EFFECTS OF PSYCHOLOGICAL SKILLS TRAINING ON GOLF PERFORMANCE

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ABSTRACT

EFFECTS OF PSYCHOLOGICAL SKILLS TRAINING ON GOLF PERFORMANCE

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Mental training is an important part of preparation for many high achieving athletes (Orlick & Partington, 1988). The aim of the present study was to build upon previous research suggesting that mental skills need to be deliberately practiced just as physical skills are (Cumming & Hall, 2002; Ericsson, Krampe, & Tesch-Romer, 1993; Feltz & Landers, 1983), and that practicing mental and physical skills together increases an athlete's chances of achieving peak performance (Krane & Williams, 2010; Vealey & Greenleaf, 2010). The skills of visualization and managing negative self-talk were trained and implemented using local male and female recreational golfers. Performance of each mental skill, as well as putting and pitching performance, were measured. It was hypothesized that over the course of the training program, performance would increase for each mental skill, and that putting and pitching performance would also improve. Ultimately, no clear effects on performance were seen as a result of the psychological skills training interventions, leading to an important discussion on participant commitment and the implications of the findings for consultation with athletes in the real world.

CHAPTER ONE: INTRODUCTION

Sport performance at any level is a culmination of genetic predispositions, training and experience, physical abilities and technique, and overall mental training and abilities. According to research in the field of sport psychology, it is often an athlete's mental capabilities during competition that sets athletes apart in the level of performance they are able to achieve. For example, although athletes may possess highly similar levels of training and innate physical capabilities, it is the utilization and training of mental skills, or lack thereof, that lead to instances of extraordinary performance or a failure to perform at the expected level. Much like the physical aspects of sport, the mental components require training in order to improve one's abilities and the impact that mental skills can have on performance (Ericsson, Krampe, & Tesch-Romer, 1993; Feltz & Landers, 1983). Utilizing sport psychology research, the goal through the current study was to investigate the effectiveness of a training program that encouraged the deliberate practice of specific mental skills as a way to improve golf performance.

One important focus of the field of sport psychology is to help athletes improve their performance through the training and utilization of mental skills that will enhance their ability to achieve new levels of performance. Sport psychology essentially combines aspects of psychology with knowledge of exercise science and motor behavior. Sport psychology aims to decipher the extra component that sets athletes with similar physical training backgrounds and capabilities apart. Research suggests this extra piece is a mental component in the form of mental skills that are deliberately trained along with the physical components (Ericsson, Krampe, & Tesch-Romer, 1993; Krane & Williams, 2010; Orlick & Partington, 1988). Through sport psychology research, mental training, or psychological skills training, has become a popular way to help enhance athlete performance. Sport psychology and mental training is especially important in the sport of golf, which is often regarded as one of the more mentally challenging sports. Golf icon Jack Nicklaus has touted the importance of a strong mental game. When speaking about Tiger Woods' future to the Associated Press, Nicklaus remarked that Tiger still has a chance to beat his record of 18 major championships, if he gets "the five inches between his ears squared out" (Gola, 2011, "Jack Nicklaus says Tiger Woods not going to go away," para. 2). As an individual sport with competition that lasts for hours, golf can be mentally fatiguing and require the highest level of psychological skill to sustain peak performance for even one round, much less the multiple days of a tournament.

Using sport psychology to improve mental training is now generally accepted as a requirement to improve performance and compete at the highest levels (Gee, 2010; Krane & Williams, 2010; Orlick & Partington, 1988). Several elite athletes have spoken of how their psychological skills elevate their performance beyond what natural talent and physical skills practice would allow. As the mental side of performance has been recognized, learning how to harness and teach these psychological skills has become more important for both sport leaders and sport researchers.

Although now widely accepted in practical application, much of early sport psychology was bound in laboratory settings using contrived simulations or competitions. More recently, the field has shifted its focus to more applied research conducted in near competition scenarios (Cohen, Tenenbaum, & English, 2006; Robazza, Pellizzari, & Hanin, 2004). Sport psychologists and mental performance consultants working with athletes in a variety of sports now use and study interventions that are evidence based and derived from methodologically sound empirical research.

Along with its shift in methodological strategy, sport psychology has grown as a practitioners' field. Recent membership includes over 2,500 professionals in 55 different countries through the Association for Applied Sport Psychology (Association for Applied Sport Psychology, 2018, "About AASP," para. 2), as well as additional practitioners who are members of Division 47 of the American Psychological Association (APA), the society for sport, exercise and performance psychology (APA Division 47, 2018, "About Div. 47," para. 1). These professionals work with athletes of all levels from novices to Olympians. As stated on the AASP website, some of the more common psychological skills in the field of applied sport psychology include attention and concentration control, imagery, visualization, and self-talk (Association for Applied Sport Psychology, 2018, "About Applied Sport and Exercise Psychology").

Due to the fact that sport psychology is still a rather new field, it is appropriate to explain how implementing psychological skills in sport can actually improve performance. Mental preparation and mental skills are less tangible than other aspects of sport, such as physical fitness. It is often easy to see how physically prepared athletes, such as golfers, are in terms of their flexibility, agility, and endurance or their technique and hours they have spent practicing on the golf course or getting swing lessons on the golf range. This being said, there are plenty of athletes with similar physical capabilities and preparation, leading to the notion that there must be something more that sets them apart. It is this "less tangible" mental aspect that allows certain athletes to perform at high levels under pressure while others fall victim to breakdowns in concentration, judgement, or swing mechanics. For example, if there was no mental aspect of performance there would be fewer standout performances, fewer performance meltdowns and less performance anxiety. If mental skills did not play a role in performance there would be far more athletes performing at a similar level because physical preparation and talent are more alike than different.

Fortunately, mental training is an integral part of preparing for athletic performance. It is incorporated into the practice regimens of many of the highest achieving athletes in a variety of sports (Orlick & Partington, 1988). While the highest achieving athletes certainly have remarkable physical abilities, it is clear that the mental aspect of sport must also be trained and practiced deliberately to achieve success.

When an athlete is able to combine physical and mental skill and reach a new level of performance and success beyond what is normal that is “peak performance” (Krane & Williams, 2010). Effective mental training programs complement physical training in order to move athletes closer to performing more consistently near their optimal level (Krane & Williams, 2010; Vealey & Greenleaf, 2010).

Researchers and practitioners distinguish between absolute performance, the best performance that could ever be seen based on an athlete’s physiological variables, and relative performance, that refers to what is actually seen from an athlete after numerous variables influence performance (Gee, 2010). For clarity, these terms will be referred to as absolute potential and relative performance, to make a clear distinction between the theoretical level that is rarely achieved and the actual achieved level of performance. Generally, the additional variables that may influence or reduce performance are referred to as performance inhibitors. Overcoming these performance inhibitors, either internal or external, is one reason for the use of sport psychology. A large part of sport psychology involves optimizing performance so that athletes overcome inhibitors and come as close to their absolute potential as possible (Gee, 2010).

One common way that athlete performance may be inhibited, or fail to reach the expected level of achievement, is due to a weakness in or failure to utilize the mental skills that help enhance performance. For example, if an athlete is unable to use optimal visualization or self-talk to prepare for competition, this will reduce the athlete's final performance. In a study of 1984 Canadian Olympians, Orlick and Partington (1988) found that 99 percent of athletes reported using imagery to prepare for the games, on average spending twelve minutes, four times a week, practicing this mental skill. Survey data suggests that athletes who could generate high quality imagery with high control of the experience had more successful Olympic performances (Orlick & Partington, 1988).

At other times, the performance inhibitors may be caused by maladaptive use of mental skills. For example, an athlete's negative self-talk may undermine self-confidence, or visualizing imagery of mistakes or missed shots may reduce performance. In a study of golf putting, it was found that negative imagery (seeing the ball missing the hole) produced significantly worse performance among participants over trials, while participants in the positive and no imagery conditions had slight improvements in performance. The results of that study also suggest that negative imagery may be more harmful to performance than positive outcome imagery is helpful to performance (Woolfolk, Murphy, Gottesfeld, & Aitken, 1985). Beilock, Afremow, Rabe, and Carr (2001) found similarly that performance on a golf putting task suffered when negative imagery was utilized in the form of suppression (imagery of "don't miss"). In order to have a positive impact on performance, imagery must be used in a way that is focused on positive outcomes, as a way to deter negative imagery. Overall, the psychological skills must be implemented and utilized in the correct manner in order to reap the performance benefits.

The mental skills of visualization, attentional focus and concentration, and positive self-talk have been found to be consistently utilized by more successful athletes (Krane & Williams, 2010). If so many athletes at the highest level are utilizing psychological skills and mental training regimens in order to enhance their performance, it is clear that these skills are an important part of athletic success and should be trained in a deliberate manner, just as the motor skills of performance are trained. At all levels of competition mental skills can be used to overcome psychological inhibitors so that relative performance will more closely approximate absolute potential (Gee, 2010).

In the present study, I developed and tested a mental skill training program for golfers with one of two different skills, self-talk or visualization. The self-talk training aimed to limit athlete use of negative self-talk that creates an inappropriate focus and takes away from performance. The visualization training aimed to help athletes create more vivid and realistic imagery for shot preparation and execution. The design of the present study was based on the notion that deliberate practice of physical skills is linked to increased performance and abilities, and that mental skills can be trained in a highly similar manner to the training of physical skills (Cumming & Hall, 2002; Ericsson, Krampe, & Tesch-Romer, 1993; Feltz & Landers, 1983). During this study researchers taught and subsequently measured performance of the psychological skills of visualization or self-talk (mental performance) as well as measured and tracked golf performance through pitching and putting tasks. The psychological performance measures were quantitative in nature and the psychological skills were taught in a structured training program similar to how motor skills training programs are implemented.

The psychological skills were taught and practiced in a natural setting, at the golf practice facilities of a local golf course. The presentation of the training and practice in a natural setting was hypothesized to increase the possibility of transfer to actual competition or play. In addition, training and testing these skills in near-competition golf settings was done to increase the external validity and generalizability of the results.

The design of this study allowed for a quantitative empirical evaluation of skills that have generally been studied qualitatively or with weak quantitative methods. In addition, it also allowed skills that typically exist internally and that are measured using self-report to be made external and measured objectively. For example, rather than utilizing self-report measures of visualization, participants were tested using visualization modules that measured how well they were actually able to create accurate imagery and visualize golf shots. The visualization scores were an objective measure of how well the participants visualized specific golf shots. When visualization, an internal phenomenon, can be tested objectively it becomes much easier to measure the skill and relate it to performance. It also becomes easier to develop more specific training programs for visualization when the skill can be measured objectively. Self-talk and visualization are fundamental skills that contribute in very specific ways to golf performance and therefore it is important to understand further how to effectively train them.

I suggest that imagery and self-talk can be improved in measurable ways through mental skills training. Through the use of deliberate mental skills training, I hypothesized that athletes would improve their performance on the specific mental skills. I also hypothesized that as the mental skills improved, overall golf performance, measured as putting and pitching accuracy, would also improve.

CHAPTER TWO: LITERATURE REVIEW

The Importance of Deliberate Practice

One of the oldest debates in psychology is the issue of nature versus nurture. More specifically in relation to the topic of achieving high levels of performance, there are differing ideas on whether individuals are born with innate abilities that set them apart or whether they are born a “blank slate” and improve their abilities through various forms of training and deliberate practice. Ericsson’s deliberate practice framework focuses entirely on the importance of deliberate practice for attaining expert levels of performance. However, there has been some debate concerning what else may account for achieving expert status. Ericsson and Pool argue in their book *Peak: Secrets From the New Science of Expertise,* that while inherited characteristics may give some individuals advantages when first learning skills (e.g., IQ, height, weight), that these advantages get smaller over time and eventually the amount and quality of practice takes on a much larger role in determining how skilled a person becomes (Ericsson & Pool, 2016).

Ericsson and Pool (2016) take this argument further, arguing that the most expert athletes are not always genetically gifted and that success comes from a mixture of both natural talent and deliberate practice. For example, they compare two quarterbacks, Jamarcus Russell and Tom Brady. Jamarcus Russell was said to have innate talent and athleticism. He was chosen first overall in the NFL draft while Tom Brady at the time of the draft did not seem to possess as much natural talent and was chosen 198th overall. The point: Russell fizzled out of the NFL after three years and Brady has become one of the most successful quarterbacks in NFL history.

For the purpose of this study, I have chosen not to utilize a strict behaviorist or a strict biological approach. While genetic predispositions or attributes (i.e., height, working memory capacity, personality, etc.) may initially set people apart, it is the added training and deliberate practice that then allows them to reach new levels of peak performance. Deliberate practice of important physical skills plays a central role in improving performance. Analysis of several findings on the antecedents of expert performance have led to the conclusion that achieving high levels of performance is a “multiply determined phenomenon” (Hambrick et al., 2016, p. 45). These findings do not suggest that mental skill training will lead to expert level performance for all athletes, but rather that they can be trained so that their relative performance will more closely approximate their absolute potential (Hambrick et al., 2016).

According to Ericsson and Pool (2016) we often assume that someone who has been doing something longer is better, but in reality, the authors argue, that once a person reaches a level of “acceptable” performance where the action becomes more automatic, additional years of basic practice do not lead to improvement. Instead, they claim individuals may slowly get worse, as abilities lessen without deliberate practice efforts taken to improve them.

Additionally, Ericsson and Pool (2016) suggest that purposeful practice consists of well-defined specific goals, focused effort, receiving feedback, and getting out of ones’ comfort zone, but suggests that this alone does not necessarily lead to expert performance. Deliberate practice takes the idea of purposeful practice one step further. Ericsson and Pool (2016) suggest that deliberate practice must occur after a skill has been well developed, and with the guidance of a teacher who themselves has a certain level of acquired skill. This type of practice must be focused and challenging and include objective criteria for what constitutes peak performance. It often requires full attention and therefore may be more hard work than enjoyable. It is for this reason that the mental skills introduced below were proposed to be utilized in way to add to pre-existing talent and enhance performance through a deliberate practice regimen including both mental and physical skills.

Visualization

Visualization Theories

The literature includes many definitions of imagery as it pertains to a sport context. Additionally, the literature uses both imagery and visualization to describe the act of creating images in the mind (Cumming & Hall, 2002; Morris, Spittle, & Watt, 2005). For clarity throughout this paper, the skill of producing vivid sport images will be referred to as visualization, with the content being referred to as imagery. For example, the process of seeing a tee shot from the tee through the air and landing in the fairway in one's mind would be considered visualization, the way the shot looks (in terms of color, shape, etc.) would be considered imagery.

Theories of how visualization training impacts performance typically fall into three main categories; psychoneuromuscular theories, pre-competition arousal training, and situation or scenario rehearsal. Psychoneuromuscular theories, such as the functional equivalence theory, state that imagery works to enhance sport performance through producing minute muscle movements identical to patterns seen during actual physical execution. For example, the functional equivalence theory suggests that imagery and actual movements are functionally equivalent in their recruitment of central nervous system structures and processes, and that the process of producing imagery merely activates the same neural networks without initiating physical execution of a skill or movement (Morris, Spittle, & Watt, 2005). Pre-competition arousal theories focus on imagery use as a way to reach an athlete's optimal arousal level for peak performance. Finally, scenario rehearsal imagery theories focus on carrying out the physical skill just as the athlete would in actual competition allowing the athletes to rehearse performance before competition and feel more prepared.

As exemplified in the psychoneuromuscular theories of imagery, many argue there is a neuroscientific basis for how and why imagery is effective in enhancing performance. Holmes and Calmels (2008), speaking from a psychoneuromuscular perspective, wrote:

> Imagery, in the context of sport, may be considered as the neural generation or regeneration of parts of a brain representation/neural network involving primarily top-down sensorial perceptual and affective characteristics that are primarily under the conscious control of the imager and which may occur in the absence of perceptual afference functionally equivalent to the actual sporting experience (as cited in Cumming & Williams, 2012, p. 214)

This quote lays out the basic premises of the functional equivalence theory of imagery. This relays the idea that when imagery is used in a sport context it occurs as a result of neural networks in the brain using information usually encountered during the actual physical performance. This theory lacks clear support in the literature and is more theoretically based than backed by clear physical evidence. The existing evidence, rather than providing clear physical evidence of how this phenomenon occurs, states what would be expected to occur based on theoretical knowledge of the activation of motor pathways without physical activity. Presently no one has produced confirming measurements of specific changes at the neuronal level.

Pre-competition arousal and scenario rehearsal theories offer other mediating variables. For example, athletes using imagery to manage their arousal level before competition are believed to be in a better state to perform well. Similarly, athletes using imagery of their upcoming performance may perform better because the task feels familiar and they feel prepared. They get these feelings from experiencing the visualized rehearsal of the actions several times.

One example of how imagery can be used is the applied model of imagery use. This model suggests that imagery has its effect on performance through the facilitation of learning and performance of skills and strategies due to its ability to help an athlete modify cognitions and regulate arousal and anxiety (Cumming & Ramsey, 2009). For the purpose of this study, athletes were trained in a way that focused on using imagery to generate positive and successful mental pictures of performances under naturally elevated arousal. Arousal is naturally higher in competition or near competition settings. Thus, instead of using imagery as a form of relaxation training or meditation as a way to reduce arousal, imagery was used to train positive performance execution despite and during increases in arousal.

While all of these theories add to the imagery knowledge base, through this study I adopted a more pragmatic position. The procedure focused on imagery as a skill to be trained and used. In this study, I first trained athletes to use imagery to accurately recreate and track a golf shot. Then, through the use of outcome imagery, specifically motivational general mastery imagery training, athletes were trained to see the path and ball flight of their shots during the performance tests. Visualization was hypothesized to lead to better performance on the putting and pitching accuracy tasks. In this study, I aimed to improve golf performance through imagery without training or changing particular physical skill execution or mechanics.

Research suggests different types of imagery may impact performance in different ways. Paivio (1985) suggests that imagery can have both cognitive (instructional) and motivational roles as well as operate between general and specific cues (as cited in Cumming & Ramsey, 2009). Cognitive specific imagery refers to the actual image of a skill, such as seeing the mechanics of a perfect golf swing. Cognitive general imagery refers to competition strategies, such as seeing one’s pre-shot routine. Motivational specific imagery refers to imagery of specific goals such as winning a tournament or shooting a personal best score. Motivational general arousal imagery refers to stress or arousal levels as they pertain to the activity, and motivational general mastery refers to imagery of coping and mastering a situation through focus, positivity and confidence (Cumming & Ramsey, 2009).

The focus of the visualization interventions in this study was imagery for motivational general mastery (MGM). MGM allows athletes to focus their attention on the shot at hand, imagining a positive outcome. The visualized outcome then provides athletes with more confidence to carry out the shot correctly (Cumming & Ramsey, 2009). For the purpose of this study I focused on the use of the motivational benefits of imagery to improve performance rather than using imagery to enhance mechanical execution of the golf swing.

In addition, I introduced a training regimen for visualization to help the athletes enhance their imagery ability in pre-competition settings so they could later harness this ability in competition settings. Although imagery can use memories of past events, it can also be used to create images of things that have not yet occurred (Vealey & Greenleaf, 2010). For example, in this study I trained athlete in visualization using videos of shots that had already occurred. As athletes became more skilled in accurately creating the imagery from the training modules without looking at it, the hope was that this skill would then be applied in practice or competition scenarios, enabling athletes to visualize their shot path and outcome prior to execution.

Using imagery to focus on positive outcomes allows athletes to approach a skill with positive expectations. The positive expectations reduce anxiety and reduce the focus on the physical skill itself. This idea is related to the benefits of an external versus an internal focus of attention, as exemplified by the constrained action hypothesis (Wulf, McNevin, & Shea, 2001). Imagining positive successful actions moves attentional focus from anxious feelings and sensations of the movement, internal events, to the successful shot, an external event. Studies show that an external perspective is more beneficial to task performance than a focus on internal processes (Bell & Hardy, 2009; Wulf, McNevin, & Shea, 2001). Perhaps, focusing on the hole or the outcome of the shot reduces analytical, mechanical thinking. This enables athletes to allow the physical movement to occur more automatically, which in turn leads to less tension and better performance outcomes.

Outcome imagery is defined in the literature as imagining the consequence of the action or skill rather than the action itself (Taylor & Shaw, 2012). For example, positive outcome imagery may consist of seeing the flight of the ball move left to right around a tree blocking a straight shot to the green, while negative outcome imagery may consist of images of the ball hitting the tree or landing short in a water hazard in front of the green. Outcome imagery is utilized by athletes in a variety of disciplines. For example, a basketball player may use positive outcome imagery to imagine dribbling around a player, driving to the basket and making the layup. Positive outcome imagery can also be used in non-sport settings. Imagining a successful presentation before you actually deliver a speech is a common example.

Woolfolk, Murphy, Gottesfeld, and Aitken (1985) looked at performance on a golf putting task with both negative and positive imagery as well as imagery of specific skills versus outcome imagery. They found that outcome imagery prior to performance had a greater effect on performance than skill related imagery. Their findings also suggest that any positive effects of skill related imagery are mostly seen when an outcome component is also incorporated into the imagery.

In another study of the effects of outcome imagery on golf-putting performance it was found that negative outcome imagery had debilitative effects on both overall performance and confidence (Taylor & Shaw, 2012). The fact that negative imagery had such debilitative effects on performance points to the need to train athletes to use the skill of visualization properly so they may reap the benefits of proper positive imagery and not see performance deficits due to maladaptive imagery use. In the present study, training athletes on modules detailing accurate and precise ball flight and shot execution was implemented to allow athletes to become familiar with how to utilize positive outcome imagery.

A sizable body of research suggests that skill in visualization contributes to better performance. In a study of 150 competitive Canadian athletes, ranging from recreational competitors to provincial and national competitors in a variety of sports, the Deliberate Imagery Practice Questionnaire found no significant differences in imagery across sports or between genders (Cumming & Hall, 2002). However, athletes performing at a higher level perceived imagery to be more important to their performance. Higher level performers engaged in visualization training more than lower level athletes and it was part of a deliberate practice regimen for many high-level performers (Cumming & Hall, 2002; Ericsson, Krampe, & Tesch-Romer, 1993). In addition, research suggests that elite athletes utilize internal imagery (imagery from one's own perspective) more often, while athletes competing at lower levels are more likely to utilize external imagery (viewing oneself from an outside perspective) (Orlick & Partington, 1988). An internal perspective may be more compatible with imagining a successful outcome as seen from the performer's perspective while an external perspective may be biased toward reviewing performance for execution errors. Thus, an internal perspective would be more likely to yield the motivational benefits of imagery. In utilizing an internal attentional focus, attention shifts from focusing on the outcome to focusing on the skill. This could be done using either an internal or external imagery perspective. The most successful athlete will often be the athlete who is able to utilize an internal imagery perspective, or have the ability to successfully use both types of imagery perspectives, while also having an external focus of attention and attending to the overall outcome rather than internal mechanical cues.

Similarities between mental imagery utilization and the practice of physical skill have led to the belief that visualization should be considered a skill requiring deliberate practice. Cumming and Hall (2002) found evidence suggesting that mental imagery could be improved using the deliberate practice framework laid out by Ericsson and colleagues (1993). The deliberate practice framework states that structured and purposeful practice that is relevant to performance and requires effort and concentration, but is not inherently enjoyable, can lead to improvements in performance when used over time. The study found that on average, a 10-year period of deliberate practice is typically achieved prior to reaching an "exceptional standard" of performance (Ericsson, Krampe, & Tesch-Romer, 1993). Just as was found with physical skill practice, athletes in the Cumming and Hall (2002) study reported imagery as being relevant to performance (with increases in this belief being positively related to competition level), and that it required effort and concentration just as physical practice does. This led to the belief that mental skill and physical skills may be practiced and trained in similar ways to improve performance.

The only disparity found with the original deliberate practice framework was that the proposed negative relationship between level of enjoyment associated with mental training's relevance to actual performance did not exist. Cumming and Hall (2002) note that some athletes may find mental training enjoyable, especially if they feel as though it will have a significant positive impact on their performance. Although this does not align with the enjoyment component of the deliberate practice framework, this is thought to be due to the nature of mental practice itself, as it is not as strenuous as physical practice and therefore may be more enjoyable. In addition, there has been debate about the enjoyment principle of deliberate physical practice, with many researchers arguing that some people may find practice both deliberate and enjoyable and still see performance enhancing effects (Helsen et al., 1998, as cited in Cumming & Hall, 2002; Hodges & Starkes, 1996).

Methodological Concerns

The study of visualization has significant methodological problems. First, little is known about the use of imagery in a natural or near natural setting. For example, research on imagery often includes relaxation procedures. Self-reports do suggest that visualization is easier with relaxation (Beauchamp, Halliwell, Fournier, & Koestner, 1996; Kendall, Hrycaiko, Martin, & Kendall, 1990). However, while relaxation may help to improve imagery, the imagery doesn't enhance performance. Practicing visualization with low arousal level does not replicate in the competition settings where arousal is typically high. Just when the imagery may be most crucial for performance arousal is elevated and there is no time available to consciously reduce arousal to enhance imagery.

A second issue is that imagery performance is often measured through prospective and retrospective self-report. An athlete's expectations for, or memories of, using imagery may be seriously confounded. It would be best to measure imagery in real time using an objective response to avoid individual error in memory.

Finally, measuring imagery is often limited to a participant's ratings of private experiences through scales or questionnaires, such as the Sport Imagery Questionnaire (Hall, Rodgers, & Barr, 1990). Whether a self-report captures actual visualization use and content accurately is questionable. For this reason, in this study I chose to incorporate a measure that tested participants' visualization with an external, quantifiable score. What has typically been internal and self-reported became empirical and quantified.

While the training-testing protocol offers some methodological rigor, it raises a different question. How does visualizing one event contribute to the execution of a separate skill? Research indicates that self-efficacy, confidence and improved performance are independent results of imagery use (Callery & Morris, 1997b, as cited in Morris, Spittle, & Watt, 2005). For the purpose of this study, athletes were trained to visualize golf shots, a putt and a short iron approach, that were different from the shots they would actually perform in the study. The training was expected to enhance skill in visualization as well as self-efficacy and confidence in creating accurate imagery. The skill in visualization was then expected to transfer to the actual performance test and eventually to regular performance outside of the study. This is an example of transfer of training. Transfer occurs when a skill trained in one context can be applied in other settings to enhance performance of skills outside of what was specifically trained.

Kearney and Judge (2017) demonstrated that training athletes to use a specific motor learning approach, the Five-Step Approach (5SA) to motor learning, in one skill enhanced the subsequent acquisition of a completely different skill. The participants in this study learned to shoot free throws using the 5SA. The study results then confirmed that the participants were using the 5SA strategy. One month later the participants were tested with a putting task. The group that had learned to use 5SA in the free throw task used that same strategy in the putting task and had superior performance. This is an example of transfer of training. The training program utilized in the present study was expected to allow similar transfer of the mental skills implemented. For example, it was expected that the proper use of visualization, as well as the benefits of well executed visualization would transfer to performance on the manipulation checks and the golf performance skills.

Visualization Types

The context within which visualization is trained and used is a key variable in creating a successful outcome. Imagery interventions that are trained in more natural settings are more effective. Holmes and Collins (2001) developed the PETTLEP method of realistic imagery training to increase the effectiveness of visualization. The PETTLEP acronym stands for: physical, environment, task, timing, learning, emotion, and perspective. Physical suggests that imagery should be practiced in a physical state similar to the actual performance. An athlete should visualize free throws while standing because standing is the physical state for performing the skill. If a wrestler is visualizing a difficult escape then he should practice the imagery on the matt in a position similar to the near pin from which he will escape. The athlete should wear competition clothing and typical athletic equipment during visualization. Environment speaks to the importance of practicing imagery in a setting similar to the performance environment. For example, golf imagery should be practiced on the golf course or at least on the practice facilities, as this is closest to where the skill will be performed during competition. Training visualization in a laboratory, classroom or home is too far from the actual setting and decreases the chance that visualization will enhance performance. Task reminds us that the imagery should mimic the actual occurrence of the skill or outcome. For example, the visualization training should include imagery of the actual shots the athlete will hit on the course using as many senses as possible to create vivid, realistic images that are multimodal. Timing relates to the importance of practicing the imagery with a skill duration and tempo similar to that of the actual performance. The imagery should be seen and experienced at the same pace it would occur in actual performance.

For example, a ball rolling into the hole should be imagined rolling at the same speed and with the same duration that it would in actual competition. Learning suggests that the imagined execution of a skill should change as learning changes the actual skill. Physical skill improves over time, so imagery will have to be adjusted as athletes' playing style matures and changes. Emotion refers to the need to bring the emotion of the performance into the imagery. Competition brings various emotions and arousal, so the athletes' imagery practice should include these same variations in emotional state. Finally, perspective emphasizes using primarily an internal perspective and adding an external perspective only when it applies (Morris, Spittle, & Watt, 2005). For closed skill sports Hardy and Callow (1999) have suggested that an internal perspective may be best. This is because closed skills are initiated entirely internally based on the athletes' decision to act. Open skills happen in a more reactionary pattern and the athlete cannot operate without regard for the external environment. Thus, an external perspective can be effective for these skills. Further, the internal perspective seems to be especially beneficial when focusing on the outcome of skills, rather than the mechanical form of the skill (Hardy & Callow, 1999, as cited in Morris, Spittle, & Watt, 2005).

Smith, Wright, Allsopp, and Westhead (2007) tested the PETTLEP model with field hockey and gymnastics. In both experiments visualization was better than other mental training activities and the more the visualization protocol matched the PETTLEP model the more performance improved. In fact, for the gymnasts PETTLEP visualization was as effective as physical practice of a very difficult balance beam skill.

Research suggests that external imagery may be beneficial for analyzing mechanical aspects of a skill (Morris, Spittle, & Watt, 2005). Athletes working on swing mechanics to improve performance may be able to utilize external imagery, but that was not the purpose of the current study. Since golf is a closed sport, for this study internal imagery was chosen to be utilized as a way to help athletes create realistic and positive outcome imagery. The purpose of the training program I implemented was to provide golfers with mental skills to enhance performance with the focus on external outcomes and aspects of performance that can be controlled by every athlete, regardless of natural skill level or mechanics.

The PETTLEP model addresses all of the five key characteristics of good imagery that have been outlined in the literature. These aspects of good imagery that are beneficial to performance include modality, perspective, angle, agency and deliberation (Cumming & Williams, 2012). As a direct comparison for further clarity, modality relates to the task aspect of PETTLEP, related to the necessity of using as many senses as possible when creating an image. These modalities include auditory (hearing), gustatory (taste), kinesthetic (movement sensation), olfactory (smell), tactile (touch), and visual (sight). The second key characteristic is perspective, which is the final aspect of the PETTLEP model, that deals with internal versus external use of vantage points by the athlete. The third key characteristic is angle, adding additional dimensions to perspective. The view may be internal or external, but it may also be from above, in front, behind or on the side of the athlete. The last two key characteristics involve the importance of the athlete feeling in control of the imagery. Agency refers to who the athlete perceives to be the author of the visualization. Athletes must feel they are in control of and confident in what they are visualizing for it to truly be beneficial. Finally, deliberation refers to the necessity for the process of visualization to be part of deliberate mental practice in order to improve imagery skill. In order for visualization to positively affect performance it must be specifically decided on to be carried out (Cumming & Williams, 2012). It is clear that PETTLEP is a good model for the implementation of visualization training due to the fact that is covers all of the characteristics of imagery that have been shown to be beneficial to performance in the literature.

Visualization Training

In a 6-week study of 34 skilled male golfers with handicaps below 5, PETTLEP imagery was implemented for bunker shot performance and compared to actual physical practice, a combination of visualization and physical practice and a control group who read a biography of Jack Nicklaus. Participants utilizing combined PETTLEP and physical practice had significantly more improvement on the bunker shot task, while participants in the PETTLEP or physical practice groups alone progressed less, but equally. This data supports the use of a PETTELP imagery intervention as previous imagery interventions did not have convincing results improving performance more than physical practice alone (Smith, Wright, & Cantwell, 2008). It is especially interesting to note that even for such advanced and skilled players, there was a significant benefit to using PETTLEP imagery in addition to physical practice (Smith, Wright, & Cantwell, 2008). For this reason, the training program used was modeled after PETTLEP as a way to promote positive performance enhancement for athletes at a variety of skill levels.

Other imagery training systems, such as Visuomotor Behavioral Rehearsal and AIM strategy, coach athletes to practice imagery in conjunction with relaxation as a way to enhance imagery (Morris, Spittle, & Watt, 2005). While the idea of using progressive muscle relaxation or active relaxation to create a relaxed state that allows for better imagery seems logical, it is flawed. Athletes do not perform in a relaxed or meditative state. For this reason, training the use of imagery, and other mental skills, should simulate competition in setting and arousal level. Training in a relaxed state could minimize the chance that training would be transferred and used successfully in actual competition settings.

One intervention that trains athletes to perform imagery even in stressful competition settings is Stress Inoculation Training. While Stress Inoculation Training does teach relaxation techniques, this system moves from teaching visualization and relaxation to practicing imagery in increasingly stressful situations, which does not mimic the natural progression experienced in competition settings (Morris, Spittle, & Watt, 2005).

Other imagery training programs, such as Rainer Martens' Sport Imagery Training Program, do not provide results about the true efficacy of the programs. These training programs probably do not provide outcome evidence because they can't generate empirical, quantitative measures of imagery (Morris, Spittle, & Watt, 2005). Generating empirical, quantitative measures of visualization performance as a manipulation check was one of the main objectives for the current study.

In the current study, visualization training modules depicting putting and pitching performance were provided to athletes in a PowerPoint format so they could practice as much as they would like on their own time during the training periods of the study. While there was no guarantee that their study habits and locations would be consistent with those utilized in the PETTLEP model, there were plenty of opportunities for the modules to be used and tested in near competition settings. During practice sessions athletes engaged with the training modules in ways that "pass" the PETTLEP test. For example, athletes were dressed in their golf clothes, in a natural setting at a golf course, and watched a golf shot representative of a shot they might encounter on a course as it would occur in real time. In addition, they were experiencing the emotions they normally would, with no techniques given to control arousal. Training utilized internal imagery, as athletes were shown a shot and asked to imagine it as if they were executing it, which is the best type of imagery for the outcome training being attempted in this study. The training system designed met PETTLEP requirements and align well with the proposed learning outcomes. Athletes were expected to demonstrate more accurate visualization over successive training and testing sessions. The tests of visualization were used as a way to provide evidence that the training exercises were helping the participants to develop and improve their visualization skill and accuracy.

In summary, the research suggests that the important components for an imagery training program include: training in both practice and competition settings, practicing imagery in a variety of settings, practicing imagery skills in real time and being sure to utilize imagery to meet the specific needs of the athlete (Morris, Spittle, & Watt, 2005). In addition, it is important to train imagery use that is multimodal in nature and utilizes the appropriate perspective (Cumming & Williams, 2012). The literature suggests PETTLEP guidelines are useful and that the more an exercise matches the PETTLEP model the more performance improve. In the current study, I aimed to incorporate as many PETTLEP principles as possible within what was plausible for the given time frame and location.

This was tested with a new systematic imagery intervention. The new system included skill specific outcome imagery in the visualization training. Training occurred with three different versions of the modules progressing from simple to complex. The training modules were set up using “Protracer” like technology to represent the path or flight of an actual golf shot. The flight path, indicated by a colored line for pitching or the golf ball for putting, moved through distinct colored areas and the athletes watched the modules, training their imagery and visualization skills. After training, the athletes were asked to imagine the golf shot indicated on the practice module and tell a researcher when the line or ball had stopped in a designated colored area. An athlete's accuracy in imagining the ball's path measured the athlete's progress in learning to use visualization appropriately.

Imagery training in the literature is often regarded as a wholly internal skill that is taught but not assessed. Instead, performance changes are taken as indicators of visualization. In this study participants' skill with imagery and visualization was measured. In the test, the Protracer video started as usual and then ended at some point in mid-flight, presented a sound cue, and the athlete, who could not see the video, indicated which colored block the Protracer line or ball was in when the cue occurred. This allowed visualization performance to be measured quantitatively without relying on questionnaires or self-report.

Participants were also asked to keep a log of how often they utilized the training modules in practicing visualization. This log was used to determine whether the amount of time spent training predicted visualization skill or performance on the measured individual golf skills of pitching and putting.

Self-Talk

While visualization is one important mental skill, it is only one of the many utilized by high achieving athletes. In addition to the training of visualization for one half of the participants, the use of appropriate self-talk was trained for the other half of the participants. Self-talk can impact how athletes feel and perform in a positive or negative way, depending how it is used. Self-talk in a sport context, is defined in the literature as an inner dialogue or self-statements used to direct sport related thinking (Hardy & Oliver 2014; Hatzigoergiadis, Zourbanos, Galanis, & Theodorakis, 2011). Self-talk can be overt and said aloud, or covert and exist mostly as an internal dialogue.

The occurrence of self-talk has long been recognized by researchers in the field of psychology. In Charles Fernyhough's book, *The Voices Within,* the focus is on the nature of self-talk, a deeply rooted human process. In the chapter entitled "Inside the Chatterbox," psychologist Bernard Baars' writing from 1997 is cited: "The urge to talk to ourselves is remarkably compelling, as we can easily see by trying to stop the inner voice as long as possible…Inner speech is one of the basic facts of human nature" (Fernyhough, 2016, p. 31). Evidence suggests that inner speech is a significant part of our mental lives. Fernyhough (2016) suggests, "A quarter to a fifth of our waking moments is a lot of waking moments, a lot of self-talk" (p. 32).

Fernyhough (2016) also explores the impact of self-talk. He notes that it is an important feature in sport performance, and cites Gallwey (1974), who argues that your body acts as both a "teller" and a "doer." The principle that your body listens and comprehends what you tell it, acting on that information is what has guided the design of the self-talk intervention for this study (p. 33). Harnessing the power behind something athletes do so often and that can have a large impact on how we feel and how we perform, is an important skill and therefore worth training.

Research on self-talk in sport specific situations focuses on athletes' verbalizations to themselves. These verbalizations can be either said aloud (overt) or internally (covert), and be instructional and/or motivational in nature (Theodorakis, Weinberg, Natsis, Douma, & Kazakas, 2000). Self-talk, or one's inner dialogue, can also differ in content, being either positive or negative (Theodorakis et al., 2000). In line with definitions in the literature, in the present study self-talk was labeled positive or negative based solely on its content, regardless of the eventual outcome or influence on performance. In addition, the effects on performance were described as either facilitative or debilitative, as suggested in the literature (Theodorakis, Hatzigeorgiadis, & Zourbanos, 2012).

Self-Talk Theories

As with visualization and imagery, there are multiple theories as to how self-talk influences performance. Meichenbaum (1997) suggested that self-talk helps to indicate beliefs and impact behavioral processes (as cited in Theodorakis, Hatzigeorgiadis, & Zourbanos, 2012). Meichenbaum proposed that self-talk helps individuals direct their attention to task relevant stimuli, helps maintain important task relevant information in short term memory, and protects individuals from negative or task irrelevant thoughts. He also suggested that self-talk impacts expectations of performance by allowing individuals to better understand their ability to cope with a situation and reassure themselves of the correct steps to take when deciding how to act (Meichenbaum 1997, as cited in Theodorakis, Hatzigeorgiadis, & Zourbanos, 2012).

In addition, the literature also suggests self-talk's impact on performance may be a result of two other factors. First, self-talk is said to enhance attentional focus. The performance enhancing effects of self-talk may come from directing attention to task relevant stimuli and allowing for movement between appropriate attentional styles (external to internal and narrow to broad). Landin (1994) developed a model based on Nideffer's attentional model of internal and external and broad to narrow focus and believed that verbal cues impact performance by helping to allocate attentional focus appropriately and helping move from one attentional style to another as necessary (as cited in Theodorakis, Hatzigeorgiadis, & Zourbanos, 2012). Second, self-talk is said to ensure proper information processing through the selection of the appropriate movement response to a stimulus. Self-talk facilitates performance by both directing attention to task relevant stimuli and helping to initiate the correct movement or action in response (Theodorakis, Hatzigeorgiadis, & Zourbanos, 2012). Wrisberg (1993) suggests that self-talk impacts performance through its role in information processing, helping to direct attention to task relevant stimuli and helping choose correct responses and initiate correct movement (as cited in as cited in Theodorakis, Hatzigeorgiadis, & Zourbanos, 2012).

Finally, Hardy (2006) suggests that Bandura's self-efficacy theory can be used to explain how self-talk works. Based on this theory, self-talk is thought to impact performance by helping to increase an individual's self-efficacy and self-confidence through internal verbal persuasion. In this case performance facilitation occurs through increased self-efficacy and confidence that stems from positive self-talk use (Theodorakis, Hatzigeorgiadis, & Zourbanos, 2012).

Although there are clearly benefits of limiting negative self-talk and increasing positive self-talk, other attributes of self-talk are also important to ensure performance facilitation. Master's (1992) conscious processing hypothesis states that skilled performers who rely too much on instructional self-talk may start consciously controlling the task that they usually carry out automatically, causing negative performance effects (as cited in Hardy, Oliver, & Tod, 2009). In the present study, the use of motivational and positive self-talk was promoted so that athletes would be less likely to concentrate on excessive and distracting instructional cues or phrases that could lead to negative self-evaluations. In addition, the athletes were asked to aim to reduce self-talk with negative content.

Research suggests that just increasing awareness of one's self-talk can change the use of self-talk (Hardy, Oliver, & Tod, 2009). Some procedures use thought stopping, which often utilizes negative cue words such as "no" or "stop" to stop negative self-talk immediately. The alternative proactive strategy of becoming aware of self-talk and changing the negative to a positive (e.g., "Don't hit it in the water!" becomes "Hit it down the right side of the fairway." or "I always pull my driver." becomes "I am a great driver of the ball.") can have more positive effects on performance (Hardy, Oliver, & Tod, 2009).

There are two main categories of self-talk in the literature that are thought to have different performance effects. Motivational self-talk may help athletes prepare for a maximum amount of effort and increasing arousal level, while instructional self-talk may help athletes focus their attention and maintain relevant instructional information, such as swing mechanics (Hatzigeorgiadis, Zourbanos, Galanis, & Theodorakis, 2011). Studies have shown that instructional self-talk can be broken down into cognitive specific, for learning or guiding the execution of a skill, or cognitive general, focused on overall performance. In addition, motivational self-talk can be broken into three distinctions. First, mastery self-talk aims to improve mental toughness, focus, confidence, and preparation. Second, arousal self-talk aims to help athletes achieve their optimal level of arousal or performance. Finally, drive self-talk can be used to maintain the maximum effort needed to achieve set goals (Hardy, Gammage, & Hall, 2001).

Hardy, Hall, Gibbs, and Greenslade (2005) found that athletes engaged in a sit-up task would naturally utilize self-talk throughout their performance. Since self-talk occurred without any instruction, this suggests it is a natural cognitive process that accompanies physical activity (Hardy, Hall, Gibbs, & Greenslade, 2005). In analyzing the effects of each type of self-talk, there was no clear difference in performance between groups who utilized motivational or instructional self-talk, but self-efficacy was identified as playing a role in the self-talk-performance relationship. Research suggests self-efficacy plays a role in how self-talk influences performance and speaks to the potential of utilizing both instructional and motivational self-talk to boost performance (Hardy et al., 2005). Bandura's self-efficacy theory states that performers get a sense of self-efficacy and confidence through seeing themselves as successful in their own minds (Short & Ross-Stewart, 2009). While "seeing" success suggests imagery, self-talk can also play a role. Self-talk allows players to gain confidence and increase belief in themselves through a positive motivational self-script.

Much like for visualization, changing self-talk is a form of mental skills training to enhance golf performance without emphasis on technique or physical swing mechanics. Instructional self-talk could lead to increased self-evaluations that may lead to frustration and negatively impact performance. For example, if a player is consciously working on a swing flaw and is using self-talk for instruction on the course, this may lead to evaluative self-talk about swing mechanics after each shot. While this may be positive when the shots go well, this may lead to greater frustration when the swing is bad, as the player may feel that she is unable to perform. Motivational self-talk on the other hand takes away the opportunity for evaluative self-talk as it doesn’t focus on the mechanical component of performance, which is most prone to evaluation.

For this reason, I chose to have athletes in this study focus on motivational self-talk as it pertains to mastery through focus, confidence, and preparation. Additionally, self-talk cues were permitted to be individual for each player. Self-talk can either be assigned or self-selected and literature exists that makes the case for both forms. Rather than using assigned statements, players in this study were given the tools and education they needed to understand self-talk and bring negative self-talk to their awareness, which then allowed them to self-select how they wished to change or decrease their negative self-talk.

Self-talk has been shown to have a large impact on novel skills. Self-talk is also relevant for learned tasks where minor improvements can make a noticeable difference, which is especially true for the sport of golf (Theodorakis, Hatzigeorgiadis, & Zourbanos, 2012). In addition, a meta-analysis revealed that self-talk may have greater effects on performance when there is training on the skill involved with appropriately managing self-talk, as well as general education (Hatzigeorgiadis, Zourbanos, Galanis, & Theodorakis, 2011). For this reason, the current study was designed to have participants utilize both training and education on self-talk as part of the intervention.

Hardy, Roberts, and Hardy (2009) studied how awareness of self-talk affects the motivation to change self-talk. They used both a log book exercise and paperclip exercise. For one group a log book was used to record negative self-talk, content and frequency. In the paperclip group participants were asked to move paperclips from one pocket to another when they became aware of negative self-talk. Participants in the log book group retrospectively answered questions about the content of their negative self-talk. Analyses of these studies suggest that all the participants were both more aware of the content of their self-talk than the control group, and the log book group was more aware of the frequency of their negative self-talk (Hardy, Roberts, & Hardy 2009). If athletes are made aware of their negative self-talk and understand the consequences of it, they are more likely and better able to change this negative self-talk to more positive self-talk and limit the negative self-talk all together.

As seen in the literature, an additional pathway to minimizing the unwanted effects of negative self-talk is to engage in thought stopping. Thought stopping uses word cues or images to stop negative thoughts once they are recognized. The theory is that telling oneself to “stop it” will diminish negative self-talk because the constant stopping acts as a form of punishment. Each “stop” gives an athlete an opportunity to change the internal dialogue to something more positive in nature (Hardy & Oliver, 2014). Similar to the implementation of imagery as a deliberately practiced skill, research suggests the positive effect of self-talk on performance increases with continued intentional practice (Hardy & Oliver, 2014).

Drawbacks of this technique include the possibility that monitoring and attempting to stop negative self-talk may paradoxically lead to an increase in negative thoughts and that the constant monitoring and processing of internal thoughts may fatigue attention. When attention is fatigued an athlete may be less able to carry out mental skills and in turn suffer performance deficits (Hardy & Oliver, 2014). For this reason, techniques that merely count and bring awareness to negative self-talk without forced correction or thought stopping may allow athletes to change self-talk in a less taxing way.

Methodological Concerns

Methodological problems with many self-talk studies seen in the literature include the reliance on retrospective self-report measures, such as the negative self-talk questionnaire (Hardy, Roberts, & Hardy, 2009) rather than more behavioral measures. In the present study a counting task was implemented. A counting task was chosen as it could produce a quantified behavioral measure and bring awareness to negative internal dialogue. Athletes were taught about motivational aspects of self-talk and encouraged, but not required, to change negative self-talk to positive self-talk as they became aware of it.

Both the paperclip and log book technique bring awareness to self-talk and promote change to both lessen negative and increase positive motivational self-talk (Hardy, Roberts, & Hardy, 2009). The logbook is preferred because it was less invasive. However, the logbook technique may be flawed because the participants have to recall self-talk after the performance. For this reason, participants in this study used a counting task that was not disruptively invasive and did not interrupt normal routines or play. Athletes were asked to move tees on a counting tray. This was expected to increase awareness of their negative self-talk, and in turn initiate change, while additionally providing a count of their negative self-talk statements. Although this method also does not have perfect reliability, the athletes couldn't record anything of which they unaware, this exercise was a good way to both measure negative self-talk, and promote change while tracking progress over time. Once they were aware of the frequency of their negative self-talk statements, athletes were then able to choose whether and how to change the talk. They could opt for positive, performance enhancing statements, utilize confidence boosting words and thoughts, or simply reduce their self-talk dialog.

Compartmentalization

The proposal for this thesis included training a second mental skill for each participant. This second skill was compartmentalization. Due to time constraints and weather related delays the training of this skill was not executed. It would be interesting to carry out this portion of the study at a later time to see its effects and if it indeed would act as a meta-skill, improving golf performance beyond what was seen during normal training weeks and allowing the other mental skills to have a greater impact. The ultimate goal of the proposed compartmentalization training was to train athletes to utilize positive outcome imagery and limit negative self-talk with optimal focus during each individual shot. By doing so, athletes should see increases in performance due to lowered cognitive load. In addition, it helps prevent the distraction and negative impact of external variables that exist when golf is played in a multidimensional manner, with athletes thinking in past and future tense rather than simply existing in the present.

Implementing Mental Practice

In this study, I implemented a training program based on the notion that mental skills, just like physical skills, require deliberate practice and are acquired in a similar manner (Cumming & Hall, 2002; Feltz & Landers, 1983). As in the beginning phase of motor learning, this training program started with a cognitive phase in which athletes were taught the basics of a skill in order to improve competence with the skill (visualization or self-talk). This initial phase also included some education about why the skill is important (Coker & Fischman, 2010). During this phase, the priority was on clear instructions and demonstrations and ensure that the athletes were carrying out the skill correctly.

Once athletes understood and were generally able to execute the skills, the training program moved into the associative phase where the athletes attempted to improve their performance of the skills through repetition in effective practice (Coker & Fischman, 2010). As golf is a closed skill sport with intertrial variability, the goal was to implement mental skill practice in a variety of settings that might naturally occur during a golf round. This was implemented in visualization training by using modules that exhibited realistic shot trajectories on real golf holes. The self-talk training occurred as it would happen naturally during the athletes' work on the performance skills at the practice facility. Finally, in each testing session the shots were changed slightly to create the variability that would lead to stronger learning.

It was expected that as athletes continued to use and practice the mental skills they should gain skill mastery. In addition, it was believed that as they utilized the skills properly and consistently they should start to reap the facilitative performance benefits. Over time this would then become more automatic and occur more naturally with less conscious thought. Automatic use of a skill occurs during this autonomous phase of learning. During the final phase of the study, the main role of the researcher would then move from facilitating learning to providing support and motivation as the athletes grow and excel (Coker & Fischman, 2010).

It is important to note, that during each phase of the training program, feedback regarding each skill was for the execution and content of the mental skill and not the physical mechanics of the swing or the performance outcomes. As this literature review suggests, there is evidence to support the idea that mental skills need to be practiced deliberately. The athletes in this study had knowledge and experience in golf, but did not have much experience with the prescribed mental skills. For this reason, the mental skills were taught and practiced systematically. The athletes in the visualization group were trained on simple visualization modules first and were asked to achieve success in these modules before moving on to train with more complex modules. The participants were given access to the training modules so they could practice as much as they would like. The self-talk athletes received education as well as a training exercise that was carried out during each session throughout the study, with no education occurring during the reversal phase.

Single-Subject Research

The design used in this research was single-subject, or single-case experimental design, in order to see the effects of the training program for each individual player. Kazdin (1998) speaks to the benefits of single-subject design as a way to see changes in dependent measures over time and draw inferences on the effects of an intervention. This type of research does not lend itself to inferential statistical analysis. Instead of such analyses visual inspection of learning curves for individual subjects can identify whether effects are consistent and a result of the intervention rather than chance or other variables, such as practice (Kazdin, 1998). Smith (1988) speaks to the benefits of using single subject research in sport psychology using applied interventions. Specifically, he writes about the importance of utilizing multiple measures as sources of evidence to clearly show the effects of the intervention. Smith (1988) also argues that when you see the same data trends for multiple individuals this adds strength to the external validity of the findings.

Many studies that look at mental skill training utilize a single subject multiple baseline design as a way to work closely with a small number of athletes while collecting larger amounts of data. Multiple researchers have condoned the use of singe subject design due to the applied nature of sport psychology (Bryan, 1987; Wollman, 1986). By looking at the performance of a small number of individuals before and after an intervention, a single subject design provides a clear measure of individual performance after an intervention. In a group design individual performance effects may not be seen as analyses consider the group as a whole. Diverse outcomes in a single subject design may help identify important individual differences that may influence results (Wollman, 1986).

While the literature is sparse on psychological skill training programs utilizing single subject designs specific to golf performance, there are studies utilizing this type of design with multiple skills for other sports. Kendall, Hrycaiko, Martin, and Kendall (1990) trained the mental skills of self-talk, imagery-rehearsal, and relaxation to improve basketball performance. They used a single subject multiple baseline design and visually inspected data. In an additional example, Thelwell and Greenless (2001) used a single subject multiple baseline across individuals design to investigate a mental skills training program for gymnasium triathlon performance. Performance time throughout the course of the study was plotted and visually inspected to look for changes from pre to post intervention.

In the current study, I originally chose to utilize a single subject modified ABAB design with multiple baseline measures. The current study included quantitative measures for the performance of each mental skill as a manipulation check to provide stronger evidence that change in performance are related to improvements in the mental skills. Although originally, the study had been designed to incorporate a modified ABAB+C design, where in the final phase

(B+C) the single mental skills were meant to be practiced along with the meta-skill of compartmentalization, due to time constraints, this portion of the study was not executed and the typical ABAB design was followed.

The Proposed Research

The purpose of this study was to test the hypothesis that deliberate practice of mental skills as part of a training program would lead to improvements in the mental skills of visualization and self-talk and ultimately lead to improvements in putting and pitching performance as well. I expected that as the assigned mental skills were practiced and trained, improvements in both mental performance and golf performance would be seen during training phases of the study. Participants were assigned to either the visualization or self-talk group and received the appropriate education and training. Participants in both groups also engaged in golf performance tasks including pitching and putting throughout the entirety of the study. The golf performance tasks were used as a way to measure physical skill improvement, while the mental performance tasks were implemented as manipulation checks to measure mental skill development. The entire study was based on the premise of participants engaging in deliberate practice, implemented through a training program for two psychological skills.

CHAPTER THREE: METHOD

Participants and Design

Local recreational golfers in western North Carolina were recruited through contact with the local golf association. A letter was sent to the emails of all members of the golf association with details of the study and contact information if members were interested in participating. Upon recruiting participants, the golfers were given consent forms to sign if they wished to participate (see Appendix A for the visualization group consent form; see Appendix B for the self-talk group consent form). The participants were randomly assigned to the visualization training group (n = 3) or the self-talk training group (n = 4). Performance was measured for the specific physical skills of putting and pitching accuracy, while measures for the mental skills of visualization and self-talk skill were recorded as a manipulation check.

Interventions

Visualization

Visualization training aimed to enhance the imagery skills of the athletes, enabling them to see their golf shots more clearly and to focus on the positive outcomes of their shots. The study process had each golfer practice with several training modules that got progressively more complex. The modules moved from a simple video with a Protracer ball flight path or ball moving through two colored areas to more complex videos with a Protracer ball flight or ball moving through four or five colored areas. The Protracer line (pitching modules only) and colored areas were superimposed on a video of a golfer putting on a golf putting green or hitting a tee shot on a par three golf hole. Each athlete was given the modules to study freely during training periods and told they would later be tested on their ability to track the Protracer line when they could not actually see the video. These tests were conducted once a week during training phases. During each test session, the researcher showed the athlete which video would be played before beginning the test. Prior to testing in the baseline condition, each athlete was asked to identify each of the colored areas to make sure they could be clearly identified and differentiated. A clear sound of the club striking the ball, which the athlete could hear, marked the beginning of the video. Additionally, a clearly audible tone signaled when the Protracer line had stopped. After the tone sounded the researcher then asked the athletes to indicate which colored area the Protracer line or ball had reached when the tone sounded. The researcher then simply recorded whether the participant was correct or incorrect.

The putting version of the visualization training module consisted of a putt that was approximately ten feet long. The pitching version of the training module consisted of an iron shot to a flag on a green from a short distance away (a par three tee shot). The tee shot in the video was longer than the short pitch shot used in the performance test. The shot was about 150 yards in the video versus 30 yards in the performance test. This was done to provide a longer duration video. Both the putting and pitching visualizations were tested with fifteen different video modules that were arranged in a different random order for each week of testing. For example, the pitching modules contained five videos for each level of difficulty (two colored areas for the simple version, three colored areas for the intermediate version and five colored areas for the complex version). The putting modules, due to length of the putt, contained only either two, three, or four colored areas. The five different versions for each level of difficulty were based on the video stopping at different times in the ball flight path (20, 40, 60, 80 or 100 percent of the total flight path or roll). See Appendix C for an example image of the simple, intermediate, and complex versions of both the pitching and putting visualization training modules.

Participants were tested once a week during the baseline, initial training, and training reinstated weeks, and twice during the reversal period. During the reversal phase, or the second A phase, participants were asked not to train at home using the modules they had been provided at the beginning of the study. In addition, throughout the study participants were asked to report how often they trained with the modules outside of the practice sessions.

Self-talk

The self-talk procedure was set up much like the paperclip self-talk procedure of Hardy, Roberts, and Hardy (2009). To make the task more normal to golf and in turn less invasive, participants utilized golf tees as a way to bring awareness to their negative self-talk. Prior to starting the experiment, participants were provided with a small strip with drilled holes that could hold golf tees. The athletes were asked to move the tees into different holes to count instances of negative self-talk. This exercise aimed to bring awareness to ones' self-talk without the invasive nature of moving objects in the athletes' pockets, having to interrupt play to record thoughts during the round, or having to rely on retrospection to recall self-talk after a round.

During the baseline sessions researchers explained to participants what constitutes negative self-talk so that they could count these statements. However, during this phase athletes did not receive education on the harmful effects of negative self-talk. This education was reserved for the training weeks. During the performance tests the participants were asked to count the negative self-talk statements he or she made. At the end of each golf performance test, the participants reported their number of negative self-talk statements.

After collecting baseline measures of negative self-talk the athletes were then educated on the negative effects of negative self-talk and the benefits of reducing negative self-talk during the following training week sessions. During the training weeks, athletes were asked to continue to report the number of negative self-talk statements made during each performance test. During the reversal phase, or the second A phase, no training or education reminders were given, but measures of negative self-talk were still collected. See Appendix D for how negative self-talk was defined, and for the educational script that was used to describe to the athletes the nature and effects of negative and positive self-talk.

Dependent Measures

Putting Accuracy

Putting accuracy was recorded two times a week for all the athletes. Athletes attempted a ten-foot putt set up by a researcher to be straight uphill. Athletes attempted twenty putts and marked the distance of each putt from the hole with standard ball markers. The distance to the hole from each ball marker was later measured by a researcher using a walking tape measure. In addition, any putt that was holed was marked by a ball marked next to the spot form which the participant was putting. Putts that went in the hole were recorded as a putt 0’0” away from the hole.

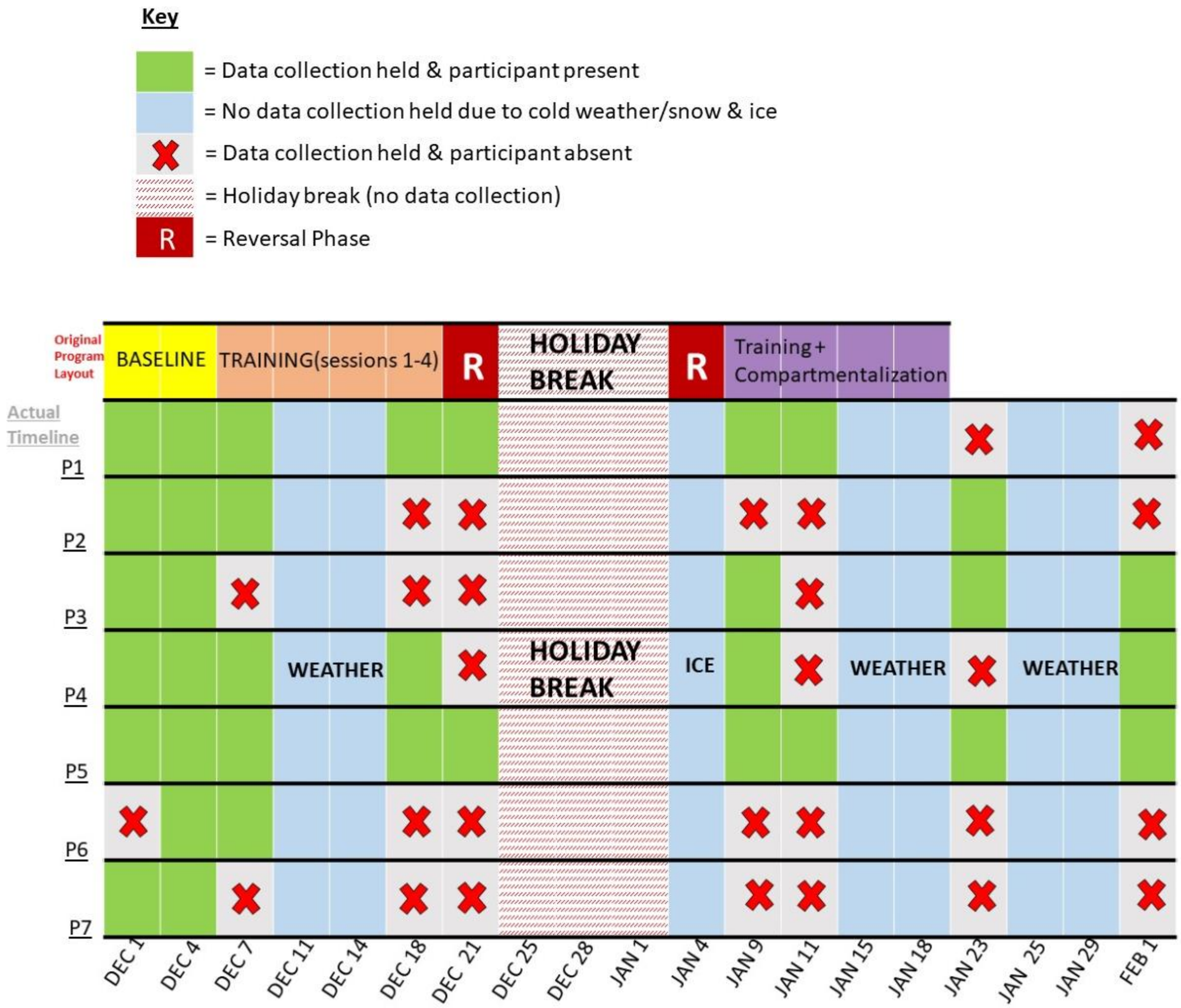
Pitching Accuracy

Pitching accuracy was recorded two times a week for all of the athletes. Athletes were told to pitch toward a specific target that was specified prior to the start of each performance test. The pitch shots were 30 yards long. The athletes were asked to attempt twenty shots at the target. Researchers then recorded the distances of the golfers’ shots from the target using a walking tape measure. Shots that went in the hole were recorded as 0’0”.

Procedure

The original training program was meant to occur over a six-week period, with a seven-day break incorporated for the Christmas holiday. The participants were going to have two baseline sessions, followed by two sessions per week for two weeks during each of the training phases (initial training and training plus compartmentalization) as well as a two session, one week reversal phase. Due to inclement weather and time factors toward the end of the study, the initial training block was shortened to three sessions. Additionally, the final training reinstatement phase was unable to include compartmentalization training and only lasted one session. A layout of the original training program can be found in Appendix E. In Table 1 shown below, you can find the actual calendar of when data was collected, which days were missed due to weather, and when participants were present or absent, in comparison to what was originally planned.

Table 1. Data collection dates (expected versus actual)



During the course of the study participants in each group had their baseline measures recorded for putting and pitching accuracy, as well as measures for their baseline levels of either their self-talk or visualization skill, depending on which intervention group they were assigned to. For each intervention group, after baseline levels were collected, the training program was introduced and player performance for putting and pitching accuracy continued to be measured twice a week. In addition, measures of self-talk were collected twice a week for athletes in the self-talk group. For athletes in the visualization group, measures of visualization skill were tested once each week during the baseline and training blocks and twice during the reversal block. The mental skill measures were manipulation checks to check on the developments of the assigned mental skill for each participant. After the conclusion of the initial training phase, participants were then asked to stop practicing and training with their assigned mental skill and education ceased. Although practice was stopped, during this reversal phase both the golf performance and mental performance were still measured to monitor changes in levels of performance achievement. After this reversal phase, the mental skills training was then reintroduced. During this final training reinstated phase performance of the golf and mental skills were measured one final time. To promote accurate and detailed data recordings for performance measures a researcher was present with the participants while they performed the required tasks.

CHAPTER FOUR: RESULTS

In order to protect participant anonymity and confidentiality, each athlete was assigned a number (1-7) identifier. Since this is a *N*=1 design, each participant's data was plotted individually in order to track performance across the different blocks (baseline, initial training, reversal, training reinstated) of the study. This section will separately present each individual's performance over the course of the study.

Two of the seven participants (P6 and P7) are not presented because they were only present on two of nine data collection days. P7 stopped participating after the baseline sessions, and P6 was only being present for one baseline session and one initial training session.

Two of the remaining five participants (P1 and P2) were present for multiple sessions in different blocks throughout the study, but were not present for the final phase. However, they provided data to track their performance changes and look for intervention effects during the initial training and reversal phases. P3 was present in all study blocks except for the initial training phase, but P3's performance baseline, reversal and final training blocks can be compared. Finally, P4 and P5 were present in at least one session of each block, with participant 5 being present for every data collection session.

In the following sections, each participants' golf performance measures for both putting and pitching will be presented in graphical form. These will include:

1. average scores for putting and pitching performance for each session (representing typical performance)
2. the distance to the hole for each shot, plotted as a *z* score, over time for the entirety of the study (representing variability of performance)

In addition, each participant's performance on the psychological skills manipulation checks will also be presented. Implications of the manipulation check performance will be explored further in the discussion section.

For clarity, "shot" will refer to a single shot that a participant took during the course of the study. This was typically twenty pitch shots and twenty putts per session. "Session" refers to each time data collection occurred. "Block" or "phase" includes all the sessions in a single condition. These are the baseline block, the initial training block, the reversal block, and the training reinstated block. Two sessions make up the baseline block, three sessions make up the initial training block, three sessions make up the reversal block, and there was one session for the training reinstated block.

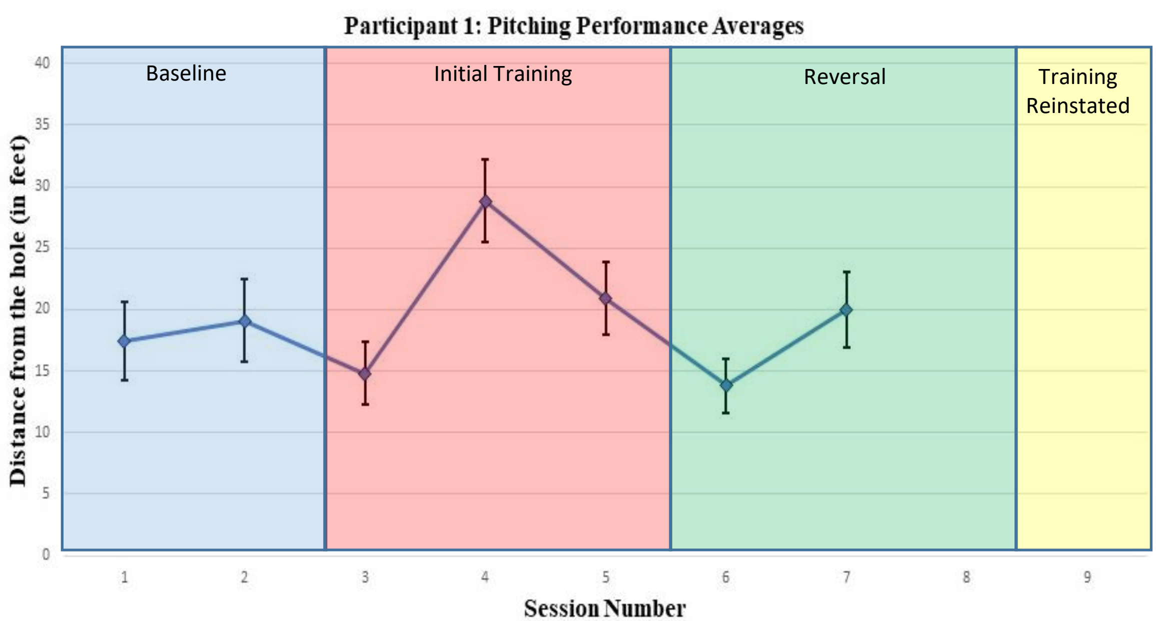
Participant 1

Participant 1 (P1) was a member of the self-talk group and was present at all sessions up through the second session of the reversal block. Figure 4.1 shows P1's performance (average inches from the hole ± SEM for putting) for the ten-foot putting task over seven sessions. The graph suggests fairly steady performance over the course of the study, with slight improvement across sessions during the initial training block, although the average performance during this time was slightly worse than performance that was recorded at baseline. This participant also showed an initial increase in performance during the initial session of the reversal phase, but performance returned back to the baseline level.

Figure 4.2 shows P1's performance (average feet from the hole ± SEM for pitching) for the pitching task over seven sessions. This was a 30-yard shot to a designated hole on a green. For this task, the participant showed a large decrease in performance during session four and a steady improvement thereafter, returning to baseline after one session and remaining there.

Figure 4.1. P1 Putting Performance Averages

Figure 4.2. P1 Pitching Performance Averages



In order to get a better picture of how the participant's performance looked within each session compared to the average performance for the entire study, the outcome of each shot was converted to a z score. Figure 4.3 shows the z scores for each of P1's putts. Similar to average putting performance, there are no clear trends. There are also clearly shots that would be considered outliers (> 2 *SDs* from the mean). Variability appears to increase during sessions three, four, and five (in the initial training block). The performance during the baseline and reversal blocks was comparable for both the average and the variability.

For the same participant, Figure 4.4 represents z scores for pitching performance. Similar to the putting performance, there are no clear trends and there were high amounts of variability in the performance recorded. There is no indication of improvement or more consistency from either practice alone or from the mental skills training.

Figure 4.3. P1 Putting Performance Standardized

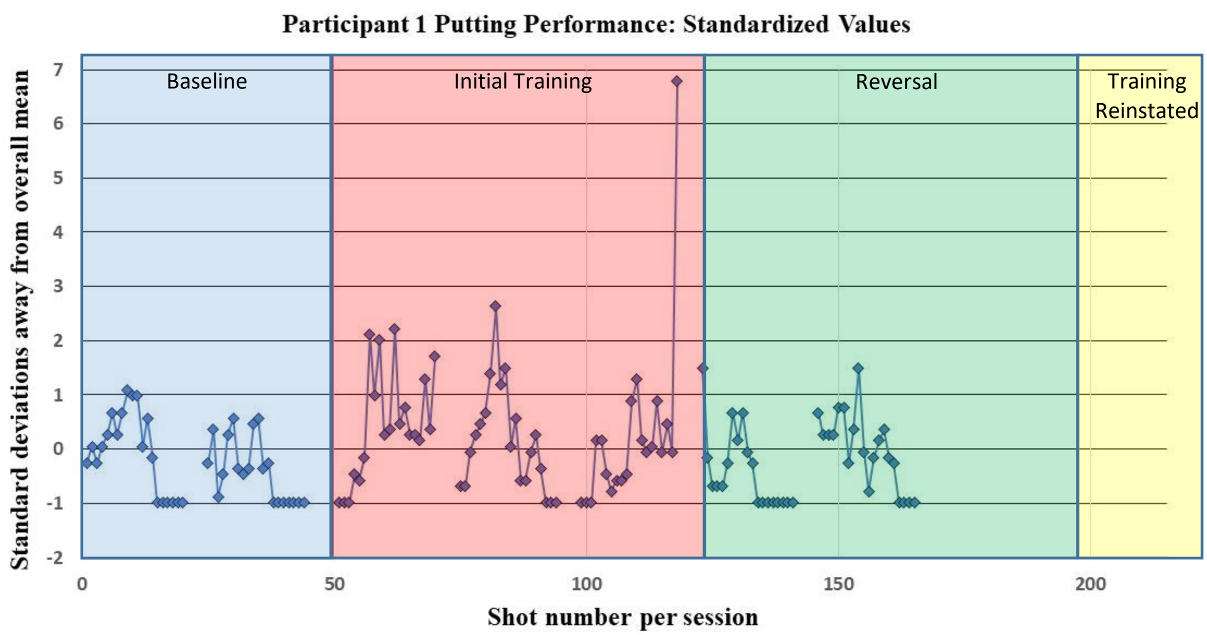
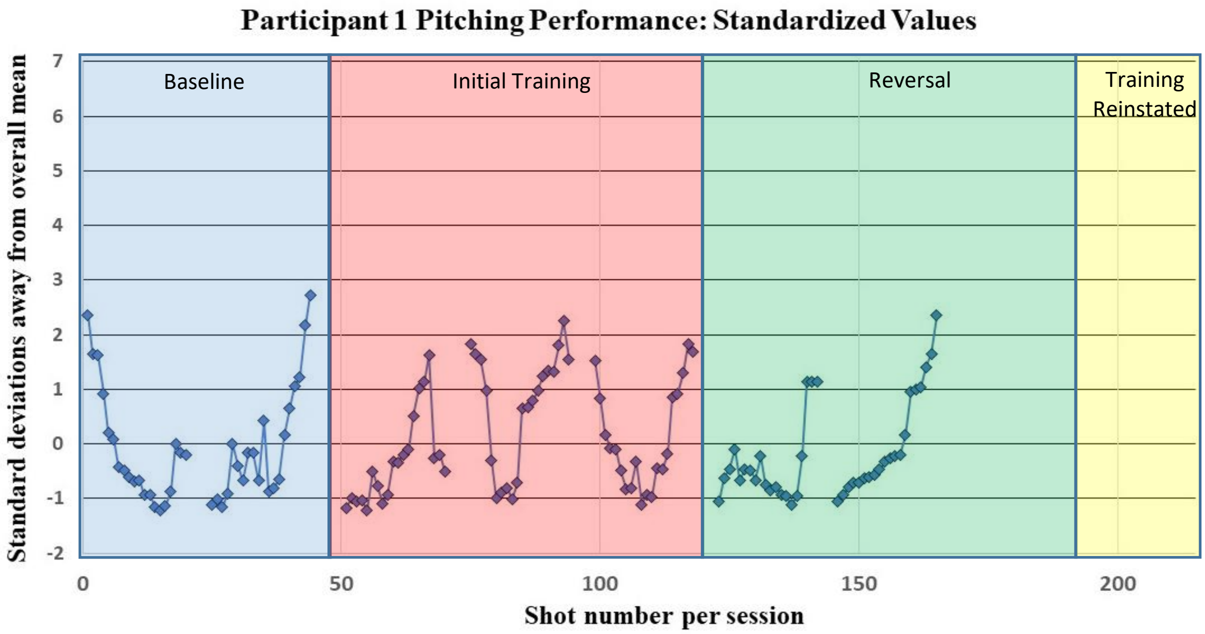
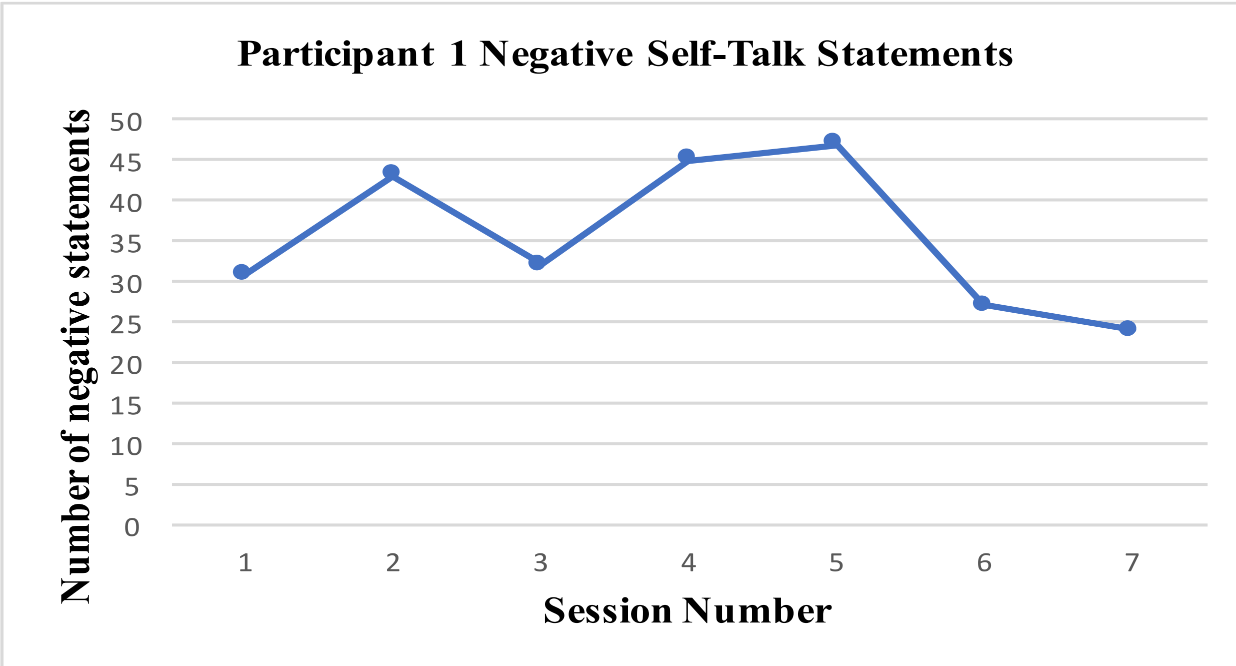


Figure 4.4. P1 Pitching Performance Standardized



P1 was trained in self-talk management. P1 recorded negative self-talk as a manipulation check during every performance test. Consistent with what was seen with golf performance, there was no evidence of improvement in mental skills over the course of the study. The number of negative self-talk statements self-recorded and reported during each session are displayed in Figure 4.5. The implications of the lack of improvement seen in the manipulation check will be discussed further in the discussion section.

Figure 4.5. P1 Self-Talk Manipulation Check



Note: This graph represents P1's performance on the self-talk manipulation check. The x-axis represents the seven sessions during which P1 reported their negative self-talk statements. The y-axis values reflect the high number of negative statements reported by this participant. For clarity, it is important to distinguish the varying axis values used between this figure (figure 4.5) and figure 4.10 for P2. P2's axis values are different in order to accurately reflect their individual results for the same manipulation check.

Participant 2

Participant (P2) was also a member of the self-talk group and was present for less than half of the data collection sessions. Although only present at four of the nine sessions, P2 was involved in sessions that were in three of the four blocks, allowing for comparison of their performance between baseline, initial training and reversal phases. Figure 4.6 shows P2's performance (average inches from the hole ± SEM for putting) for the ten-foot putting task over four sessions. The graph suggests inconsistent performance, with a decline occurring during the initial training phase when compared to the baseline sessions, and with improvement seen during the reversal phase. Their performance during the reversal phase was better than their recorded performance in any other blocks, but putting performance overall was inconsistent and does not suggest any clear trends.

Figure 4.7 shows P2's performance (average feet from the hole ± SEM for pitching) for the pitching task over four sessions. Similar to putting performance, there are no clear trends. Similar to what was seen for putting, performance during the initial training phase was much worse than what was recorded during the final baseline session. During the reversal phase, pitching performance then returned to near baseline levels.

Figure 4.6. P2 Putting Performance Averages

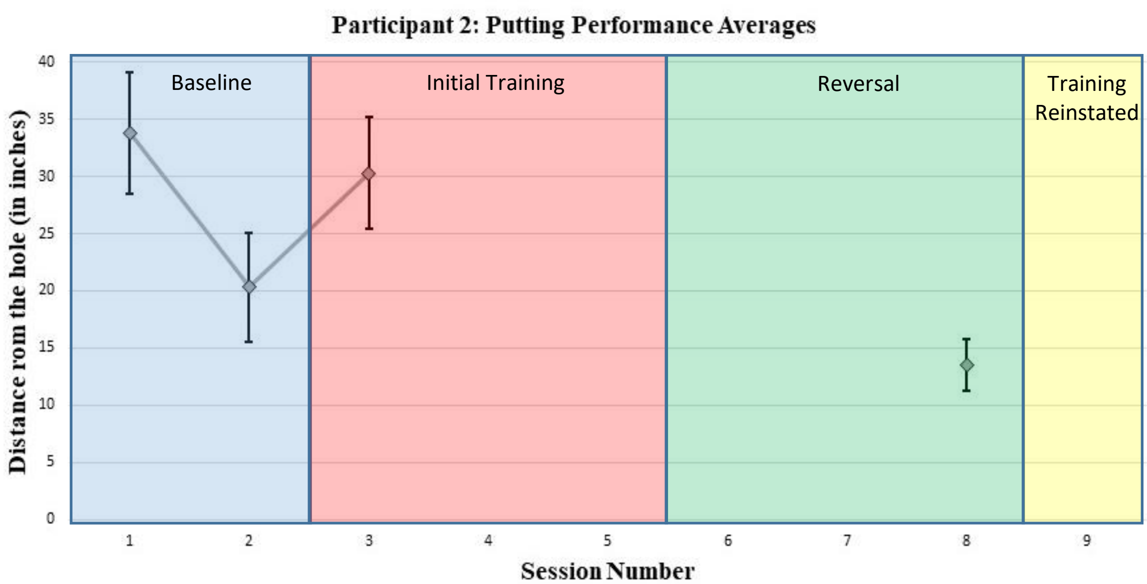


Figure 4.7. P2 Pitching Performance Averages

Figure 4.8 shows putting performance with each of P2's putts plotted as z scores. Similar to their average performance for each session, there are no clear trends and high variability can be seen throughout the study. Similar to P1, P2 also recorded shots that would be considered outliers, although the occurrence of this is on the low side. Performance was highly inconsistent during the third session, as part of the initial training block, with performance becoming slightly more consistent and improving during the session in the reversal phase.

Figure 4.9 similarly shows P2's pitching performance plotted as z scores. Similar to their putting performance, no clear trends are evident. Performance during the reversal phase especially was more variable than what was seen for putting and decreased most overall during the session in the initial training phase. Additionally, no increases in consistency throughout the study are evident either.

Figure 4.8. P2 Putting Performance Standardized

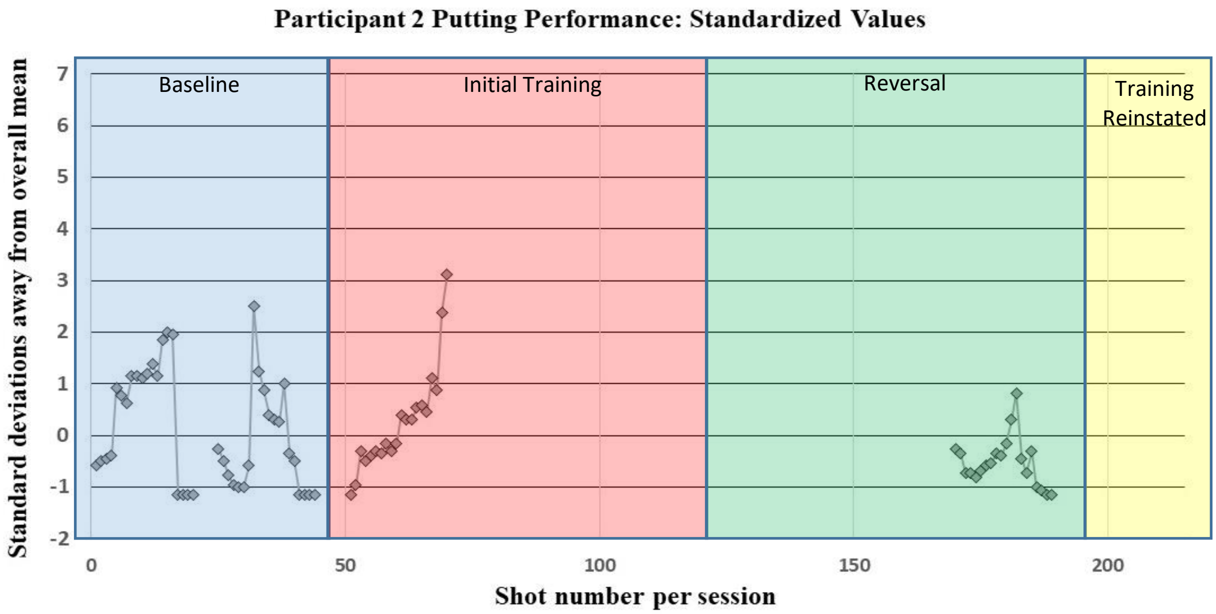
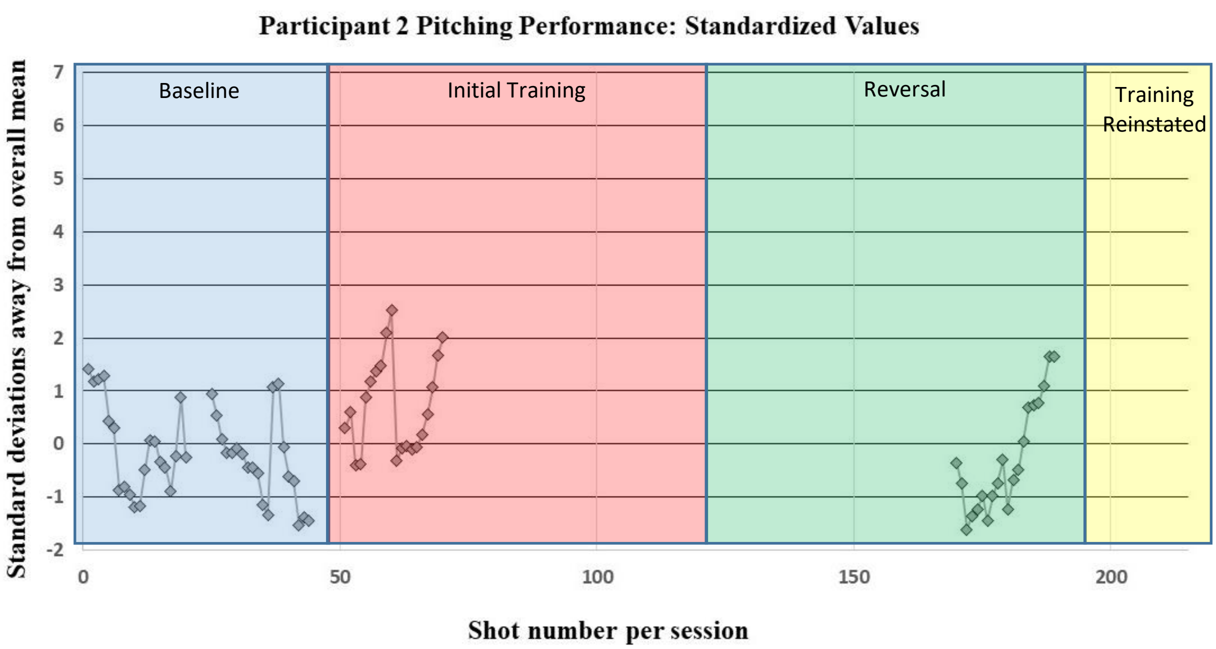
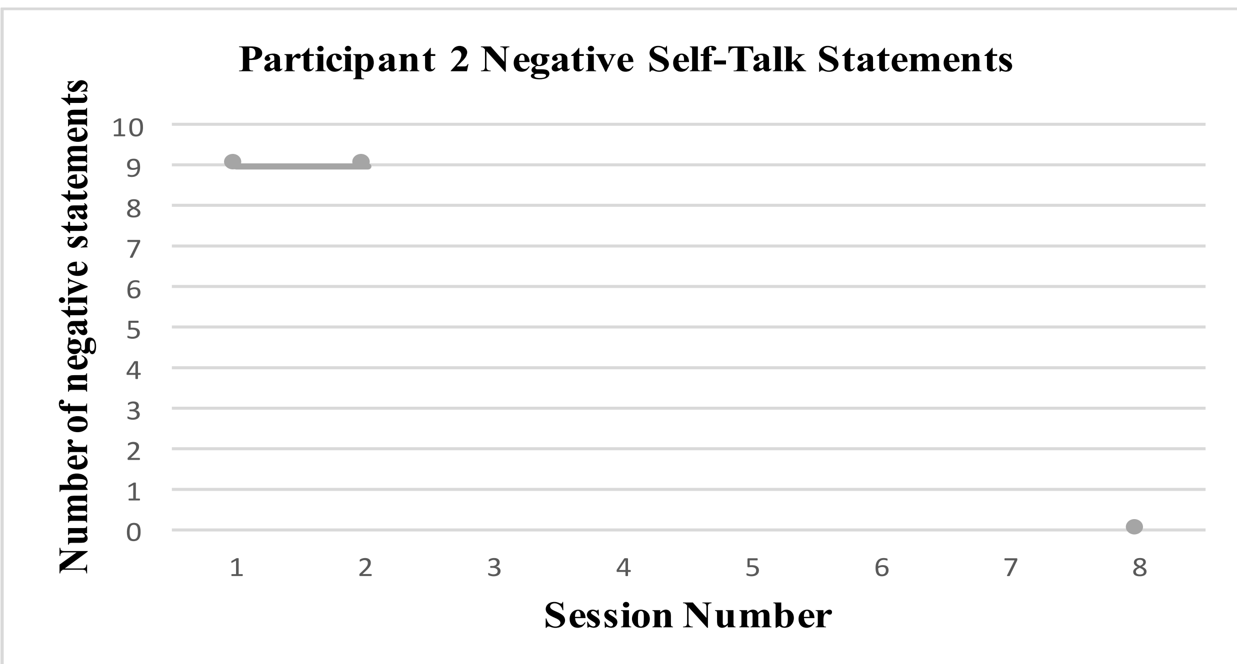


Figure 4.9. P2 Pitching Performance Standardized



Like P1, P2 was assigned to the self-talk group of this experiment. They reported the number of self-recorded negative self-talk statements after each golf performance test. One day of this measure is missing from this study due to P2's lack of reporting to a researcher for this manipulation check measure. Figure 4.10 shows the graph of the negative self-talk statements for P2. P2's self-reported negative self-talk showed improvements over the sessions that this measure was collected, with a report of zero negative self-talk statements during their last data collection session (the final session of the reversal phase). An exploration of the inconsistent relationship seen between measured mental performance and measured golf performance will be discussed further in the discussion section.

Figure 4.10. P2 Self-Talk Manipulation Check



Note: As mentioned under figure 4.5, this figure's x and y axis values are different, although figures 4.5 and 4.10 represent performance on the same manipulation check. P2's x axis goes out to eight, as their last self-talk manipulation check occurred during the eighth session. The y-axis only goes up to ten, as P2 reported much lower amounts of negative self-talk than P1.

Participant 3

Participant 3 (P3) was a member of the visualization group and was present for five sessions. Although P3 was not present during any of the sessions in the initial training phase, their performance can be compared between their two baseline sessions, two reversal sessions, and one session during the training reinstated phase. Figure 4.11 shows P3's performance (average inches from the hole ± SEM for putting) for the putting task over five sessions. During the putting task, final performance was better than what was recorded during the baseline phase, but performance decreased from the final reversal session to the training reinstated session. Overall, slight improvement can be seen after what was recorded for the initial baseline sessions, but no clear or definite trends consistent with what was expected are shown.

Figure 4.12 similarly shows P3's performance (average feet from the hole ± SEM for pitching) for the pitching task over five sessions. Different from what is seen with the putting performance, pitching performance is shown to decline fairly steadily over the course of the study, with performance in both the reversal and training reinstated phases being worse than what was seen in the baseline phase.

Figure 4.13 shows P3's putting performance plotted as z scores. The performance recorded in the reversal and final training phase appear to be slightly more consistent than the baseline phase, with more outliers apparent in the baseline phase. There are no clear trends evident of performance enhancement from either a practice effect or intervention effect.

Figure 4.14 shows P3's pitching performance plotted as z scores. No clear trends are evident and increased variability in performance is seen during later sessions when compared to the baseline sessions. Additionally, an increase in the number of outliers are seen during the reversal and traiing reinstated phases.

Figure 4.11. P3 Putting Performance Averages

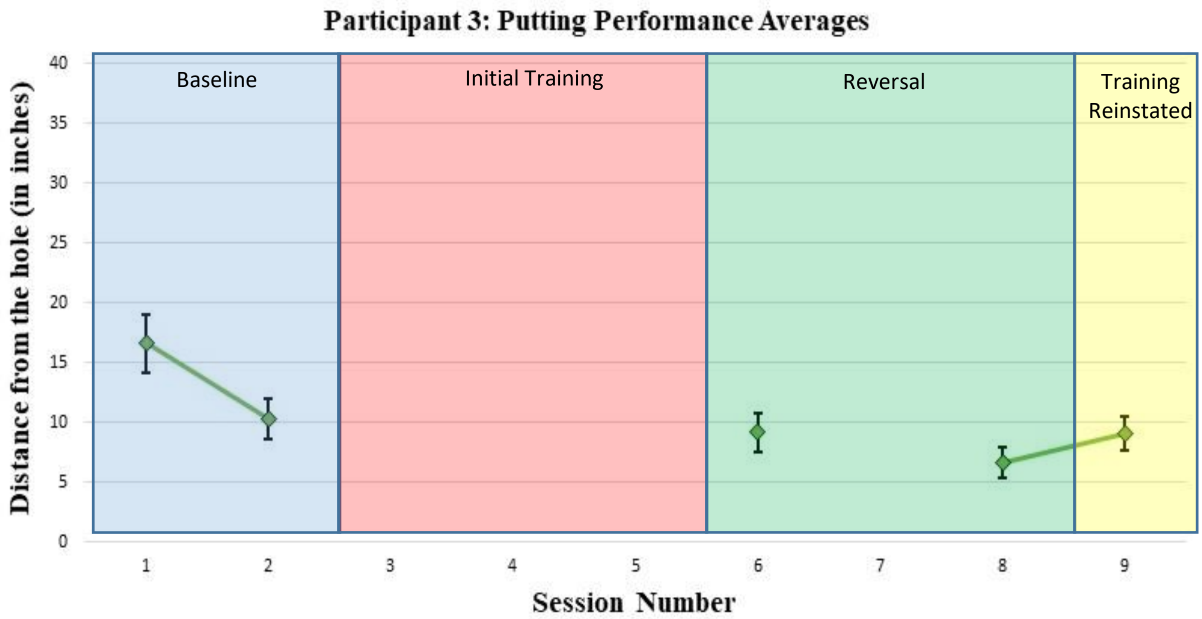


Figure 4.12 Pitching Performance Averages

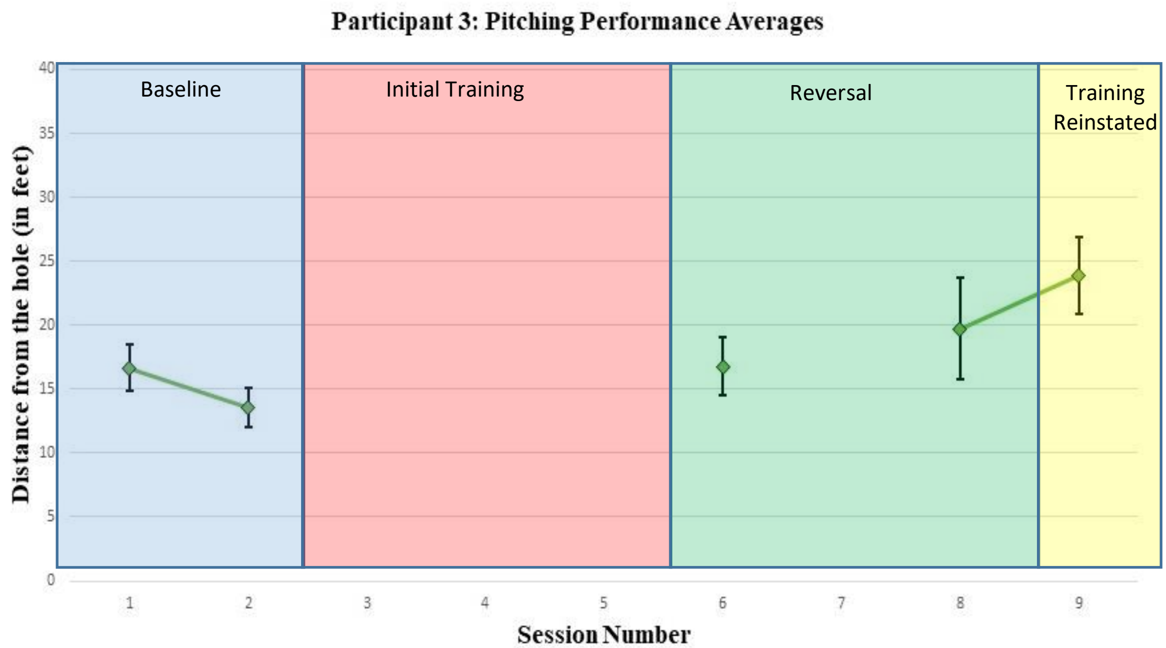


Figure 4.13. P3 Putting Performance Standardized

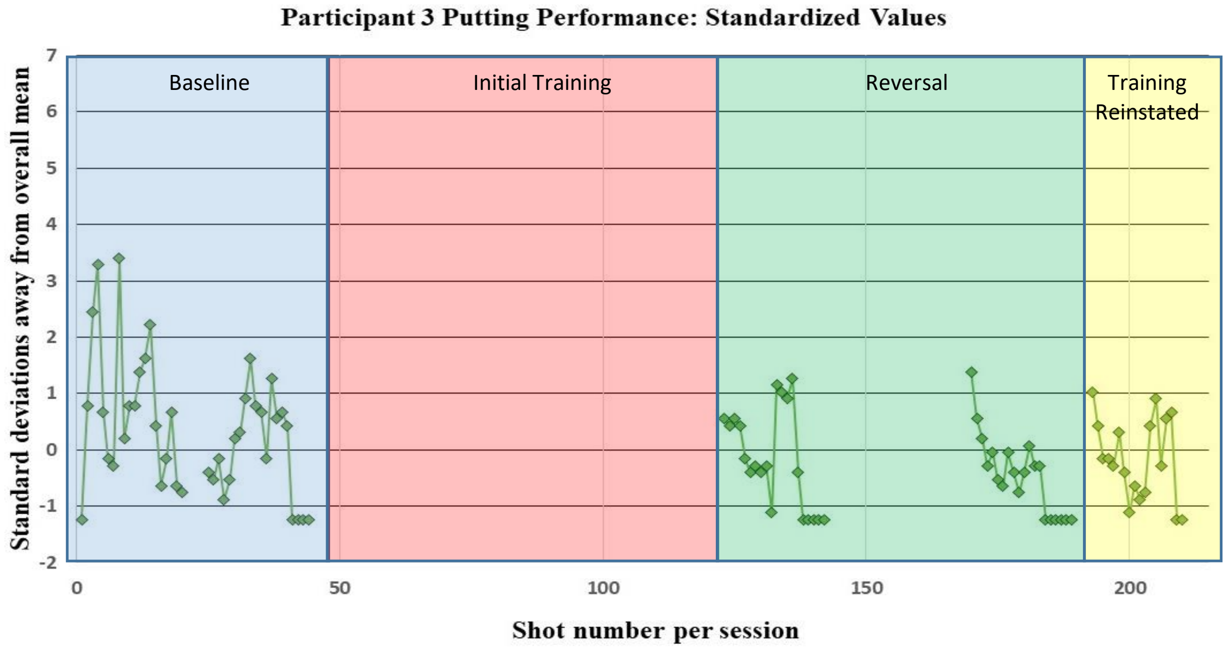
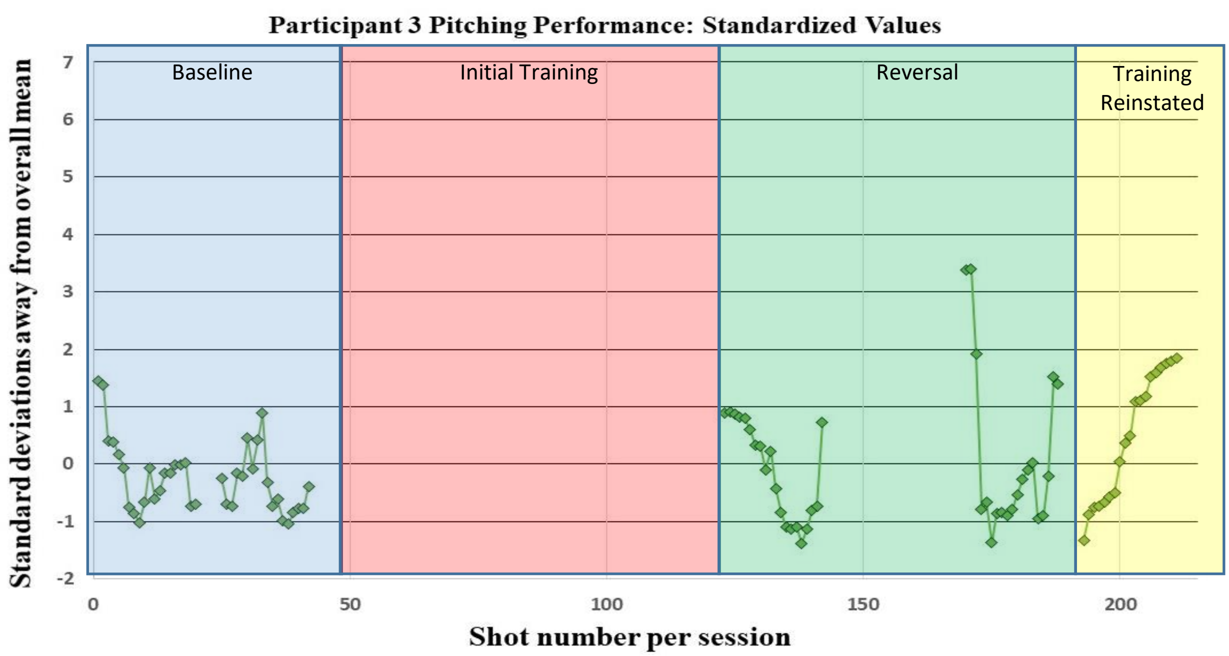


Figure 4.14. P3 Pitching Performance Standardized



As a member of the visualization group, P3 was present for three different visualization manipulation checks. These tests aimed to measure participant ability to create accurate imagery and visualize golf shot execution. Figure 4.15 indicates P3's performance on the putting visualization modules over the three data collection sessions. P3 saw a slight improvement after the measurement that occurred during the baseline session, but performance dropped below what was seen during the baseline phase during their final test.

Figure 4.16 shows P3's performance on the pitching portion of the visualization manipulation check. For the pitching modules, P3 showed consistent improvement overall for the three sessions.

Figure 4.15. P3 Putting Visualization Overall

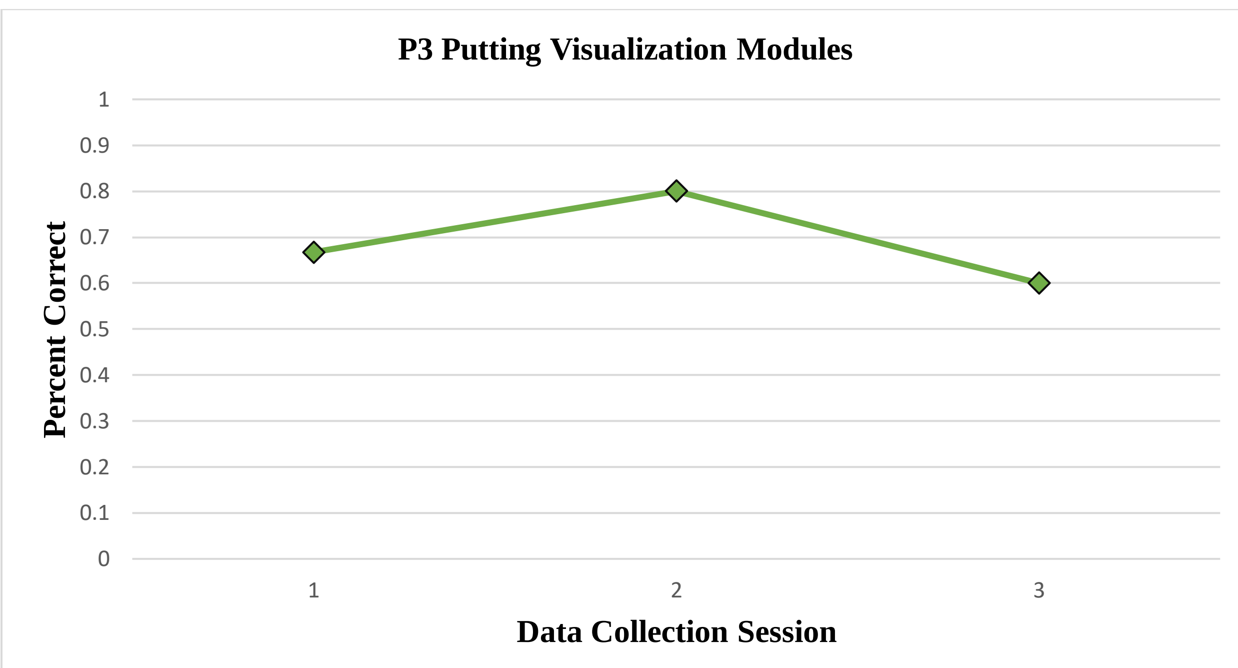


Figure 4.17 represents how P3 did on the putting visualization modules based on the varying levels of difficulty included in each test. No clear trends are evident for improvement based on increasing level of difficulty. Performance on the simple modules showed no improvement, performance on the complex task decreased over the course of the three tests, and performance on the intermediate modules increased during the second session only to return to the performance seen during baseline.

Figure 4.18 shows P3's performance on the pitching visualization modules, when separated by level of difficulty. Small improvements can be seen for all three levels of complexity, with stagnant performance for the simple and intermediate modules in the final two sessions. These results compared to those seen in Figure 4.17 for the putting modules, suggests that this participant was able to more accurately visualize pitching than putting. Further discussion of the implications of these manipulation checks will occur in the discussion section.

Figure 4.16. P3 Pitching Visualization Overall

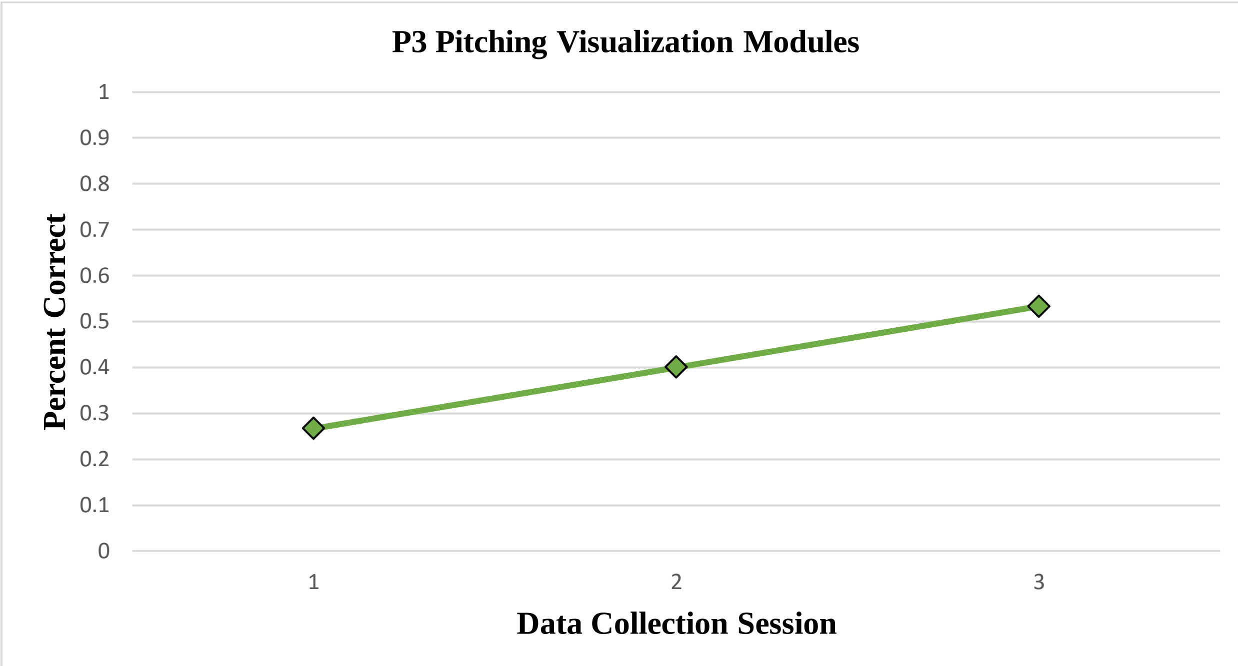


Figure 4.17. P3 Putting Module Accuracy by Difficulty

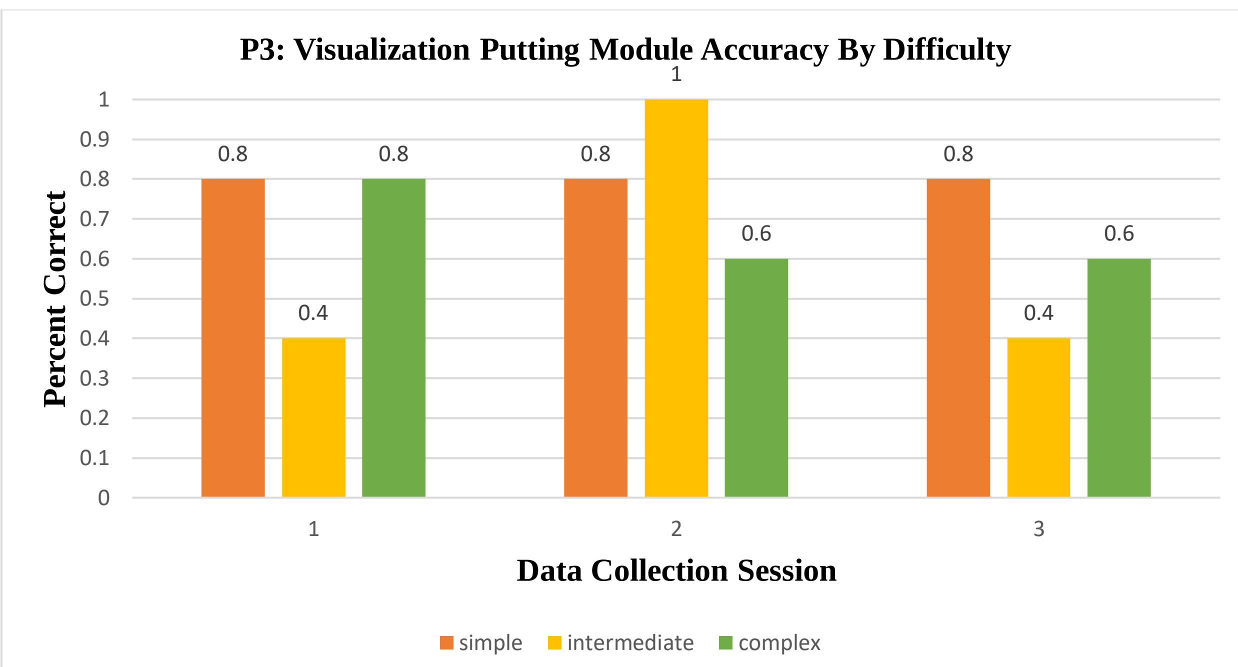
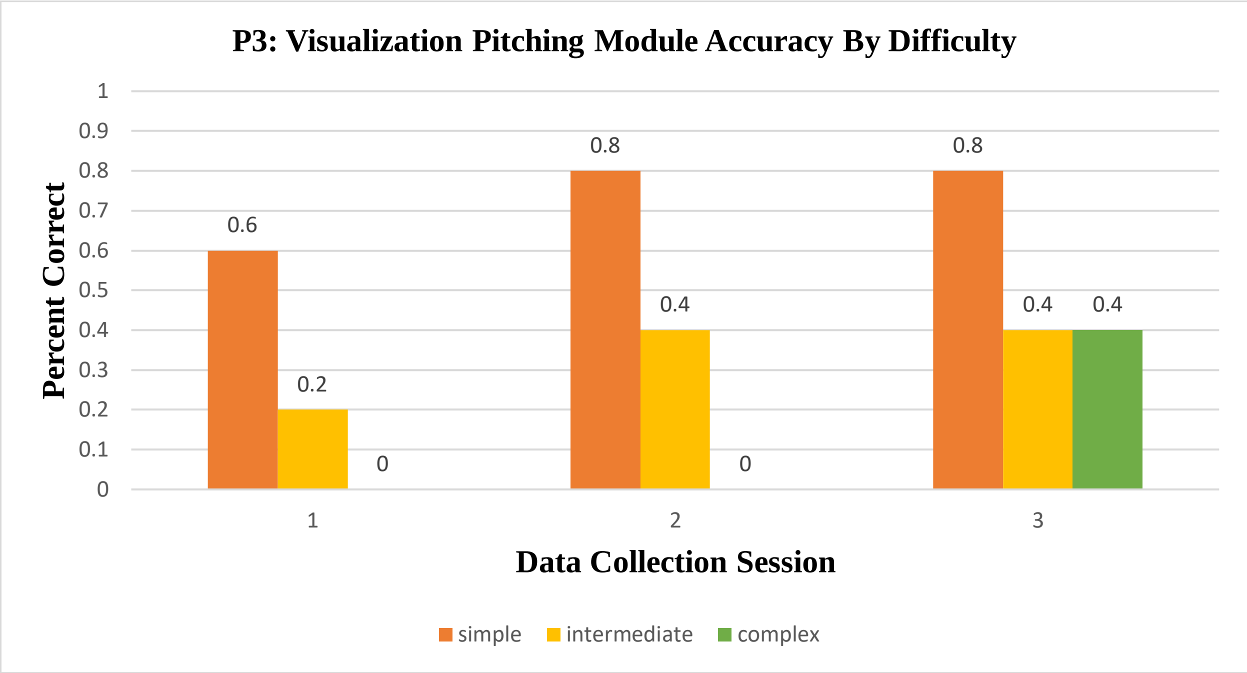


Figure 4.18. P3 Pitching Module Accuracy by Difficulty



Participant 4

Participant 4 (P4) was also a member of the visualization group and was present for a total of six sessions spread out throughout the four blocks. Figure 4.19 shows P4's performance (average inches from the hole ± SEM for putting) for the putting task over six sessions. Performance showed improvement after the initial baseline session, with performance staying fairly stable throughout the other three blocks of the experiment. Performance during the training reinstated phase was slightly worse than what was recorded in either the initial training or reversal blocks and the second session of the baseline block.

Figure 4.20 shows P4's performance (average feet from the hole ± SEM for pitching) for the pitching task over six sessions. The graph suggests even more stable performance on the pitching task than what was seen in the putting task in Figure 4.19. Overall, a slight decrease in performance is seen, with performance during the training reinstated phase being somewhat worse than performance in all other blocks, and the same as performance during the second session of the baseline block. No clear performance improvements can be seen for either putting or pitching performance and there is no evidence of any effect of the mental skill training or any practice effect.

Figure 4.21 shows P4's putting performance as z scores for the entirety of the study. This graph suggests fairly consistent amounts of variability of shots throughout the study, with a few outliers occurring as well. Overall, performance does not show clear trends in either direction, and there is still much variability in performance during later phases.

Figure 4.19. P4 Putting Performance Averages

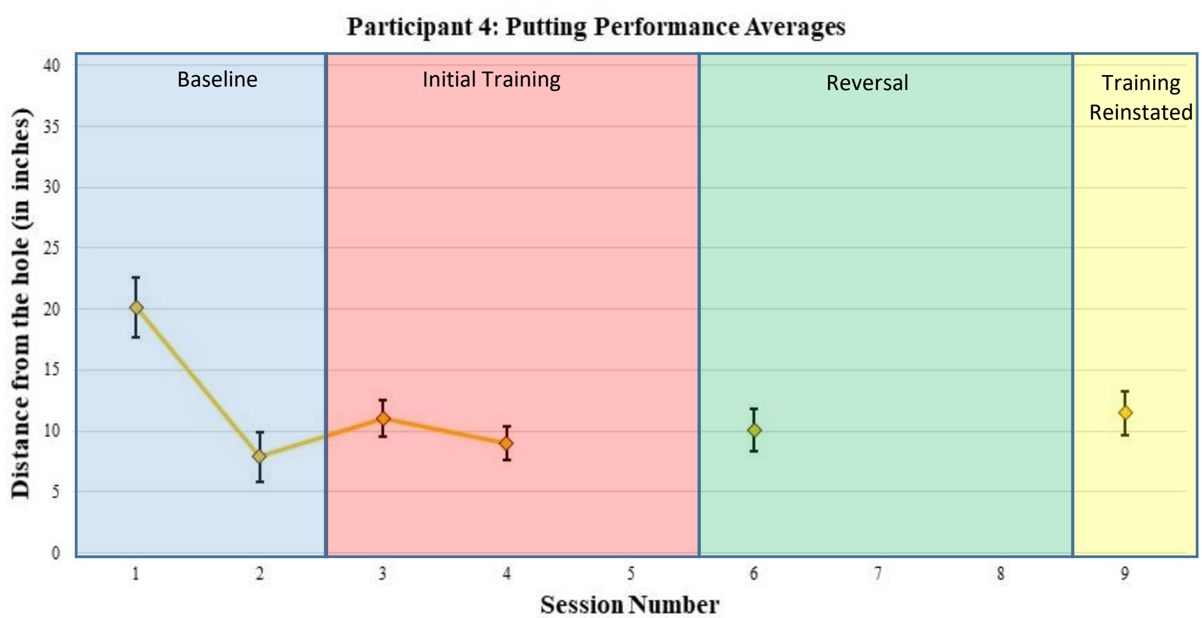


Figure 4.20. P4 Pitching Performance Averages

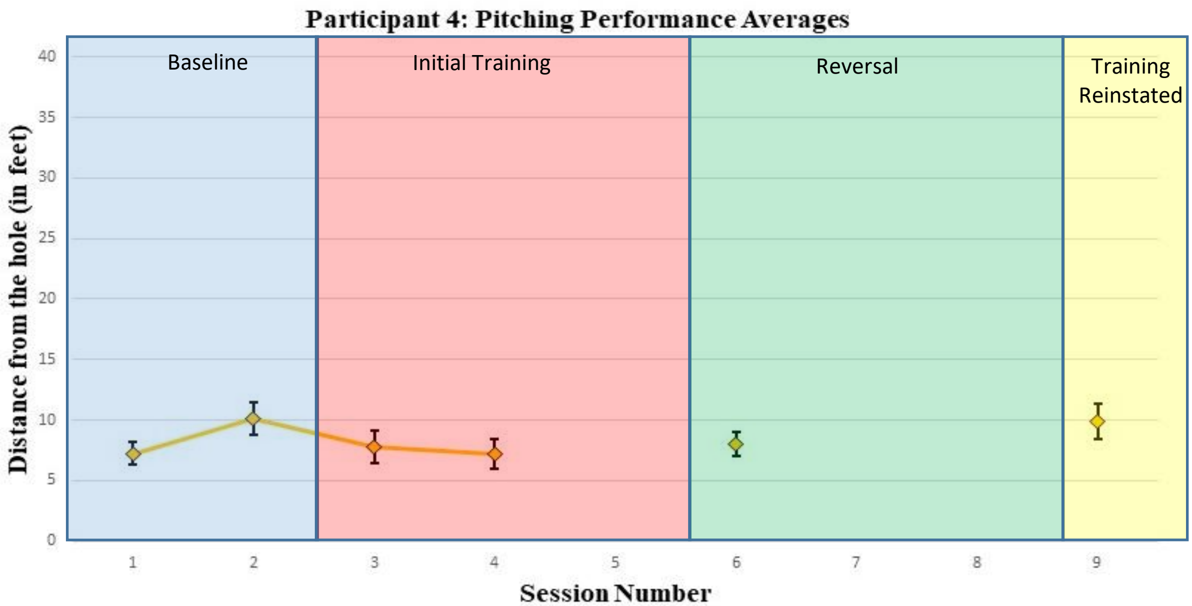


Figure 4.21. P4 Putting Performance Standardized

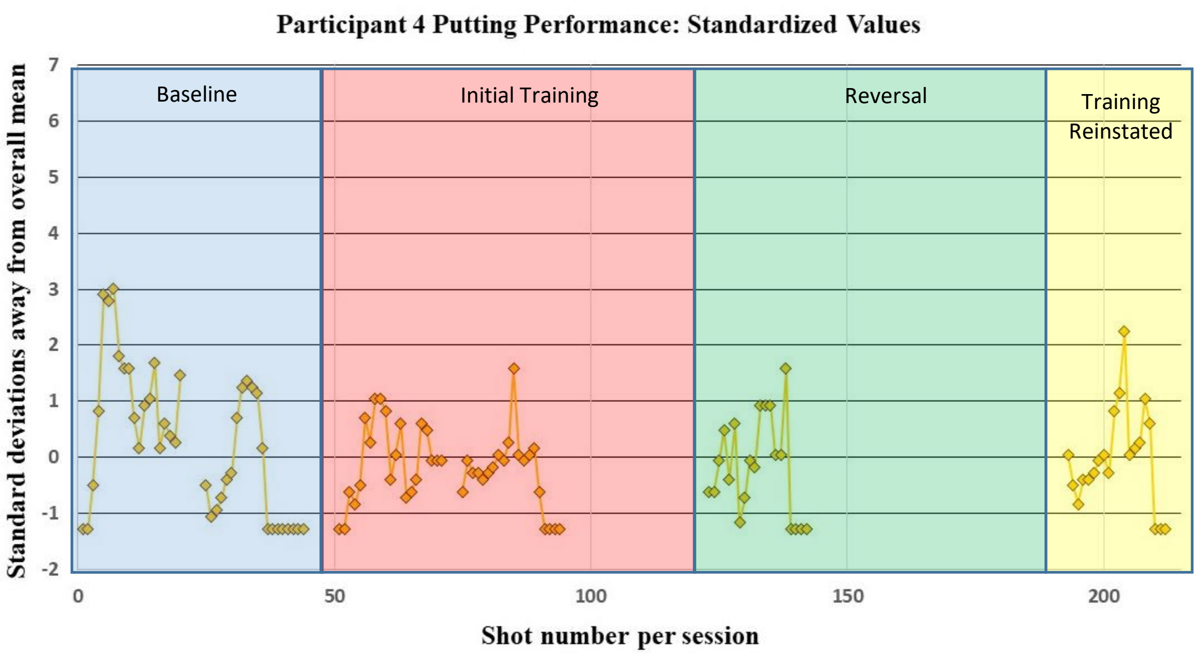


Figure 4.22, shows P4's pitching performance as z scores. This graph suggests high variability in performance, much like the putting task, and similarly no clear performance trends or indications of increases in consistency. Additionally, a high number of outliers are apparent in this figure.

P4 was also a member of the visualization training group and was present for three manipulation check tests. As seen in Figure 4.23, no change in accuracy for the putting modules can be seen, with consistent performance at 60 percent correct throughout the three tested sessions.

Figure 4.22. P4 Pitching Performance Standardized

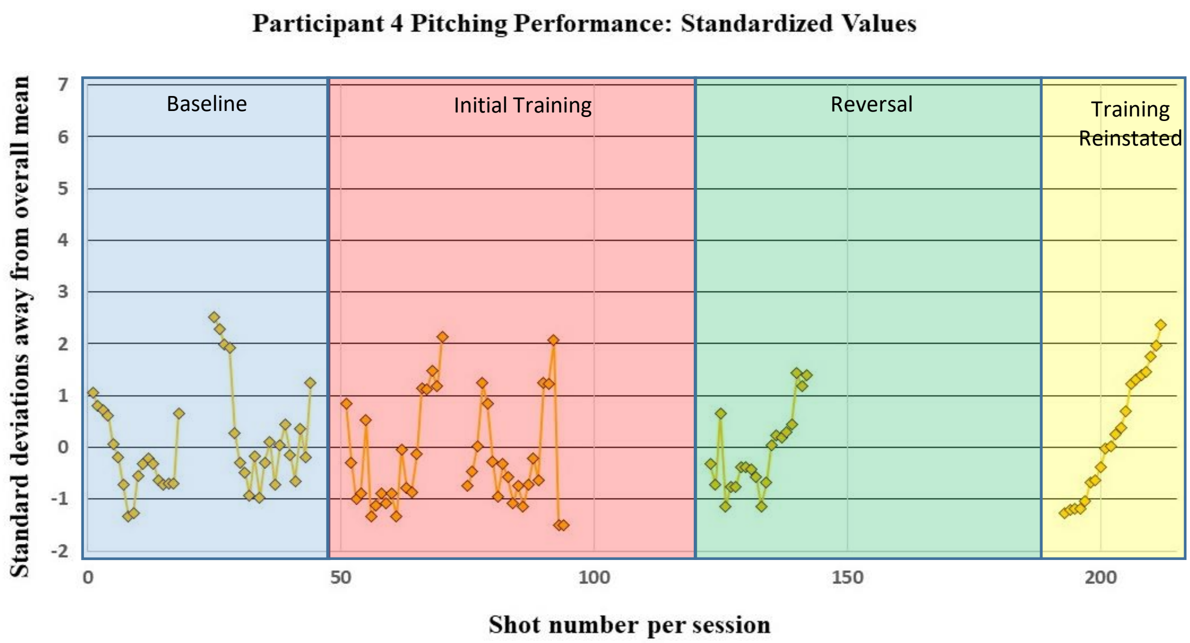


Figure 4.23 P4 Putting Visualization Overall

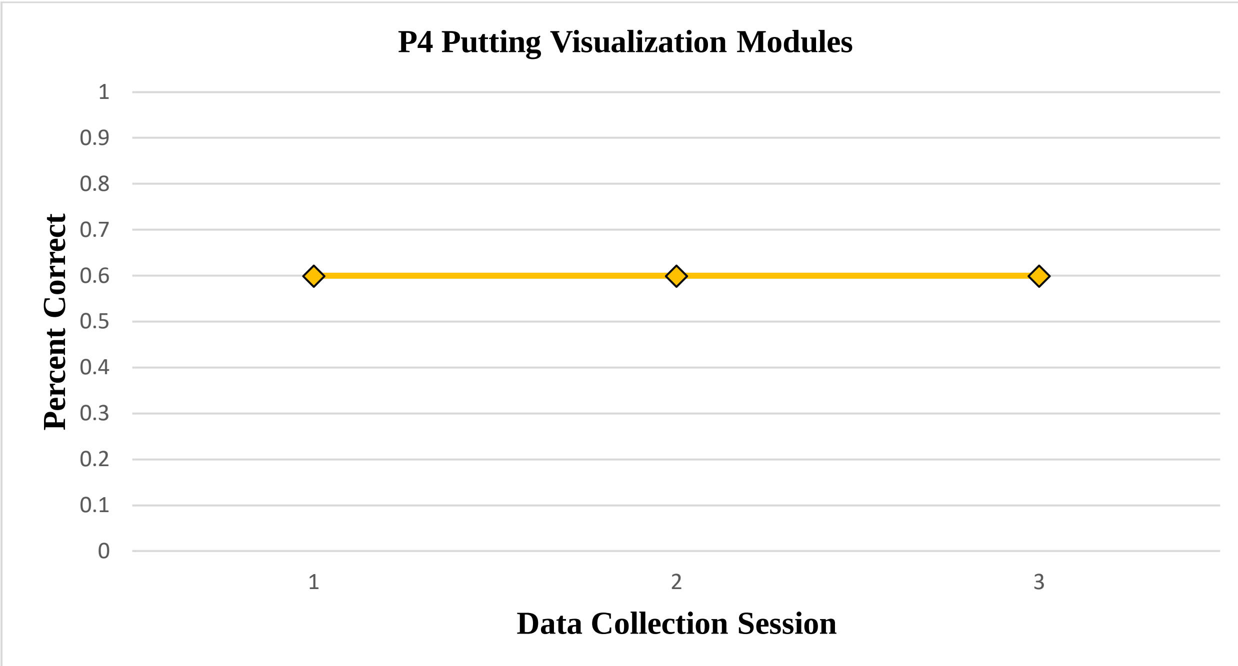


Figure 4.24 similarly shows P4's performance on the pitching module manipulation checks as consistent throughout the study, with 60 percent accuracy during each of these tests.

Figure 4.25 shows P4's performance on the visualization manipulation check tests based on the level of difficulty of the putting modules seen during each session. For the putting modules, performance decreased on the simple modules, was steady for the intermediate module and increased slightly before plateauing for the complex modules.

Figure 4.24. P4 Pitching Visualization Overall

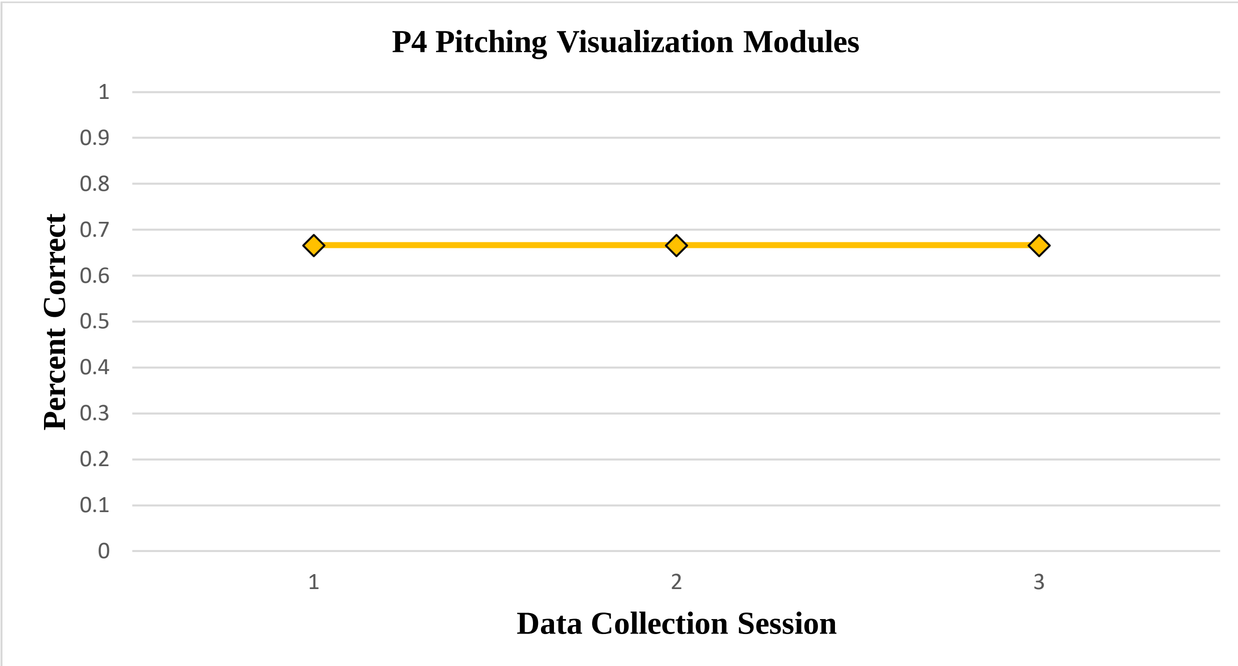


Figure 4.25. P4 Putting Module Accuracy by Difficulty

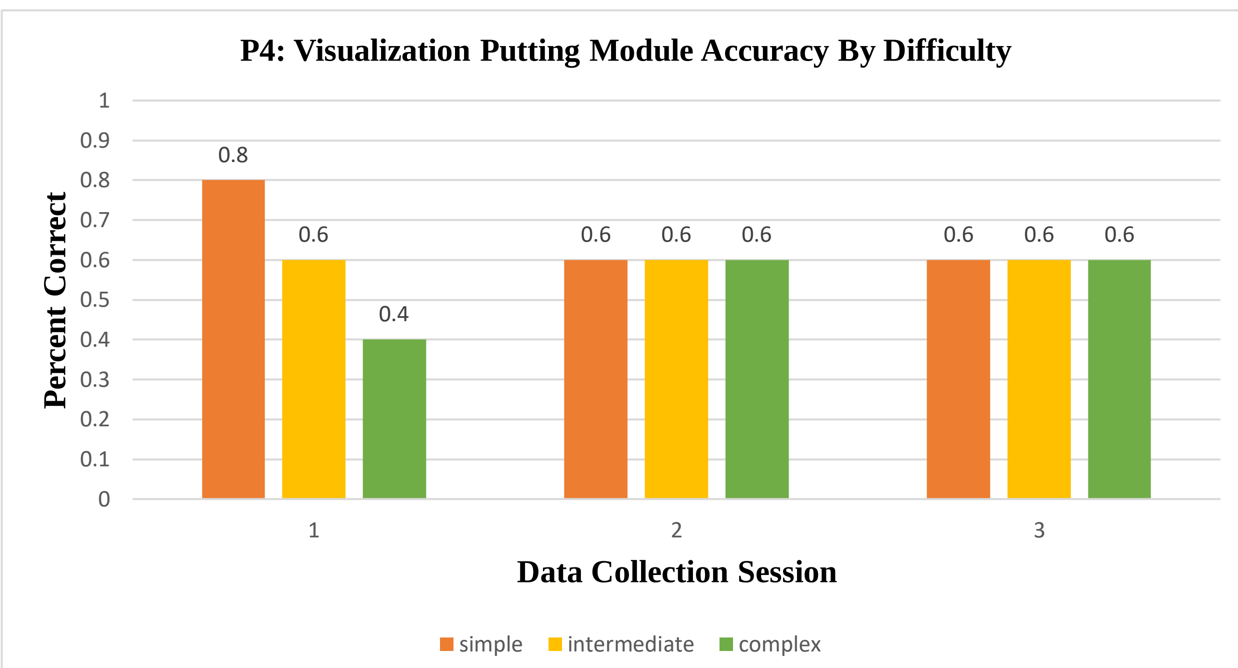
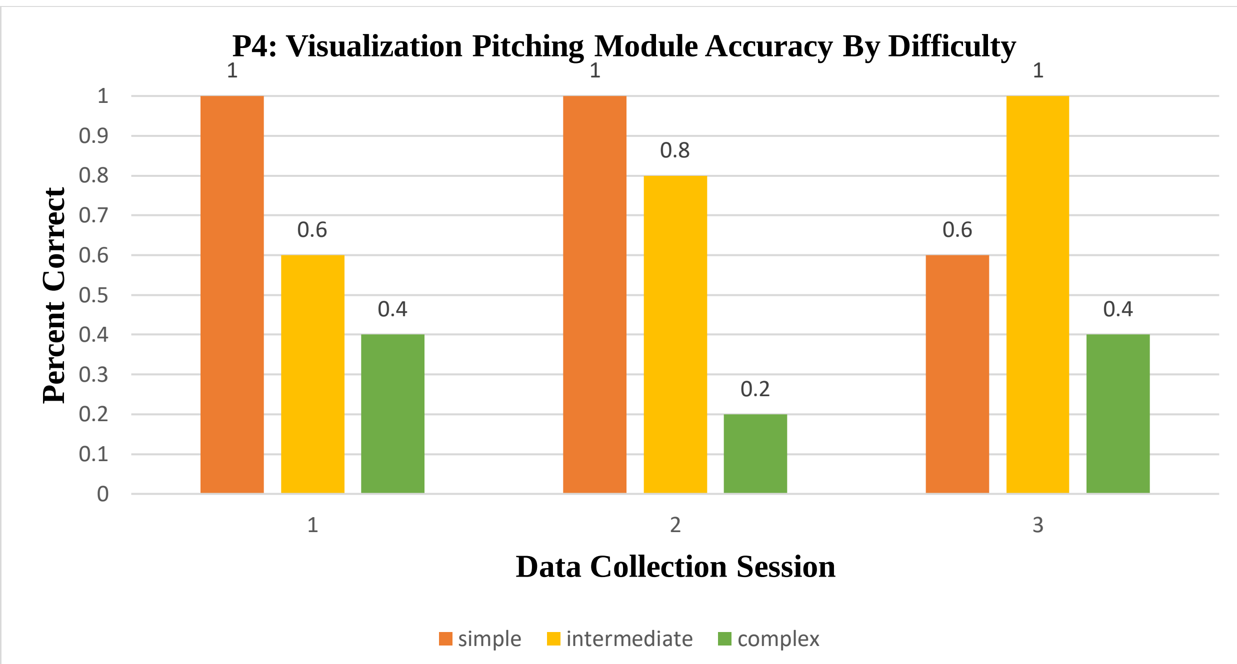


Figure 4.26 represents P4's performance on the pitching visualization modules based on the varying levels of difficulty. For the pitching modules, performance decreased over the course of the study for the simple modules, where performance was expected to increase most, but increased steadily for the intermediate difficulty modules and stayed fairly steady for the complex, with a slight dip in accuracy during the second session. The results for both the putting and pitching manipulation checks do not indicate clear improvement trends and are not consistent with what was initially expected for these findings. This will be explored further in the discussion section.

Figure 4.26. P4 Pitching Module Accuracy by Difficulty



Participant 5

Participant 5 (P5) was the only participant present for every data collection session, with nine total data collection sessions over four different blocks. Figure 4.27 shows P5's performance (average inches from the hole ± SEM for putting) for the putting task over nine sessions. Performance was fairly stable throughout the study, with performance during the training reinstated phase being consistent with what was recorded for both the initial training phase and reversal phase.

Figure 4.28 shows P5's performance (average feet from the hole ± SEM for pitching) for the pitching task over the nine sessions. The graph suggests an overall decrease in performance over the course of the study, with performance during the training reinstated phase being worse than what was measured during any other phase.

Figure 4.27. P5 Putting Performance Averages

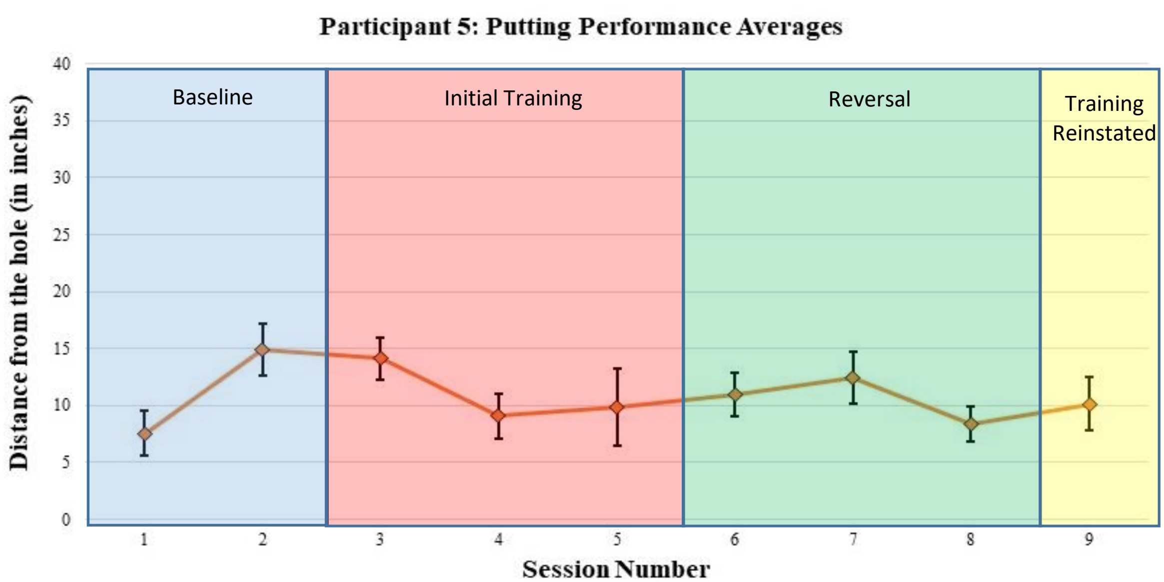


Figure 4.28. P5 Pitching Performance Averages

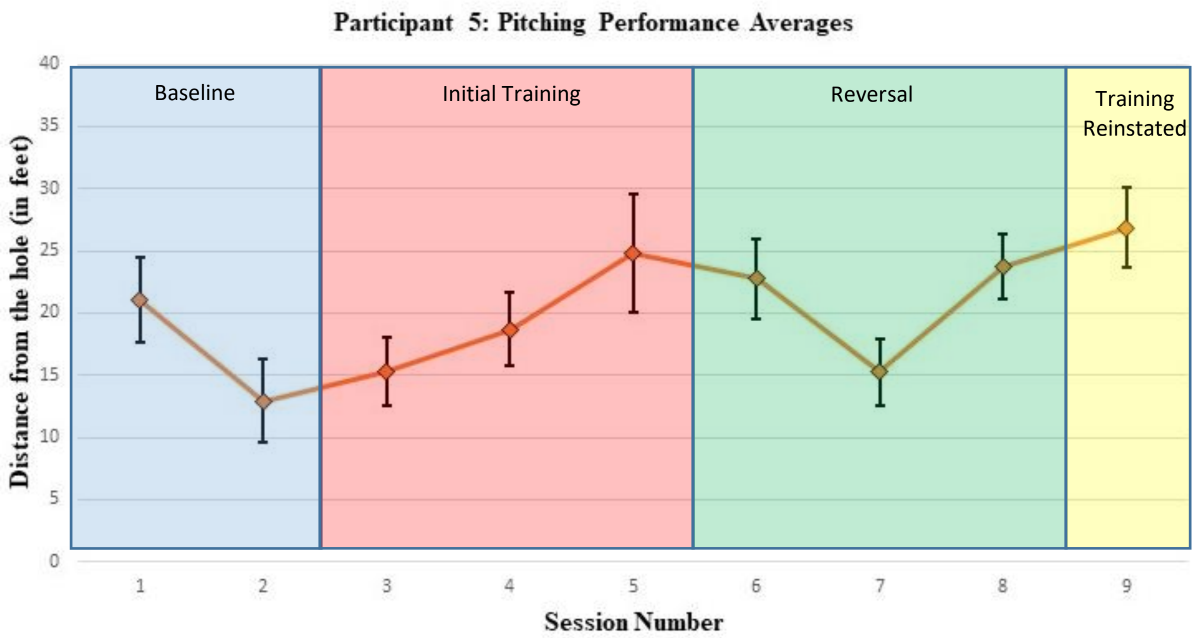


Figure 4.29 shows P5's putting performance as z scores. As the graph shows, there is evidence of some clear outliers throughout all blocks of the study. Overall, performance variable, with performance occurring between one two standard deviations away from either side of the overall mean. No clear trends in the data are shown either for overall performance improvement or for an increase in consistency.

Figure 4.29. P5 Putting Performance Standardized

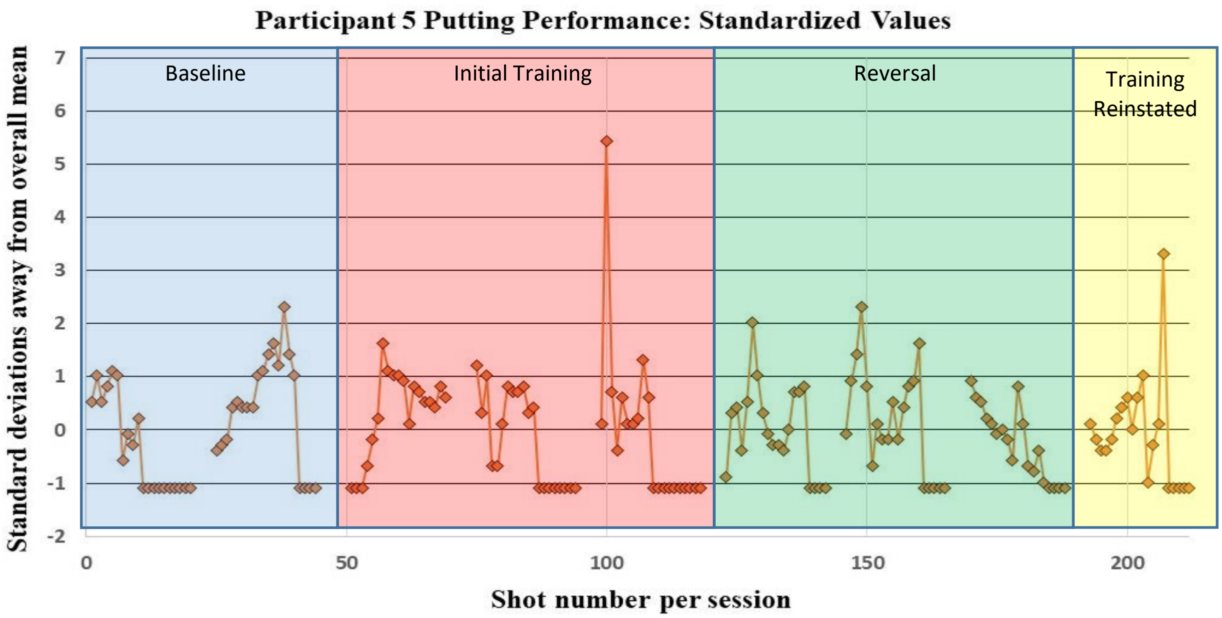


Figure 4.30 shows P5's pitching performance as z scores. This graph also indicates high variability in performance for P5 on the pitching task throughout the entirety of the study. No clear trends in the data are shown, and there are no indications of any performance improvements based on the intervention or practice effects. Similarly, there is also no evidence of a decrease in performance variability over the course of the study.

Figure 4.30. P5 Pitching Performance Standardized

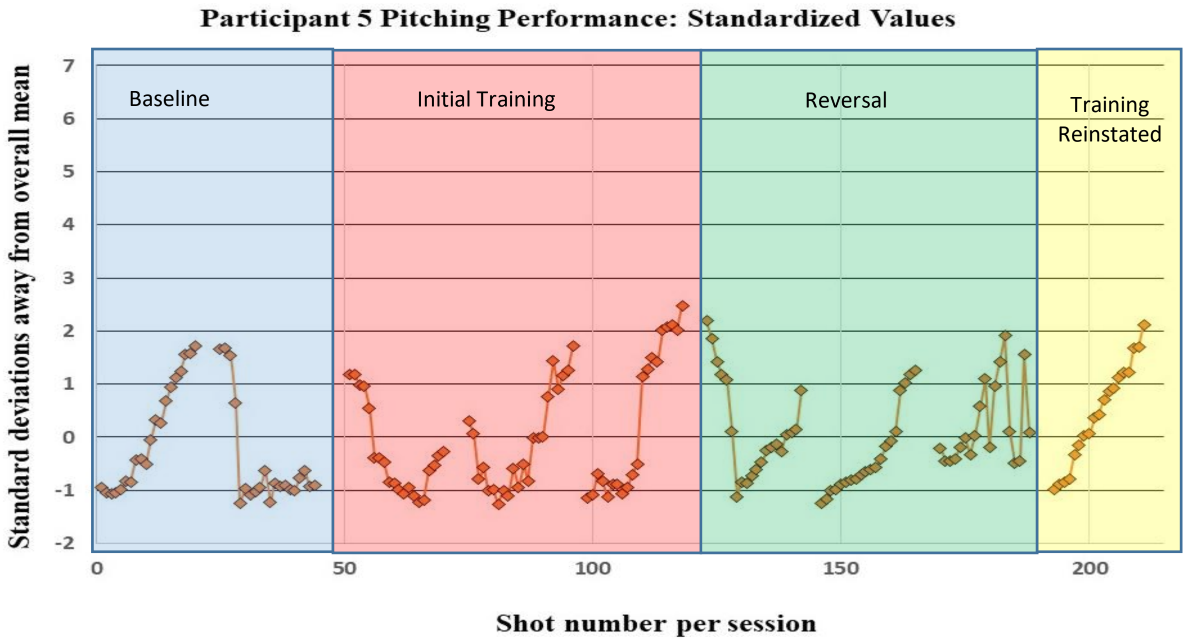


Figure 4.31 shows P5's performance on the putting visualization manipulation checks. Over the course of the study, P5 was present for five separate visualization manipulation checks that occurred during each of the various blocks of the study. Overall, performance on the putting modules declined over the course of the study, with a slight decrease in accuracy during a session held during the initial training phase which was then followed by a slight increase during the reversal phase. Despite this increase, performance was best during the first manipulation check that occurred during the baseline phase before any training or practice had occurred.

Figure 4.32 shows P5's overall performance on the pitching visualization manipulation checks. Similar to their performance on the putting modules, overall their performance decreased over the course of the study and the five testing sessions. A slight improvement in accuracy can be seen during the final session, which occurred during the training reinstated phase, but this level of achievement was nonetheless less than what was recorded during the baseline phase before the task had been practiced.

Figure 4.31. P5 Putting Visualization Overall

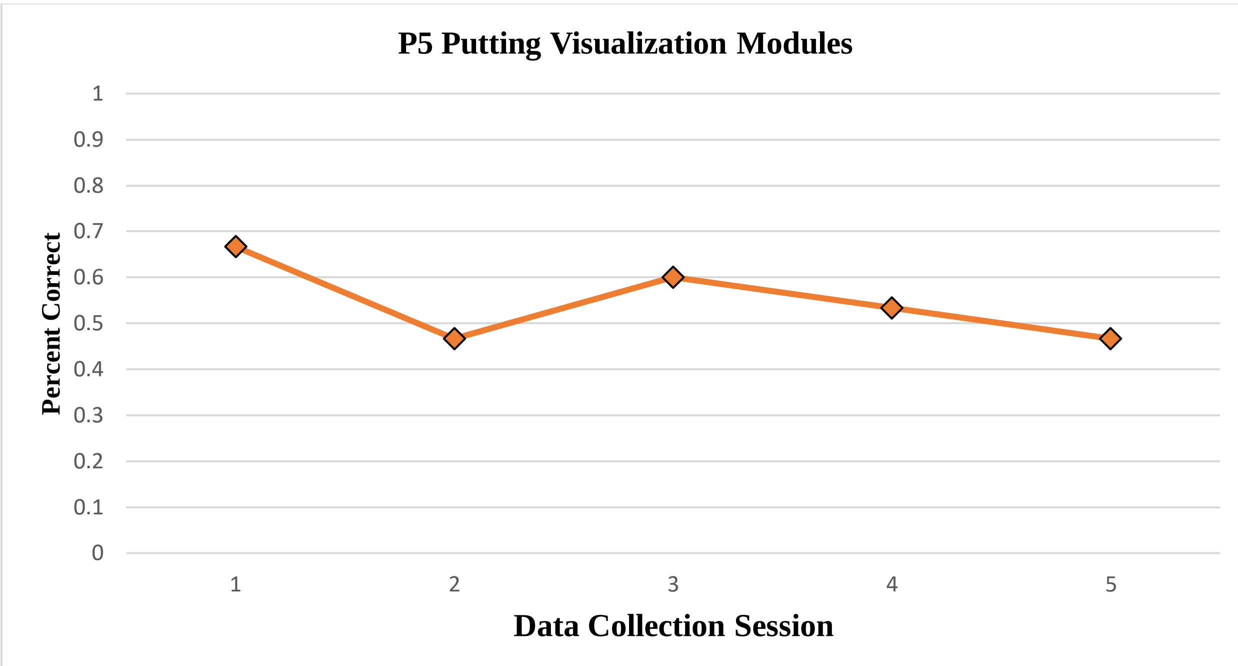


Figure 4.32. P5 Pitching Visualization Overall

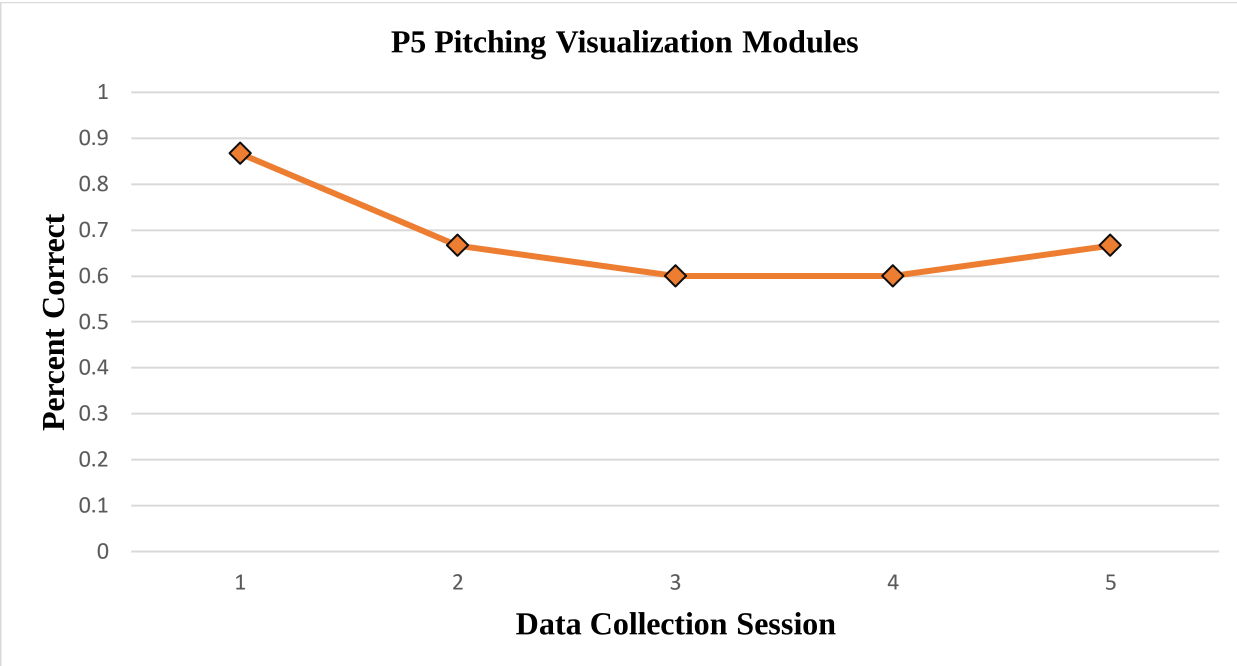


Figure 4.33 shows P5's performance on the putting modules separated based on the varying levels of difficulty. P5 improved their performance on the simple putting modules after the first session, remaining constant in sessions two through five. No clear improvements for the intermediate or complex modules are seen, with slight increases and decreases following the first test session. These trends are not consistent with what was expected and do not suggest any improvement in the development of the mental skill of visualization for putting.

Figure 4.34 shows P5's performance on the pitching portion of the visualization manipulation checks. For the pitching modules, performance on the simple modules was perfect throughout, but performance for the intermediate and complex tasks both declined following the first test session, inconsistent with what was originally expected. The possible explanations and implications of the data findings for all participants will be explored further in the discussion section of this paper.

Figure 4.33. P5 Putting Module Accuracy by Difficulty

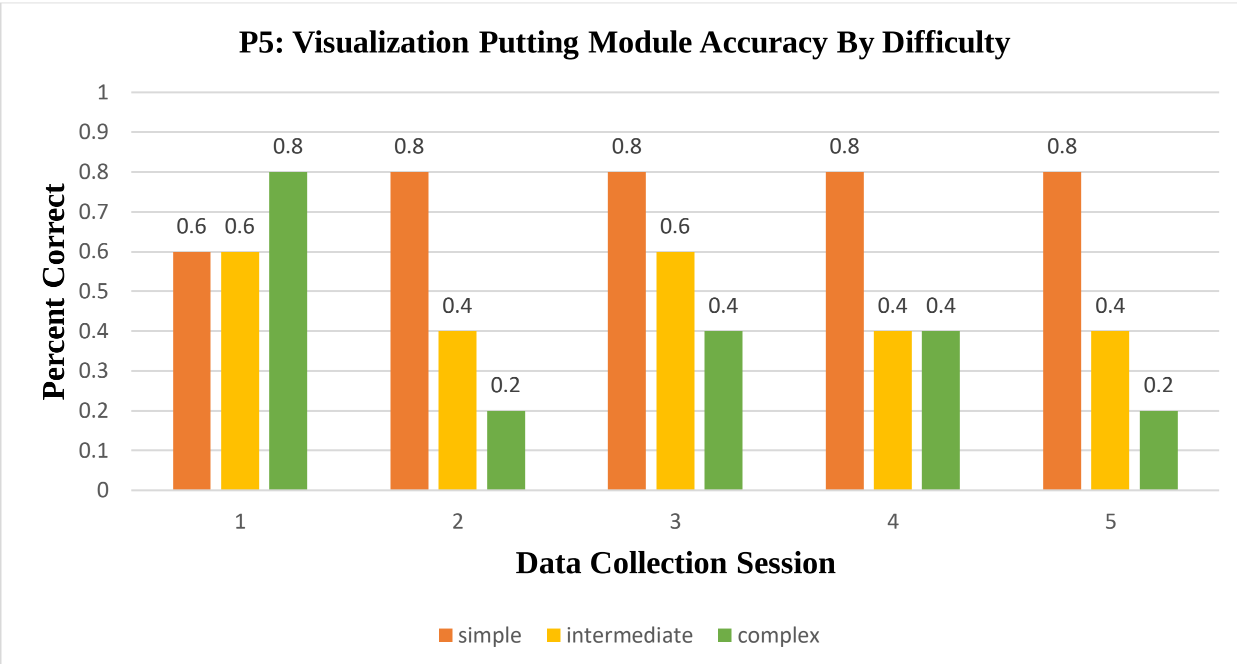
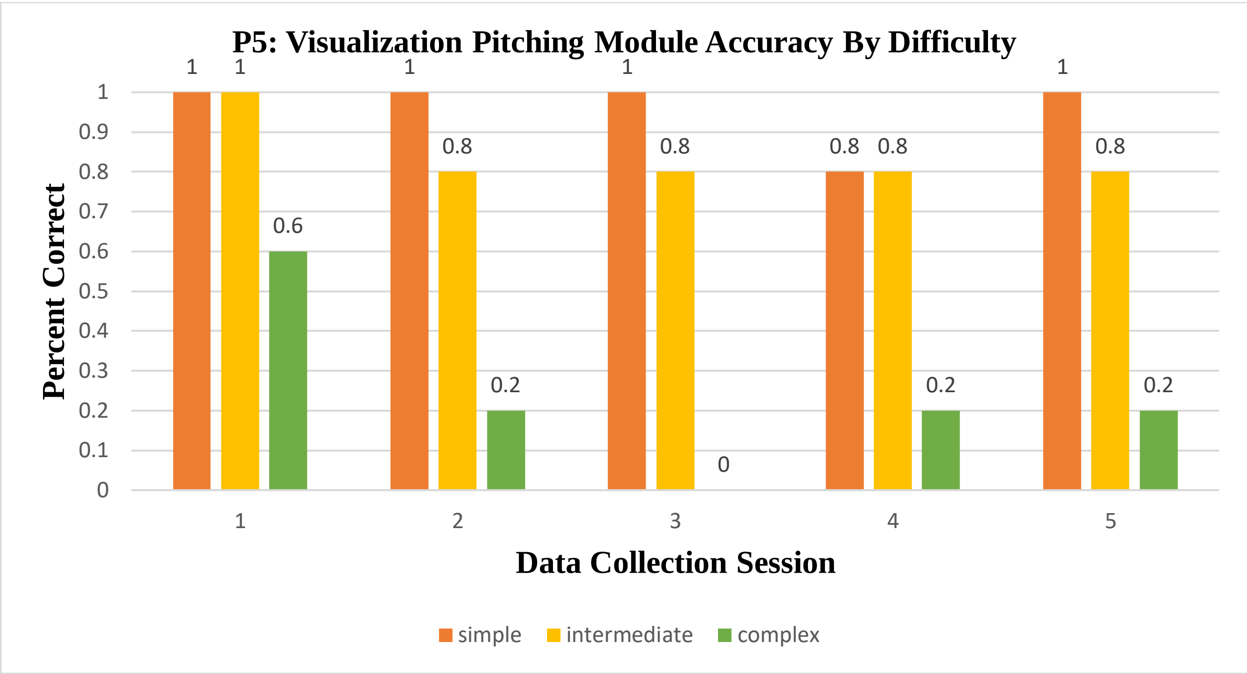


Figure 4.34. P5 Pitching Module Accuracy by Difficulty



CHAPTER FIVE: DISCUSSION

This experiment tested the hypothesis that implementing psychological skills training as part of a deliberate practice regimen for golfers in a natural setting would improve performance of both the trained mental skills and standard putting and pitching performance tasks.

The results of this experiment did not support the hypothesis and there were no clear trends suggesting performance improvements for any of the five participants included for data analysis. Further, the lack of trends in performance make it hard to draw inferences about what occurred over the course of the study. The inconsistency, evident in high variability, of all the athletes' performances is most likely a reflection of the skill level of the population used in this study. The golfers who participated in this study were all recreational golfers who played for enjoyment rather than playing for competition. This type of golfer is more interested in playing than practicing and is not as dedicated to improving the technical skill required to increase performance to the level seen in competitive amateur or expert golfers.

Two problems make it very difficult to draw any conclusions about the effectiveness of the mental skills training. First, the participants showed a lack of commitment to practicing the skills. Second, the expanded timeline of the study caused participants to miss testing sessions. The extended time between tests almost certainly affected both the mental skills performance and the golf performance. Perhaps the study would be more successful using participants such as a team that meets regularly. With regular practice mental skills and golf training could be implemented as part of a pre-existing regular practice schedule.

However, both of these confounds are tradeoffs in how the study was set up. First, if a recreational population is used and more rigorous practice is imposed then the study is less ecologically valid. If the practice demands are left as they were in this study that means there are lower levels of control. Perhaps it is methodologically impractical to test these interventions in recreational athletes.

Second, the fact that this study was conducted in an outdoor natural setting added to its ecological validity, but contributed to the problematic time line. Golf is always susceptible to disruption by the weather. An atypical winter caused many problems for data collection throughout this study (see Table 1). Cold weather, snow, and ice caused five different data collections to be cancelled. This extended timeline was negative for several reasons. First, it caused larger gaps between training prior to the reversal period and additionally extended the reversal period longer than expected. This made it so that training was not as deliberate as intended. This may be part of why mental skills did not have the expected effect on performance. Second, the extended timeline had a negative impact on participant commitment and completion of the study. Participant 1 had to leave the study before completion due to the extended timeline. Other participants left even earlier in the study and could not be included in the data analysis. These departures were due to the longer timeline and the lack of consistency with scheduling. Third, the lack of commitment to mental skills practice may have been in part due to the lack of predictability in scheduling. Fourth, it was evident during testing sessions when the weather was not ideal that some participants were less committed to their performance. This was apparent in the pace at which they completed tasks and the lack of effort in completing the manipulation checks. For example, on inclement days the self-talk counters were hardly used for the negative self-talk group. Finally, the delays caused the final phase, reinstated training plus compartmentalization, to be cancelled and the reinstated training to be cut to only one session.

Mental Skill Manipulation Checks

Self-talk

The lack of commitment to practicing the skills are most clearly seen through the manipulation checks. For the self-talk group, P1 showed no clear trend of improvement for negative self-talk. P2 improved but had very few reported negative statements and received only one training session. This makes it very hard to draw any conclusions about the self-talk intervention or the usefulness of the counting tool. In addition, the last session where this participant reported zero negative self-talk statements they had forgotten and not utilized their counting tool, making it impossible to reach any conclusions about the accuracy of the report or if the tool helped in creating more awareness of self-talk and played any role in the decrease seen. P1 received more training, but left the study before the final training phase, making it impossible to see if any improvements would have been made long-term after more training and increased use of the counting tool.

Visualization

For the visualization group, the same lack of practice was evident. Participants were asked to report how often they practiced with the training modules at home during the training phases. Only P3 showed clear improvements in visualization, but this was seen during the non-training phase and P3 reported never practicing throughout the program, even during training phases.

It was hypothesized that as participants became more familiar with and better at the visualization task, through exposure and deliberate practice, their performance would improve on the more difficult modules over time. There was no indication of this occurring for any of the participants. For example, P4 showed perfect accuracy on the simple modules in the pitching version for the first two sessions. This would indicate a good ability to create accurate imagery that was simple, which would lead to the expectation that performance on the harder tasks should also increase over time with more exposure and practice. Although the desired practice did not occur, the exposure alone would be expected to play a role in performance outcomes, but the trends did not follow what was expected. It would be expected that performance on the simple tasks would continue to be high and improve and then performance on the intermediate and complex tasks would follow similar trajectories. This was not the case, as clearly seen in figures 4.25 and 4.26.

Low amounts of practice were also self-reported by the other members of the visualization group. P4 reported only 15 minutes total during the initial training week and P5 reported 10 minutes total during the initial training phase and 15 minutes total during the final training phase. Therefore, any improvements were probably due to increased familiarity with the modules rather than improved visualization skills. These effects should be much larger if true deliberate practice had occurred.

Golf Skill Performance Measures

It is not surprising that golf performance did not improve. Perhaps these recreational golfers did not believe in the importance of mental skills for improving their game. Therefore, they did not practice the mental skills and did not show changes in performance. It is also possible that the skill level of the golfers in the study, as seen in the high variability of their performance, would make it hard to see clear indications of any performance improvements. The presentation of standardized scores was an attempt to see if variability changed even if average performance did not. Unfortunately, there was little improvement in either measure of golf performance.

When comparing participants to each other, it did not appear that being present in more sessions made a big difference in the golf performance outcomes. For example, although P5 was present for all the performance testing sessions, his average performance did not improve and his performance showed high variability throughout the program. In short, he showed no sign of improvement in accuracy or consistency. This would suggest that improvement requires more than just being present. Deliberate practice of and commitment to the training exercises may be the primary requirement to reap the performance benefits.

Finally, once again, it is reasonable to assume that the inclement weather directly impacted the golf performance measures. There were several data collection days that were cold and windy. These conditions may have reduced the participants' performance by disrupting the execution of the putting and pitching tasks. Cold, stiff hands and shivering makes it harder to execute the golf skills tested in this procedure.

Implications

The results of this experiment provide important information for future research utilizing similar designs. The low level of control makes it hard to enforce the practice needed to see if mental skills training helps performance. Sport psychology consultants working with clients in real world settings should assess an athlete's commitment to practice before concluding that a prescribed intervention is not effective. It may be difficult to convince some athletes of the positive impact that mental skills training can have on performance. It may be equally hard to convince some athletes that it is necessary to practice the skills deliberately in order to reap the benefits.

Limitations and Directions for Future Research

There were several limitations of this study. First, the participants were all recreational golfers. This mental skills training program had no effectiveness with this specific group. It would be ill advised to use these data to make any inferences about golfers with other skill levels or playing and practice habits. This same program may have better outcomes when used with an established group with a regular practice regimen. This type of program might appeal to and be more beneficial for golfers who are more committed to and interested in learning mental skills to improve their performance. Additionally, players with higher skill level may benefit more from mental skills training because their physical skill performance is more reliable and consistent (Bell & Hardy, 2009; Wulf, McNevin, & Shea, 2001).

In hindsight, despite the lack of clear results, I believe there is a lot to be learned and carried over from this study to future application in both research and real-life settings. In terms of the interventions themselves, I think both the self-talk and visualization protocol could prove useful and powerful if the implementation were more deliberate and successful. For self-talk specifically it may be useful to add a segment on positive self-talk training. While the counting tool could help bring awareness to the negative self-talk experienced and help keep track of it, it may seem overly negative to some athletes if they are unsure how to change negative statements to positive statements. In order to avoid frustration, it may be beneficial to provide added training on creating positive self-talk or reframing techniques.

I believe it could also be beneficial for the visualization training to be given in a format where athletes could more easily test themselves and make it more game-like and fun. This may make the training more engaging, easier to use, and more enjoyable. This may be more appealing to golfers of all skill levels, especially those who are not as dedicated to practice or training for intrinsic reasons alone.

For both research and for consultants tracking the progress of an athlete's performance, it is important to spend ample time in the baseline phase to get an accurate representation of baseline skill measures. The performance must become stable before the intervention. This would make it easier to see how performance changes after training has begun.

In real world applied settings, I think it would be most important for sport psychologists or mental performance consultants to be able to develop a richer relationship with the athlete with whom they are working. From the start, it would be important to spend more time getting to know the athlete's game and personality as a way to build trust and understanding about how best to proceed. While the general interventions may be beneficial to many, it is important for consultants to be able to individually tailor the implementation based on each athletes' unique needs. Additionally, it is important for the athletes to have an interest in learning the skills and a true understanding of the time and practice it takes to see the effects of mental skills. Although I have no clear evidence based treatment to recommend, I believe the research methodology laid out in this study could be useful for future research and in applied settings in the field of sport psychology.

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Appendix A: Consent Form for Visualization Group

Informed Consent (Visualization)
Project Title: Effects of a psychological skills training program on golf performance
Principal Investigator: Dr. Winford Gordon, Psychology

Based on your overall golf skill and ability, you have been invited to participate in a mental skill training program research project which could improve your golf performance.

What is the purpose of this study?

Mental skills have been shown to be beneficial in improving athletic performance in a variety of sports. This program will specifically looking at the mental skills of visualization (Group 1) or self-talk (Group 2) and compartmentalization (the skill of playing golf one shot at a time).

What will be expected of you?

During this program, you will be asked to participate in mental skills training over the course of a six-week period during the fall semester. Training for each mental skill will be as follows:

Visualization Training

Visualization training aims to enhance the golfer's imagery skills to see shots more clearly and to focus on positive outcomes of shots. You will go through several training modules that get more complex as you achieve higher levels of control of your visualization. The modules will move from videos with more simple images to more complex images. Once the study begins you will be able to practice with the visualization training modules as much as you would like.

Compartmentalization

Compartmentalization aims to train athletes to break golf up into individual shots, in order to maintain optimal focus on the shot at hand and not worry about past performance or look too far ahead to future performance or score. Compartmentalization training will be set up as a partner exercise where participants will have a partner move their shots to pre-determined locations and be asked to rate how each shot feels on a scale of 1-5. By breaking up shots, the athletes are unable to worry about where the current shot will go or where their next shot will be. This allows athletes to focus on only the shot at hand. As training goes on the shots will be once again linked up and the round played normally with the hopes that the athletes will be able to apply what they learned from the training exercises.

How long will the research take?

The program will run for approximately six weeks. Participants can practice the mental skills on her own through the entire six-week program. Participants will also be asked to complete two golf skills tests throughout their time at regular practices (20 shots of pitching and putting 2 times a week). These skills tests will take approximately 15 minutes each. During the last two weeks of the study, the compartmentalization exercises will take about 45 minutes per session for 3 sessions per week. In addition, researchers will be present to provide the necessary education and test visualization skills during the two performance test days each week. The visualization test will take about 15 minutes. In addition, you will be asked daily to report how long you practiced or engaged in any golf related activity and how long you trained with the visualization modules.

Confidentiality – how will your information be used?

Your performance will be measured and recorded, but once all of the measures are collected your identity will be removed from your measures. This will protect your confidentiality. Personal information and performances will be protected and confidential until all the identifying information can be removed.

Consent and Withdrawal

Participation in this study is voluntary and you are free to decline to participate. There is no compensation for participating in this project. You have the right not to participate at all and to leave the study at any time and there is no penalty for doing so.

Risks – Is there any harm you experience from taking part in the study?
There is no more than minimal risk for your participation in this study. The only risks involved are the same risks assumed by taking part in golf.

Benefits – How will you benefit from taking part in the research?
You have the opportunity to improve your golf performance and enhance your mental/psychological skills. If you are interested, you may request a summary of the overall results at the end of the study.

Who should I contact if I have questions or concerns about the research?
If you have any questions about this study contact Alyssa Morahan (aemorahan1@catamount.wcu.edu) or Dr. Winford Gordon at the Department of Psychology, Western Carolina University, Cullowhee, NC 28723 (828-227-3361 or wgordon@wcu.edu).

If you have concerns about your treatment as a participant in this study, contact the chair of WCU's Institutional Review Board through the office of Research Administration at WCU (828-227-7212) or irb@wcu.edu

____ _______________________

Signature Date

Appendix B: Consent Form for Self-Talk Group

Informed Consent (Self-Talk)
Project Title: Effects of a psychological skills training program on golf performance
Principal Investigator: Dr. Winford Gordon, Psychology

Based on your overall golf skill and ability, you have been invited to participate in a mental skill training program research project which could improve your golf performance.

What is the purpose of this study?

Mental skills have been shown to be beneficial in improving athletic performance in a variety of sports. This program will specifically looking at the mental skills of self-talk and compartmentalization (the skill of playing golf one shot at a time).

What will be expected of you?

During this program, you will be asked to participate in mental skills training over the course of a six-week period during the fall semester. Training for each mental skill will be as follows:

Self-talk Training

Self-talk training aims to enhance the golfer's ability to become aware of negative self-statements and in turn decrease the use of negative self-statements or increase the chances of using positive statements instead. You will be asked to keep track of your negative self-talk. Golfers will be educated on negative self-talk as well as how self-talk can impact performance.

Compartmentalization

Compartmentalization aims to train athletes to break golf up into individual shots, in order to maintain optimal focus on the shot at hand and not worry about past performance or look too far ahead to future performance or score. Compartmentalization training will be set up as a partner exercise where participants will have a partner move their shots to pre-determined locations and be asked to rate how each shot feels on a scale of 1-5. By breaking up shots, the athletes are unable to worry about where the current shot will go or where their next shot will be. This allows athletes to focus on only the shot at hand. As training goes on the shots will be once again linked up and the round played normally with the hopes that the athletes will be able to apply what they learned from the training exercises.

How long will the research take?

The program will run for approximately six weeks. Participants can practice the mental skills on her own through the entire six-week program. Participants will also be asked to complete two golf skills tests throughout their time at regular practices (20 shots of pitching and putting 2 times a week). These skills tests will take approximately 15 minutes each. During the last two weeks of the study, the compartmentalization exercises will take about 45 minutes per session for 3 sessions per week. In addition, researchers will be present to provide the necessary education and collect self-talk data during the two performance test days each week. The visualization test will take about 15 minutes. In addition, you will be asked daily to report how long you practiced or engaged in any golf related activity.

Confidentiality – how will your information be used?

Your performance will be measured and recorded, but once all of the measures are collected your identity will be removed from your measures. This will protect your confidentiality. Personal information and performances will be protected and confidential until all the identifying information can be removed.

Consent and Withdrawal

Participation in this study is voluntary and you are free to decline to participate. There is no compensation for participating in this project. You have the right not to participate at all and to leave the study at any time and there is no penalty for doing so.

Risks – Is there any harm you experience from taking part in the study?
There is no more than minimal risk for your participation in this study. The only risks involved are the same risks assumed by taking part in golf.

Benefits – How will you benefit from taking part in the research?
You have the opportunity to improve your golf performance and enhance your mental/psychological skills. If you are interested, you may request a summary of the overall results at the end of the study.

Who should I contact if I have questions or concerns about the research?
If you have any questions about this study contact Alyssa Morahan (aemorahan1@catamount.wcu.edu) or Dr. Winford Gordon at the Department of Psychology, Western Carolina University, Cullowhee, NC 28723 (828-227-3361 or wgordon@wcu.edu).

If you have concerns about your treatment as a participant in this study, contact the chair of WCU's Institutional Review Board through the office of Research Administration at WCU (828-227-7212) or irb@wcu.edu

____ ____________________
Signature Date

Appendix C: Visualization Training Modules

Visualization Training:

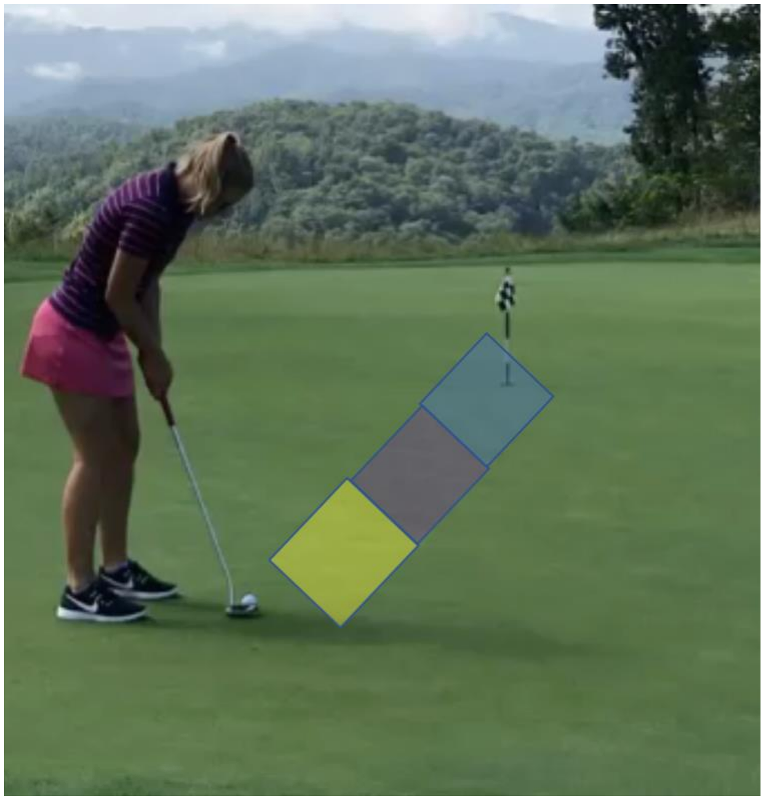
(A) Simple Pitch Shot

(B) Intermediate Pitch Shot

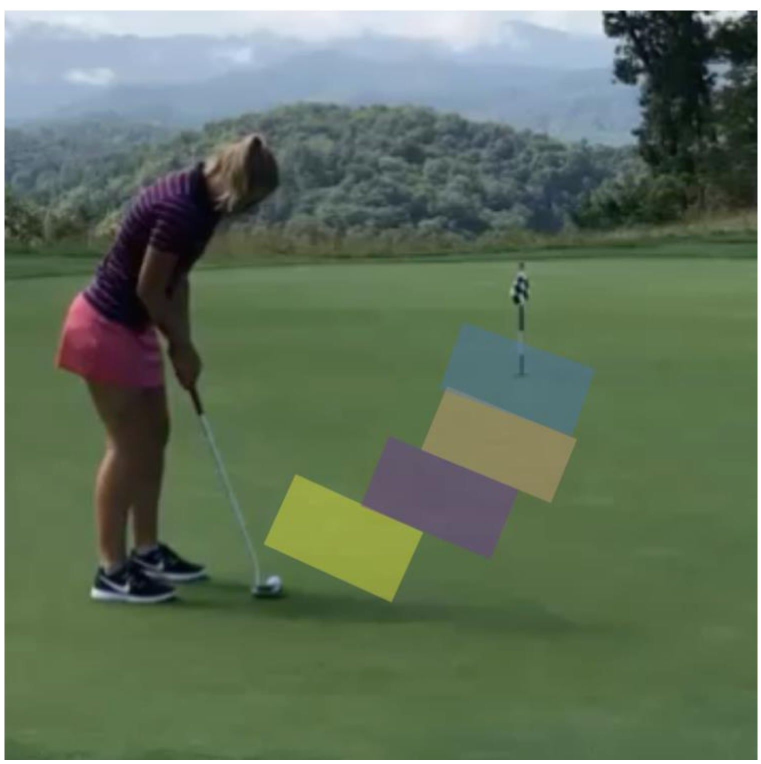
(C) Complex Pitch Shot

(D) Simple Putting

(E) Intermediate Putting



(F) Complex Putting



Appendix D: Self-Talk Script

The following definition was used to describe what constitutes negative self-talk:

"Negative self-talk includes any internal or external speech that is negative in nature either towards oneself personally or about the execution of a skill or shot" Examples of negative self-talk include: "I'm no good at golf", "This ball is going in the water", "My swing is terrible", and "I'm never going to make par."

The following script will be used when describing what constitutes negative self-talk and what the consequences of negative self-talk are, as well as the benefits of positive self-talk:

"Negative self-talk can have negative impacts on athletic performance. Studies have shown that bringing awareness to one's negative self-talk can motivate athletes to decrease the use of negative self-talk as well as change negative dialogue to positive dialogue. The goal of the self-talk training exercise is to limit the use of negative self-talk and change negative to positive. For example, instead of saying you know you are going to hit the shot in the water, say you know you are a good iron player and will hit it on the green. Positive self-talk has been shown to improve confidence in skill execution, in this case confidence in upcoming shots prior to execution, and has been shown to help athletes improve their performance."

Appendix E: Original Training Program Layout

- **Group 1: Visualization**
- **Group 2: Self-talk**

Week 1- baseline measures

- (1 day of visualization testing- Group 1)
- (2 days of self-talk measurements – Group 2)
- (2 days of golf performance measures – putting / pitching- Groups 1 and 2)

Weeks 2-3 - training interventions introduced (self-talk education/ visualization modules given)

- (1 day of visualization testing- Group 1)
- (3 days of self-talk measurements- Group 2)
- (2 days of golf performance measures – putting / pitching- Groups 1 and 2)

Weeks 4-5 – baseline reversal (No self-talk education/ No training with visualization modules)

- (2 days of visualization testing- Group 1)
- (3 days of self-talk measurements- Group 2)
- (3 days of golf performance measures – putting / pitching – Groups 1 and 2)

Weeks 5-6 - Training interventions reintroduced + compartmentalization

- (2 days of visualization testing- Group 1)
- (3 days of self-talk measurements- Group 2)
- (3 days of pitching/putting measurements – Groups 1 and 2)
- (3 days of compartmentalization exercises- Groups 1 and 2)