3	4	5	

19. Staying supportive of an praising teammates' performance?		1	2	3	4	5	

Additional Concerns about Competitions:

_____

_____

_____

_____

_____

_____

Training: **Would you say that, at practices, you need to improve at:**	Not Sure	Definitely Do not need to improve		Somewhat		Definitely need to improve	Check here if you would like help to improve
1. Setting specific physical, technical, tactical, and mental goals for every practice?		1	2	3	4	5	
2. Keeping a written record of progress in meeting your goals?		1	2	3	4	5	
3. Arriving at practice totally committed to do your best? (e.g., consistently be stretched before the practice is scheduled to start, etc.)		1	2	3	4	5	
4. Maintaining your concentration, especially when practice gets long, repetitive, or uninteresting?		1	2	3	4	5	
5. Maintaining your effort and focus, especially when you are tired or don't feel like being there?		1	2	3	4	5	
6. Making better use of full practice times? (e.g., swimming all sets under the set time, practicing good turns at both ends, etc.)		1	2	3	4	5	
7. Staying positive when you're having a bad practice?		1	2	3	4	5	
8. Remaining positive when an injury forces you to stop training?		1	2	3	4	5	
9. Constantly working on improving your technique? (i.e., don't just go through the motions)		1	2	3	4	5	
10. Trying new and challenging		1	2	3	4	5	

skills? (e.g., trying to perfect a new stroke or turn, etc.)							
11. Practicing mental skills, as well as physical skills?		1	2	3	4	5	
12. Not worrying about what other swimmers are doing? (i.e., concentrating on what you have to do to improve)		1	2	3	4	5	
13. Using key words and self-talk to improve your skills? (e.g., on backstroke: “Head still”, “Hips High”, etc.)		1	2	3	4	5	
14. Making better use of visualization/mental rehearsal before practices to improve your skills?		1	2	3	4	5	
15. Focusing on having quality practices?		1	2	3	4	5	
16. Doing serious race simulations during some practices? (e.g., using a start gun, timing your splits, swimming against other club members, wearing competitive suits, etc.)		1	2	3	4	5	
17. Using self-talk, key words, and imagery before and during race simulations?		1	2	3	4	5	

Additional Concerns about Practices:

_____

_____

_____

_____

_____

_____

_____

APPENDIX B

Table 2
Chi Square Analysis for Question

		2. Tuning out negative thoughts?					Total
		1	2	3	4	5	
Competition:	pre_Survey_Measure	3	3	9	5	5	25
	post_Survey_Measure	3	5	7	10	0	25
Total		6	8	16	15	5	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.417[a]	4	.115
Likelihood Ratio	9.386	4	.052
Linear-by-Linear Association	.722	1	.395
N of Valid Cases	50		

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is 2.50.

Table 3
Chi Square Analysis of Question 3

		3. Staying loose and not getting too nervous: a) just before a race? B) in pressure situations?					Total
		1	2	3	4	5	
Competition:	pre_Survey_Measure	4	6	5	8	2	25
	post_Survey_Measure	4	4	7	7	3	25
Total		8	10	12	15	5	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.000[a]	4	.910
Likelihood Ratio	1.006	4	.909
Linear-by-Linear Association	.115	1	.735
N of Valid Cases	50		

a. 4 cells (40.0%) have expected count less than 5. The minimum expected count is 2.50.

Table 4

Chi Square Analysis of Question 4

		4. Maintaining/regaining your confidence in difficult situations?					
		1	2	3	4	5	Total
Competition:	pre_Survey_Measure	1	9	10	4	1	25
	post_Survey_Measure	4	4	7	6	4	25
Total		5	13	17	10	5	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.452[a]	4	.168
Likelihood Ratio	6.763	4	.149
Linear-by-Linear Association	.764	1	.382
N of Valid Cases	50		

a. 4 cells (40.0%) have expected count less than 5. The minimum expected count is 2.50.

Table 5

Chi Square Analysis of Question 5

		5. Maintaining your concentration during a race?					
		1	2	3	4	5	Total
Competition:	pre_Survey_Measure	3	10	5	3	4	25
	post_Survey_Measure	4	7	8	5	1	25
Total		7	17	13	8	5	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.665[a]	4	.453
Likelihood Ratio	3.807	4	.433
Linear-by-Linear Association	.127	1	.722
N of Valid Cases	50		

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is 2.50.

Table 6

Chi Square Analysis of Question 6

		6. Blocking out distractions over which you have no control?					
		1	2	3	4	5	Total
Competition:	pre_Survey_Measure	3	9	6	4	2	24
	post_Survey_Measure	2	9	7	5	2	25
Total		5	18	13	9	4	49

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.368[a]	4	.985
Likelihood Ratio	.369	4	.985
Linear-by-Linear Association	.168	1	.682
N of Valid Cases	49		

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is 1.96.

Table 7

Chi Square Analysis of Question 7

		7. Blocking out what people might say if you don't perform well?					
		1	2	3	4	5	Total
Competition:	pre_Survey_Measure	6	5	8	4	1	24
	post_Survey_Measure	7	7	7	1	3	25
Total		13	12	15	5	4	49

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.258[a]	4	.516
Likelihood Ratio	3.432	4	.488
Linear-by-Linear Association	.084	1	.772
N of Valid Cases	49		

a. 4 cells (40.0%) have expected count less than 5. The minimum expected count is 1.96.

Table 8
Chi Square Analysis of Question 8

		8. Blocking out distractors that don't involve swimming?					
		1	2	3	4	5	Total
Competition:	pre_Survey_Measure	7	6	7	3	2	25
	post_Survey_Measure	3	10	3	7	2	25
Total		10	16	10	10	4	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.800[a]	4	.215
Likelihood Ratio	5.948	4	.203
Linear-by-Linear Association	.831	1	.362
N of Valid Cases	50		

a. 2 cells (20.0%) have expected count less than 5. The minimum expected count is 2.00.

Table 9
Chi Square Analysis of Question 9

		9. Refocusing after you get distracted for any reason?				
		1	2	3	4	Total
Competition:	pre_Survey_Measure	5	11	6	3	25
	post_Survey_Measure	3	8	8	6	25
Total		8	19	14	9	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.259[a]	3	.520
Likelihood Ratio	2.287	3	.515
Linear-by-Linear Association	2.108	1	.146
N of Valid Cases	50		

a. 4 cells (50.0%) have expected count less than 5. The minimum expected count is 4.00.

Table 10
Chi Square Analysis of Question 10

		10. Staying energized in difficult situations?					
		1	2	3	4	5	Total
Competition:	pre_Survey_Measure	0	6	9	5	5	25
	post_Survey_Measure	2	2	10	8	3	25
Total		2	8	19	13	8	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.245[a]	4	.263
Likelihood Ratio	6.122	4	.190
Linear-by-Linear Association	.018	1	.894
N of Valid Cases	50		

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is 1.00.

Table 11
Chi Square Analysis of Question 11

		11. Making adjustments as the race progresses?					
		1	2	3	4	5	Total
Competition:	pre_Survey_Measure	2	7	4	6	4	23
	post_Survey_Measure	4	5	8	7	1	25
Total		6	12	12	13	5	48

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.134[a]	4	.388
Likelihood Ratio	4.295	4	.368
Linear-by-Linear Association	.688	1	.407
N of Valid Cases	48		

a. 4 cells (40.0%) have expected count less than 5. The minimum expected count is 2.40.

Table 12
Chi Square Analysis of Question 12

		12. Staying positive throughout a race?					
		1	2	3	4	5	Total
Competition:	pre_Survey_Measure	0	6	10	6	3	25
	post_Survey_Measure	4	5	10	5	1	25
Total		4	11	20	11	4	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.182[a]	4	.269
Likelihood Ratio	6.774	4	.148
Linear-by-Linear Association	2.613	1	.106
N of Valid Cases	50		

a. 4 cells (40.0%) have expected count less than 5. The minimum expected count is 2.00.

Table 13
Chi Square Analysis of Question 13

		13. Managing troublesome emotions?					
		1	2	3	4	5	Total
Competition:	pre_Survey_Measure	3	9	9	1	3	25
	post_Survey_Measure	3	5	8	4	4	24
Total		6	14	17	5	7	49

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.125[a]	4	.537
Likelihood Ratio	3.268	4	.514
Linear-by-Linear Association	1.098	1	.295
N of Valid Cases	49		

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is 2.45.

Table 14

Chi Square Analysis of Question 14

		14. Giving 100% effort when there are excuses not to?					
		1	2	3	4	5	Total
Competition:	pre_Survey_Measure	6	5	6	4	4	25
	post_Survey_Measure	7	11	1	3	3	25
Total		13	16	7	7	7	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.184[a]	4	.186
Likelihood Ratio	6.632	4	.157
Linear-by-Linear Association	1.259	1	.262
N of Valid Cases	50		

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is 3.50.

Table 15

Chi Square Analysis of Question 15

		15. Setting challenging uet attainable goals for each meet?				
		1	2	3	4	Total
Competition:	pre_Survey_Measure	6	6	9	4	25
	post_Survey_Measure	4	14	6	1	25
Total		10	20	15	5	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.000[a]	3	.112
Likelihood Ratio	6.226	3	.101
Linear-by-Linear Association	1.186	1	.276
N of Valid Cases	50		

a. 2 cells (25.0%) have expected count less than 5. The minimum expected count is 2.50.

Table 16

Chi Square Analysis of Question 16

		16. Having a better health management plan before and during a meet?					
		1	2	3	4	5	Total
Competition:	pre_Survey_Measure	4	5	6	8	2	25
	post_Survey_Measure	2	8	4	6	5	25
Total		6	13	10	14	7	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.330[a]	4	.504
Likelihood Ratio	3.396	4	.494
Linear-by-Linear Association	.311	1	.577
N of Valid Cases	50		

a. 4 cells (40.0%) have expected count less than 5. The minimum expected count is 3.00.

Table 17

Chi Square Analysis of Question 17

		17. Preparing and following a detailed precompeition and competition plan					
		1	2	3	4	5	Total
Competition:	pre_Survey_Measure	6	2	9	6	2	25
	post_Survey_Measure	0	6	9	7	2	24
Total		6	8	18	13	4	49

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.060[a]	4	.089
Likelihood Ratio	10.467	4	.033
Linear-by-Linear Association	1.308	1	.253
N of Valid Cases	49		

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is 1.96.

Table 18

Chi Square Analysis of Question 18

		18. Communicating your precompeition needs to others?					
		1	2	3	4	5	Total
Competition:	pre_Survey_Measure	4	7	5	5	2	23
	post_Survey_Measure	4	3	13	4	0	24
Total		8	10	18	9	2	47

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.249[a]	4	.123
Likelihood Ratio	8.191	4	.085
Linear-by-Linear Association	.009	1	.923
N of Valid Cases	47		

a. 7 cells (70.0%) have expected count less than 5. The minimum expected count is .98.

Table 19

Chi Square Analysis of Question 19

		19. Staying supportive of an prasing teammates' performance?					
		1	2	3	4	5	Total
Competition:	pre_Survey_Measure	13	4	4	1	2	24
	post_Survey_Measure	9	10	1	3	2	25
Total		22	14	5	4	4	49

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.081[a]	4	.193
Likelihood Ratio	6.341	4	.175
Linear-by-Linear Association	.303	1	.582
N of Valid Cases	49		

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is 1.96.

APPENDIX C

Table 2

Chi Square Analysis of Training Question 2

		Training		
		1	2	Total
2. Keeping a written records of progress in meetings your goals?	1	3	3	6
	2	3	1	4
	3	4	9	13
	4	4	8	12
	5	7	2	9
Total		21	23	44

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.958[a]	4	.138
Likelihood Ratio	7.230	4	.124
Linear-by-Linear Association	.294	1	.588
N of Valid Cases	44		

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is 1.91.

Table 3

Chi Square Analysis of Training Question 3

		Training		
		1	2	Total
3. Arriving at practice totally committed to do your best?	1	3	3	6
	2	6	11	17
	3	13	8	21
	4	2	2	4
	5	1	1	2
Total		25	25	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.661[a]	4	.616
Likelihood Ratio	2.695	4	.610
Linear-by-Linear Association	.555	1	.456
N of Valid Cases	50		

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is 1.00.

Table 4
Chi Square Analysis of Training Question 4

		Training		Total
		1	2	
4. Maintaing your concentration, especially when practice gets long, repetitive, or uninteresting?	1	3	2	5
	2	2	7	9
	3	11	9	20
	4	7	4	11
	5	2	3	5
Total		25	25	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.196[a]	4	.380
Likelihood Ratio	4.374	4	.358
Linear-by-Linear Association	.262	1	.609
N of Valid Cases	50		

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is 2.50.

Table 5
Chi Square Analysis of Training Question 5

		Training		Total
		1	2	
5. Maintaining your effort focus, especially when you are tierd or don't feel like being there?	1	3	4	7
	2	3	2	5
	3	13	12	25
	4	3	4	7
	5	3	3	6
Total		25	25	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.526[a]	4	.971
Likelihood Ratio	.528	4	.971
Linear-by-Linear Association	.000	1	1.000
N of Valid Cases	50		

a. 8 cells (80.0%) have expected count less than 5. The minimum expected count is 2.50.

Table 6
Chi Square Analysis of Training Question 6

		Training		Total
		1	2	
6. Making better use of full practice times?	1	2	1	3
	2	7	13	20
	3	7	6	13
	4	8	4	12
	5	1	1	2
Total		25	25	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.544[a]	4	.471
Likelihood Ratio	3.604	4	.462
Linear-by-Linear Association	1.254	1	.263
N of Valid Cases	50		

a. 4 cells (40.0%) have expected count less than 5. The minimum expected count is 1.00.

Table 7
Chi Square Analysis of Training Question 7

		Training		Total
		1	2	
7. Staying positive when you're having a bad practice?	1	1	2	3
	2	2	5	7
	3	12	11	23
	4	9	6	15
	5	1	1	2
Total		25	25	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.263[a]	4	.688
Likelihood Ratio	2.316	4	.678
Linear-by-Linear Association	1.519	1	.218
N of Valid Cases	50		

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is 1.00.

Table 8
Chi Square Analysis of Training Question 8

		Training		
		1	2	Total
8. Remaining positive when an injury forces you to stop training?	1	1	4	5
	2	5	6	11
	3	5	6	11
	4	7	6	13
	5	4	2	6
Total		22	24	46

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.643[a]	4	.619
Likelihood Ratio	2.779	4	.595
Linear-by-Linear Association	2.147	1	.143
N of Valid Cases	46		

a. 4 cells (40.0%) have expected count less than 5. The minimum expected count is 2.39.

Table 9
Chi Square Analysis of Training Question 9

		Training		
		1	2	Total
9. Constantly working on improving your technique?	1	1	2	3
	2	10	5	15
	3	9	12	21
	4	5	5	10
	5	0	1	1
Total		25	25	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.429[a]	4	.489
Likelihood Ratio	3.855	4	.426
Linear-by-Linear Association	.622	1	.430
N of Valid Cases	50		

a. 4 cells (40.0%) have expected count less than 5. The minimum expected count is .50.

Table 10
Chi Square Analysis of Training Question 10

		Training		
		1	2	Total
10. Trying new and challenging skills?	1	4	4	8
	2	10	8	18
	3	4	7	11
	4	6	3	9
	5	1	3	4
Total		25	25	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.040[a]	4	.551
Likelihood Ratio	3.117	4	.538
Linear-by-Linear Association	.127	1	.721
N of Valid Cases	50		

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is 2.00.

Table 11
Chi Square Analysis of Training Question 11

		Training		
		1	2	Total
11. Practicing mental skills, as well as physical?	1	3	3	6
	2	1	3	4
	3	10	11	21
	4	9	5	14
	5	2	3	5
Total		25	25	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.390[a]	4	.664
Likelihood Ratio	2.454	4	.653
Linear-by-Linear Association	.258	1	.611
N of Valid Cases	50		

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is 2.00.

Table 12
Chi Square Analysis of Training Question 12

		Training		
		1	2	Total
12. Not worrying about what other swimmers are doing?	1	3	3	6
	2	2	7	9
	3	8	7	15
	4	8	5	13
	5	4	3	7
Total		25	25	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.680[a]	4	.451
Likelihood Ratio	3.851	4	.427
Linear-by-Linear Association	1.337	1	.248
N of Valid Cases	50		

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is 3.00.

Table 13
Chi Square Analysis of Training Question 13

		Training		
		1	2	Total
13. Using key words and self-talk to improve your skills?	1	6	8	14
	2	7	6	13
	3	7	6	13
	4	3	4	7
	5	1	1	2
Total		24	25	49

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.562[a]	4	.967
Likelihood Ratio	.564	4	.967
Linear-by-Linear Association	.029	1	.865
N of Valid Cases	49		

a. 4 cells (40.0%) have expected count less than 5. The minimum expected count is .98.

Table 14
Chi Square Analysis of Training Question 14

		Training		
		1	2	Total
14. Making better use of visualization/mental rehearsal before practices to improve your skills?	1	3	4	7
	2	5	6	11
	3	8	7	15
	4	7	7	14
	5	2	1	3
Total		25	25	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.634[a]	4	.959
Likelihood Ratio	.641	4	.958
Linear-by-Linear Association	.380	1	.538
N of Valid Cases	50		

a. 4 cells (40.0%) have expected count less than 5. The minimum expected count is 1.50.

Table 15
Chi Square Analysis of Training Question 15

		Training		Total
		1	2	
15. Focusing on having quality practices?	1	3	6	9
	2	13	9	22
	3	5	6	11
	4	3	2	5
	5	1	2	3
Total		25	25	50

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.352[a]	4	.671
Likelihood Ratio	2.383	4	.666
Linear-by-Linear Association	.017	1	.897
N of Valid Cases	50		

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is 1.50.

Table 16
Chi Square Analysis of Training Question 16

		Training		Total
		1	2	
16. Doing serious race simulations during some practices?	1	7	5	12
	2	3	9	12
	3	5	8	13
	4	5	1	6
	5	4	2	6
Total		24	25	49

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.342[a]	4	.119
Likelihood Ratio	7.743	4	.101
Linear-by-Linear Association	1.090	1	.296
N of Valid Cases	49		

a. 4 cells (40.0%) have expected count less than 5. The minimum expected count is 2.94.

Table 17
Chi Square Analysis of Training Question 17

		Training		Total
		1	2	
17. Using self-talk, key words, and imagery before and during race simulations?	1	5	6	11
	2	8	8	16
	3	8	6	14
	4	1	3	4
	5	2	2	4
Total		24	25	49

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.357[a]	4	.852
Likelihood Ratio	1.404	4	.844
Linear-by-Linear Association	.004	1	.949
N of Valid Cases	49		

a. 4 cells (40.0%) have expected count less than 5. The minimum expected count is 1.96.

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