

Joshua Stephen G. Basnight IV. EXAMINING THE IMPLEMENTATION OF PETTLEP-BASED IMAGERY IN YOUTH SOCCER-DRIBBLING PERFORMANCE. (Under the direction of Dr. Nicholas Murray) Department of Kinesiology, April 2016.

Purposes: To examine the effect of PETTLEP imagery on performance (dribbling time, error performance, performance time) when it is introduced at different times during the process of learning a soccer skill. **Hypotheses:** Hypothesis one stated that all groups that take part in the PETTLEP imagery intervention will increase the performance of the soccer players on the dribbling task by decreasing their completion time as well as the number of errors committed by each athlete. Hypothesis two stated that the earliest implemented PETTLEP imagery intervention will show the largest performance increases from the pre-test to the post-test. **Methods:** Participants self-reported their sex and age before completing the Movement Imagery Questionnaire-Revised to assess imagery ability (Hall & Martin, 1997). Teams completed an adapted version of a soccer-dribbling task (O & Munroe-Chandler, 2008) as a performance assessment three times over the course of the study and physically practiced the task once each week. Imagery Group 1 began practicing a PETTLEP mental imagery program four times per week and were asked to record these sessions in an Imagery Diary for the duration of the study, beginning during week one. A control group practiced four stretches derived from the FIFA 11+ stretching routine (F-Marc, 2003) over this same time period. Imagery Group 2 was scheduled to begin practicing the same program during week three of the study. Following the post-test, participants completed the MIQ-R (Hall & Martin, 1997) as well as a Post-Experimental Manipulation Check. **Results:** Participants (N = 8, M age= 11.88 ± 0.35 years) in this study were youth soccer players. The initial sample was composed of 68 participants but due to an

unexpectedly wet season, the two teams participating as members of imagery group 2 dropped out of the study, preventing the assessment of hypothesis two. A 2 (Group) x 3 (Session) repeated measures ANOVA was utilized to test the effects of imagery use on dribbling speed and revealed a non-significant effect for Speed, $F(2, 5) = 1.64, p = .28, n^2 = .40$ and Group, $F(2, 5) = 5.31, p = .06, n^2 = .68$. There was a significant Group x Session interaction ($F(2, 12) = 7.19, p < .01$). An independent samples t-test indicated that the average member of the stretching group achieved a significantly faster dribbling speed at the second session session ($t(6) = 1.68, p < .01, d = 1.38$) than the average member of imagery group 1. A separate, 2 (Group) x 3 (Session) repeated measures ANOVA analysis revealed no significant effects for Errors, $F(2, 5) = 5.64, p = .05, n^2 = .69$ or Group, $F(2, 5) = 12.85, p = .01, n^2 = .84$. There was a significant Group x Session interaction between the two groups ($F(2, 12) = 9.30, p < .01$). The average member of imagery group 1 reduced the errors that they committed at each testing session while the stretching group did not improve over this same time period. A 2 (Group) x 3 (Session) repeated measures ANOVA revealed a non-significant effect for Performance time on each group, $F(2, 5) = 0.48, p = .65, n^2 = .16$ and Group, $F(2, 5) = 3.54, p = .11, n^2 = .59$. There was a significant Group x Session interaction ($F(6) = 7.19, p < .01$) between the imagery and stretching groups. There were no significant differences in the calculated performance times of the two groups to complete the soccer-dribbling task at any session. **Conclusion:** Due to the attrition of 88% of the initial sample, this study was unable to assess the differing affects of PETTLEP mental imagery on soccer-dribbling performance. It is hoped that future researchers will continue the study of this topic as this information will allow researchers to provide coaches, parents and athletes with a guideline for the most effective time when practicing a new skill to begin practicing mental imagery in an effort to improve performance to the greatest degree.

EXAMINING THE IMPLEMENTATION OF PETTLEP-BASED IMAGERY IN YOUTH
SOCCER-DRIBBLING PERFORMANCE

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DEDICATION

I dedicate this to my entire family who have supported me and urged me to chase my dreams. My grandma (she hated that word) “Fancy”, who was absolutely certain that I would get in to graduate school and never got to even see my acceptance letter. I wouldn’t have been able to accomplish this without your help the whole way.

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CHAPTER 1: INTRODUCTION

Mental imagery, specifically PETTLEP imagery, has been successfully utilized for over 15 years to help athletes improve their performance (see review, Wakefield et al., 2012). Yet, very few researchers have sought to create guidelines that can be used to help coaches and practitioners aiming to implement this mental skill to its greatest effect on performance. The purpose of this study is to begin filling this void by providing a guideline for the most appropriate time to implement a PETTLEP imagery intervention for improving performance while learning a specific soccer skill. PETTLEP imagery is a model intended to aid those seeking to employ mental imagery by providing its name as an acronym for the required elements for the creation of an effective mental image (Holmes and Collins, 2001). Youth coaches spend time teaching drills when they could be spending less of that time teaching the design of the drill and replace it with time where their athletes are improving their skills targeted as a part of the drill. This study aims to identify the degree to which, previous knowledge of a technical soccer-dribbling task affects the performance of youth soccer players completing this same task, who have undergone a PETTLEP imagery intervention.

When utilized in a sports setting, mental imagery has been termed the volitional experience involving the use of one or more of the senses to create, or recreate a specific sport situation or skill (White & Hardy, 1998). Mental imagery interventions have been utilized to increase the performance of athletes in lab settings, practices, as well as games (Blair, Hall, and Leyshon, 1993; Taktek, Zinsser, & St. John, 2008; Ramsey et al., 2010; Munroe-Chandler, Hall, Fishburne, and Hall, 2012; Weinberg, 2008). Recognizing the benefits of mental imagery, researchers have investigated the types and methods of imagery that are already being used by athletes in a sports setting (Munroe-Chandler et al., 2007). Building on research that focused on

the types of imagery utilized by adult athletes, Munroe-Chandler et al., (2007) were the first to investigate the types of imagery that were used by youth athletes. The 110 youth athletes surveyed as a part of that study reported the use of visual, kinesthetic, auditory, and tactile imagery in relation to sports (Munroe-Chandler et al., 2007). The majority of research in to the use of imagery by youth athletes has focused on visual and kinesthetic imagery (Munroe-Chandler et al., 2007). Within the categories of visual and kinesthetic imagery, Hall et al., (1998) identified five focuses of imagery that are utilized by athletes. These five focuses were identified as motivational specific (e.g., mentally imaging the achievement of specific performance goals), motivational general-mastery (e.g., mentally imaging maintaining focus when faced with a problem), motivational general-arousal (e.g., mentally imaging the emotions that are associated with a major competition), cognitive general (e.g., mentally imaging a game plan successfully), and cognitive specific imagery (e.g., mentally imaging perfectly executing specific skills) (Hall et al., 1998). The most commonly utilized focus of imagery for the athletes surveyed was cognitive specific imagery (Munroe-Chandler et al., 2007). This type of imagery is generally used to review technical sport skills or short sequences of skills and has resulted in similar if not, greater performance increases than physical practice alone (Martin et al., 1999; O & Munroe-Chandler, 2008; Munroe-Chandler et al., 2012).

Many types and methods of imagery interventions have resulted in the successful increase in the performance of athletes (e.g., Blair, Hall, and Leyshon, 1993; Taktek, Zinsser, & St. John, 2008; Ramsey et al., 2010; Munroe-Chandler, Hall, Fishburne, and Hall, 2012; Weinberg, 2008). The PETTLEP imagery model is the most appropriate model for those wishing to increase technical sport performance due to the PETTLEP imagery model's focus on creating the most complete and vivid mental image possible. English, university soccer club players that

underwent an imagery intervention improved their performance more than the control group, which underwent a planned stretching regimen (Ramsey et al., 2010). Even in youth athletes, imagery has been used to improve the learning of a closed motor skill (Taktek, Zinsser, & St. John, 2008). In both Ramsey et al. (2010) and Taktek et al. (2008), the researchers investigated the use of cognitive specific imagery to increase the physical performance of athletes in a sports setting but each researcher utilized a different version of a cognitive specific imagery script. The PETTLEP imagery model's name is an acronym for guiding the creation of successful cognitive specific imagery interventions that is a reminder for the requirements (Holmes & Collins, 2001). In an effort to simplify and streamline the process of creating cognitive specific imagery interventions, Holmes and Collins (2001) created the PETTLEP imagery model as a 7-point guideline for the creation of a successful imagery intervention script. At the time of its creation, researchers believed that the positive results seen by those implementing imagery interventions were due to the functional equivalence of the imagined scenario to the physical action being imaged. Functional equivalence is the concept that an image created in the mind activates the same neural pathways as the physical perception of the same object or events (Finke, 1980). Behavioral matching is similar to functional equivalence but differs in that it suggests the general similarity in the brain's perception of imagined tasks and those that are physically performed by the same person. Over time, behavioral matching has emerged as better description of the mechanisms behind the effect of PETTLEP more so than the functional equivalence hypothesis cited by Holmes and Collins (Wakefield et al., 2013). Building off the continued successes of imagery interventions, the next step in imagery research is to take these positive results of imagery interventions such as the PETTLEP imagery model and further test the most effective

methods of implementing them so the field can continue its transition from a laboratory setting to enhancing human performance on the field of play.

PETTLEP is a specific model of imagery focusing on the Physical, Environmental, Task, Timing, Learning, Emotion and Perspective elements of the image that have been previously helpful in creating a functional equivalent mental image to the physical action being imaged (Holmes & Collins, 2001). Encouraged by the successes resulting from the implementation of mental imagery interventions based on the PETTTLEP model (e.g. Wakefield & Smith, 2009; Wakefield & Smith, 2011; Wright et al., 2008; Wright & Smith, 2009), researchers then investigated the individual elements of the PETTTLEP imagery model to assess their importance in the overall goal of increasing performance. Wright and Smith (2009) found that including the “physical” component of the model by grasping the handles of a weight machine while performing PETTTLEP imagery improved performance of that task following the intervention. This may be the most important component to include in a PETTTLEP imagery intervention because it helps to improve create the most physically similar, thus equivalent movement to the actual task (Wakefield & Smith, 2012). The environment component of the model has been examined and proven effective at increasing the positive effects of imagery for golfers imaging bunker shots while standing in a sand box (Smith, Wright, & Cantwell, 2008) and for hockey players imaging penalty shots while standing on a hockey rink (Smith et al., 2007). Further investigating the importance of the “environment” component of the PETTTLEP imagery model as well as the importance of the “task” element, Smith et al. (2007) studied the effect of imagery on a gymnastics balance beam exercise. The group that underwent a PETTTLEP imagery intervention out performed the group that performed a stimulus imagery intervention (Smith et al., 2007). These results suggest that both the environment and task elements of a mental image

are important to improving performance because the addition of PETTLEP imagery focusing on the specific balance beam task while standing on a balance beam resulted in greater performance increases than imagery that focused on the stimuli present when normally performing the task (Smith et al., 2007).

The task portion of the image must also be appropriate for the performance level of the participant imaging it (Weinberg, 2008), meaning that the image should be built from the athlete's current understanding of the skill, not a simplified or more complicated version of the skill. This suggestion mentions the task but refers to it in relation to the "learning" component of the PETTLEP imagery model. This component was investigated by updating the content of an imagery intervention throughout the intervention period to reflect the progress of the athlete and resulted in greater performance increases than those who used the same image throughout the duration of the study (Wakefield & Smith, 2011). Also individual to each athlete are the emotions experienced when participating in sport, which should be included under the "emotion" component of the PETTLEP imagery model. While investigating the effect of adding personalized emotion-filled scripts on muscle activation and imagery vividness, Wilson, Smith, Burden, and Holmes (2010) found that the scripts including personalized emotion were correlated with greater muscle activation and higher participant rated imagery vividness than the generic imagery scripts used as a control in the study. The "perspective" component of the PETTLEP model references the view from which the participant views the image. It is important to note that this element of the model should be chosen by the athlete's preference because although Holmes and Collins (2001) note that a first person point of view should be most often used, they go on to note that a third person point of view can be helpful to those practicing form-based skills. Hardy and Callow (1999) found that utilizing a third person view to image a form

based skill (e.g. gymnastics performance) resulted in successfully improved performances of that skill following the intervention.

The “Timing” element of the PETTLEP imagery model proposed by Holmes and Collins (2001) suggests that real-time imagery should be the most commonly used image speed during mental imagery sessions but similarly to the perspective component of the model, other speeds can be successfully used in specific circumstances to create a functionally equivalent mental image. The suggestion that speed of an image should be real-time is likely a result of Moran and MacIntyre’s (1998) findings that time taken by elite slalom canoe athletes was significantly correlated with their subsequent race completion time. More recently, the suggestion to utilize real-time imagery was supported by O and Hall (2009), who found that the majority of athletes taking part in their study choosing to use real-time imagery as opposed to slow motion or faster motion image speeds. While this survey of 604 athletes reported that athletes most often use the suggested, real-time image speed when performing imagery, the participants also reported using slow motion and fast motion imagery, depending on the strategies and skills that served as the focus of their imagery session. Utilizing an adapted form of Blair et al.’s (1993) technical soccer task, the effect of various image speeds as well as timing was studied in reference to the performance of youth soccer players (O and Munroe-Chandler, 2008). Results showed that the real-time, slow motion, slow motion concluding with real-time imagery and the physical practice conditions all improved to the same degree on their time and error performance following the intervention (O and Munroe-Chandler, 2008). These results provide evidence to support Holmes and Collins (2001) suggestion that slow motion imagery can also be used to focus on and improve the learning of a skill. The inclusion of the physical practice condition to this study

provides further evidence to support the assertion that PETTLEP imagery can be used to improve performance as much as physical practice alone.

After observing the successes of applied research in to mental imagery as a method of increasing performance, researchers should focus on guiding those outside of academia who seek to utilize mental imagery programs to increasing sport performance (e.g. Blair et al., 1993; Smith & Wright, 2007; Wright & Smith, 2009). Imagery interventions created for the instruction of coaches frequently suffer from a lack of theoretical basis (Vealey & Greenleaf, 2010). As a result of research, word of mouth, etc., coaches are often aware that imagery can be an effective method of increasing athletic performance but still have issues incorporating it in to practice and competition (Finch, 2011). Coaches' lack of awareness, as well as a lack of information regarding the implementation of mental imagery programs has been echoed by others as a reason that many people do not utilize this mental skill as a method of improving physical performance. O and Munroe-Chandler (2008) suggest that sport performance researchers should give as much information in as thorough a manner as possible to guide mental training programs. In the same year, Weinberg (2008) noted that future research should investigate the conditions under which imagery is the most effective at increasing performance. It appears that over time, researchers have accepted mental imagery as a form of increasing physical performance. The next step in mental imagery research should be to clarify the most appropriate methods of implementing imagery for coaches and athletes to most effectively improve performance.

Mental imagery has been successfully used as a method of increasing soccer performance for all ages and ability levels. Munroe-Chandler, Hall, Fishburne, and Hall (2012) again utilized the adapted technical dribbling task taken from Blair et al.'s (1993) study, this time investigating the effect of a cognitive specific imagery intervention on increasing the performance of different

age groups. They found that the seven to ten year old age group improved their performance significantly more than the eleven to fourteen year old age group following a cognitive specific imagery intervention. Cognitive specific imagery is the most similar type of imagery to the imagery created with the PETTLEP imagery model. Munroe-Chandler et al.'s, (2012) results suggest that imagery interventions are more effective at increasing the performance of children than teenagers. While these results suggest that imagery may appear to be more effective in youth than teens and adults, experienced athletes report using psychological skills more often than less experienced athletes (Thelwell, Greenlees, & Weston, 2009). Specifically in soccer, experienced players report using mental imagery more than novice players (Salmon, Hall, & Haslam, 1994). Forms of cognitive specific imagery such as the PETTLEP imagery model have been effective at increasing the soccer performance of youth players yet, experienced soccer players report using psychological skills such as mental imagery more than novice, youth players. Mental imagery is most often used by experienced soccer players but imagery is most effective at improving the performance of youth soccer players, then efforts need to be made to increase the use of psychological skills for youth.

While mental imagery has been successfully used to increase the performance of a variety of ages and ability levels, there is little agreement as to the effect of concept knowledge or skill level as a mediator for the effect of imagery in increasing performance. As skill level increases, psychological state may change as well, which requires imagery interventions to be updated throughout the intervention period to be most effective (Wakefield & Smith, 2012). This suggestion was implemented in a study investigating performance of a bicep curl and performance was enhanced following a six-week imagery intervention that regularly updated the content to reflect participant learning over time (Wakefield & Smith, 2011). Imagery content

must be updated to provide the most effective imagery intervention to increase performance but an individual's ability to perform mental imagery also affects its impact on improving the desired target behavior or skill (Weinberg, 2008). The imagery ability of the participant may also be increased with practice over time (Rymal & Ste-Marie, 2009; Rattanakoses et al., 2012). For those who initially lack adequate imagery ability can, with practice, develop a quality image that is vivid, clear, and accurate and should be practiced further (Finch, 2011). With the understanding that imagery ability can be improved so that it does not hinder the positive effects that result from participating in a mental imagery program, researchers should focus on identifying the most appropriate concept knowledge necessary to increase athlete's performance to the greatest degree.

The relationship between existing task knowledge and its effect on the level of success of a mental imagery program at increasing performance has been investigated but the results have not been fully explored in reference to providing a theoretical basis that can be used to guide the implementation of programs that successfully increase physical performance. Specifically in reference to PETTLEP mental imagery, Wakefield and Smith (2009) suggested following their study of netball shooting performance that future research examine all aspects of the dose-response relationship when using the PETTLEP model of mental imagery. Wakefield and Smith (2012) again echoed this suggestion, noting that researchers need to identify, "how much?" and "how often?" the PETTLEP imagery model should be practiced to maximize its effect. Similarly to identifying the amount of imagery necessary to most effectively experience performance improvements, some have suggested that research should look to examine the differences in what exactly is being imaged by highly skilled vs. novice athletes (Weinberg, 2008). This line of research builds off the example that elite tennis player's focus on difference

aspects of the swinging motion as their skill level at the task increases (Wakefield & Smith, 2012). Researchers are aware that efforts need to be made to add to the theoretical basis of knowledge behind the successful implementation of mental imagery but to date, the most effective methods of implementing mental imagery have not been clearly identified.

These questions are still being asked years after Blair et al. (1993) initially tested the effects of imagery on skilled and novice soccer players. In their research, they suggested that there were two opposing views present in the literature surrounding the successful implementation of mental imagery. The first view is that imagery is most effective at improving performance while learning a skill because the task of learning is cognitive (Schmidt, 1987, p. 418; Blair et al., 1993). Citing support from research suggesting that imagery introduced early in the process of learning a motor skill facilitated performance more than imagery introduced later in the process of learning a motor skill (Wrisberg & Ragsdale, 1979). The second and contrasting view that they present is that imagery may be more effective after the athlete has had an opportunity to practice the task, which allows them to create a strong internal representation of the task to include in the image (Blair et al., 1993). If a mental imagery intervention is introduced before sufficient knowledge has been gained of the task, the weak internal representation may lead to an incorrect or under detailed image that has negative effects on performance (Denis, 1985). This negative side effect of inexperience is also seen in low-ability imagers who may use incorrect images that reinforce errors rather than promote proper technique (Weinberg, 2008). Weinberg's findings may suggest that people who are low-ability imagers may be as ineffective at performing imagery as those who do not have the proper understanding of the task that they are trying to improve. As discussed previously, the issues associated with low-ability imagers

such as helping athletes avoid devoting attentional capacity to negative images can be lessened through practice (Murphy, 1994).

Blair et al.'s (1993) results do little to clear up the remaining holes in the literature over the best time to implement mental imagery in to the process of learning a motor skill to improve performance. They found that both the novice and skilled soccer players significantly improved their performance of the soccer task from pre- to post-test while the control (stretching) group showed no significant improvements in performance (Blair et al., 1993). Both imagery groups were noted to have improved to the same extent (Blair et al., 1993), which still leaves those aiming to use imagery such as coaches, without a guideline for the most appropriate time to implement an imagery program to help their teams improve to the greatest extent. There is a large hole in the field in terms of being able to identify the best time to implement imagery as a form of performance enhancement (Smith, Wright, Allsopp, & Westhead, 2007). Collecting more information on this topic will help practitioners identify the most effective way to utilize PETTLEP imagery in sports.

In this study, O and Munroe-Chandler's (2008) adapted version of Blair et al.'s (1993) soccer performance task will be used to investigate the effect of PETTLEP mental imagery on youth soccer player's performance of a soccer-dribbling task. In line with the results of both studies (Blair et al., 1993; O & Munroe-Chandler, 2008) investigating the effect of imagery on performance of the same task, the first hypothesis of this study is that all groups taking part in the PETTLEP imagery intervention will increase the performance of the soccer players on the dribbling task by decreasing their completion time, the number of errors committed by each athlete, as well as their calculated performance time. While Blair et al. (1993) investigated the differing effects of imagery on experienced and novice soccer players; this study will investigate

soccer players of the same skill level. This choice was made because it will allow the researchers to investigate the resulting performance effects of a PETTTLEP imagery intervention when it is introduced to groups at three different times throughout the process of learning a novel soccer-dribbling task. It is assumed that these groups will have different levels of internal representation of the task due to different levels of practice with the task before the PETTTLEP imagery intervention is implemented. Based on Blair et al.'s (1993) suggestion that a higher level of internal representation of the task will result in greater performance, the second hypothesis of this study is that the earliest group that implemented a PETTTLEP imagery intervention will show the largest performance increases from the pre-test to the post-test.

Purpose statement

- To examine the effect of PETTTLEP imagery on performance when it is introduced at different times during the process of learning a soccer skill.

Hypothesis

- #1: All groups that take part in the PETTTLEP imagery intervention will increase the performance of the soccer players on the dribbling task by decreasing their completion time as well as the number of errors committed by each athlete.
- #2: The earliest implemented PETTTLEP imagery intervention will show the largest performance increases from the pre-test to the post-test.

Definition of terms

Mental Imagery: A volitional experience involving the use of one or more senses to create, or recreate a specific sport situation or skill (White & Hardy, 1998).

PETTTLEP Imagery: A specific model of imagery focusing on the Physical, Environmental, Task, Timing, Learning, Emotion and Perspective elements of the image that

have been previously helpful in creating a functional equivalent mental image to the physical action being imaged (Holmes & Collins, 2001).

FIFA 11+: A comprehensive warm-up routine designed by FIFA to serve as a routine that can be used before practices and games to help prepare the body for the demands of soccer to help prevent significant injuries (F-Marc, 2013).

Performance time: The resulting time that it takes an athlete to complete the dribbling task from start to finish with error time penalties added in.

Error Penalty: A two-second addition to the time taken to complete the dribbling task as a result of (1) losing control of the ball or (2) hitting a cone with the ball.

Accuracy: The ability to navigate the cone course by going between the previous and next cone with the ball at the athlete's feet without hitting a cone or losing control of the ball.

Delimitations

- Participants will be youth athletes under that age of 14 years of age.
- The only skill tested will be dribbling ability which does not encompass all of the skills necessary to play soccer
- As an eight-week intervention, long-term effects of a PETTLEP imagery intervention cannot be suggested as a result of this intervention
- The use of the PETTLEP imagery model does not allow this intervention to be generalized to the results of other imagery techniques and models.
- The short-term nature of the intervention does not allow the athletes to be assessed at significantly different stages of learning the soccer-dribbling task.
- The mental technique of imagery will be learned at the same time as the novel soccer-dribbling task, which may limit the positive effects of imagery on performance.

Limitations

- The use of self-report questionnaires may result in a response bias.
- Small sample size of teams from a specific area may not represent the general population of soccer players in The United States of America.
- The task being performed is a basic soccer practice drill instituted by many coaches but will differ from the ones seen by the participants in the novel placement of the cones that must be dribbled around.
- By practicing the task once per week, physical practice will likely improve the athlete's performance on the task outside of the effects of the PETTLEP imagery intervention.
- The team undergoing the control condition or teams that do not begin imagery during week one may come in to contact with participants in the experimental conditions outside of the practice setting and tell them about PETTLEP imagery. If individuals from the other groups learn about PETTLEP imagery, they may attempt to use it outside of the directions of the experimenter and skew the study's results.

CHAPTER 2: REVIEW OF LITERATURE

Introduction

Around the world today, people are constantly trying to push the boundaries of human performance beyond the limits previously thought possible. This statement is particularly true when viewed in the context of sports performance. Major events such as the 2012 London Olympics and 2014 World Cup have brought international attention to the field of sports psychology, and specifically its effect on the performance of the world's top athletes. The field of sports psychology seeks to improve athletes mental aspects of sport performance to complement the effects of the physical training that they are generally expected to complete. Mental imagery is one of the many tools in a sports psychologist's toolbox that has been effective at increasing the performance of not only elite athletes but athletes as young as seven years old as well (Munroe-Chandler, Hall, Fishburne, & Hall, 2007). Even with the presence of these promising results, athletes report that their coaches still do not encourage the use of imagery as a tool of assisting their players to excel (Jedlic et al., 2007). Jedlic et al. (2007) also reported that coaches understand the value of imagery use to rehearse skills, but they did not encourage imagery practice the in the same way as they do physical practice. That is, they did not encourage specifically planning and regularly practicing structured mental imagery to aid skill learning (Jedlic et al., 2007). The PETTLEP imagery model, created by Holmes and Collins (2001), may be the solution to this issue for athletes of any age by providing a simple acronym to guide the creation of successful imagery interventions for those seeking to improve technical sport performance. There may be many reasons behind the coaches' lack of encouragement for

implementing structured mental imagery programs but the wide variety of imagery functions and models available may be chief among them.

The ambiguity surrounding the most effective use of imagery has resulted in the creation of many imagery models and methods of implementation that all aimed to serve as a standard definition for practice. The PETTLEP imagery model was created as a simple 7-point checklist for the successful implementation of a cognitive specific imagery program that may solve this issue. This model has been effective at increasing performance for athletes performing a bicep curl (Wakefield & Smith, 2009; Wakefield & Smith, 2011), netball shooting performance (Wakefield & Smith, 2009), golf bunker shot performance (Smith, Wright, & Cantwell, 2008), and even those playing driving video games (Smith, Wright, Allsopp, & Westhead, 2007) Mental imagery is a valuable technique that has been used to successfully increase performance in the past and with continued research may become a common feature of sport practice.

As described previously, the term, mental imagery describes the use of images created in the mind to see skills, strategies, and desired mind states outside of the actual stimulus situation. Mental imagery research initially attributed the success of mental imagery to the creation of an image that is functionally equivalent to a chosen physical action or situation (Finke, 1980, p. 113; Moran, 1996 pp. 216-217). Over the years, the definition of mental imagery as well as the functional equivalence of that image to the desired task or situation required to be effective has been debated and studied. When one single definition was not found, researchers (e.g., Fenker & Lambiotte, 1987; MacIntyre & Moran, 1996; Munroe, Giacobbi, Hall, & Weinberg, 2000; Callow & Hardy, 2001) then began studying the individual uses of imagery in depth. This research gave rise to imagery targeting specific traits such as confidence, anxiety, motivation, arousal, and physically, to improve skill learning. Imagery has successfully increased human

performance in all of these areas but no single model has been consistently and successfully utilized for multiple types of imagery (Munroe-Chandler, Hall, & Fishburne, 2008; Pain, Harwood, & Anderson, 2011; Blair et al., 1993; Driskell, Copper, & Moran, 1994). Since its creation, over 15 years ago, the PETTLEP imagery model has been used to increase the performance of the individuals that implement it by helping to increase technical skills in sport (Wakefield & Smith, 2009), increase physical strength (Wright & Smith, 2009), increase performance on a driving game (Smith, Wright, Allsopp, & Westhead, 2007), balance beam performance (Smith et al., 2007) and to increase penalty shooting performance in soccer (Ramsey et al., 2010) and field hockey (Smith et al., 2007) Research has investigated the effects of the overall model at increasing technical sport performance (Wakefield & Smith, 2009), strength performance (Wakefield & Smith, 2009), long jump distance (Potter, Devonport, & Lane, 2005) as well as its individual elements (Smith et al., 2007; O & Munroe-Chandler, 2008; Wright & Smith, 2009; Ramsey et al., 2010; Wakefield & Smith, 2011). Imagery research initially identified the link between increased performance and viewing a specified situation in the mind before investigating the effects of imagery on different situations relative to sports.

Imagery

As an umbrella term, the exact definition of imagery varies between its specific uses. Generally, mental imagery is known as a central pillar of interventions of applied sports psychology (Perry & Morris, 1995, p. 339) but this importance and flexibility in terms of implementation has led to multiple descriptions of the term. Guillot et al. (2010) defined mental imagery as the ability of a person to create different types of images in absence of the original stimulus. This is a very basic, general definition that has come about likely as a result of the wide variety of implementation goals and methods available to researchers. More specifically and also

more accurately, mental imagery is the conscious creation of quasi-perceptual experiences that are reviewed in the absence of the situation that would normally accompany the same sensory and perceptual information (Richardson, 1969; Kosslyn, Thompson, & Ganis, 2006). This previous definition of mental imagery alludes to the true complexity and sensory detail included in successful imagery interventions. In sports, mental imagery is utilized by athletes as a volitional experience involving the use of one or more of the senses to create, or recreate a specific sport situation or skill (White and Hardy, 1998). All of these definitions have been used to describe the ways in which mental imagery goes about the truly remarkable task of mentally inventing a chosen situation or skill. Mental imagery is a blanket definition for a variety of methods that all seek to create a detailed image in the mind that can be used as a method of rehearsing a task or situation in absence of the actual stimuli.

In sports, mental imagery has been successfully utilized as the primary practice method when learning a skill (Smith, Wright & Cantwell, 2008) or as an additional method of practice to complement the traditional method of skill learning that is physical practice (Maring, 1990; O & Munroe-Chandler, 2008). When used in conjunction with physical practice, imagery is often known as mental rehearsal. The process of mentally rehearsing a skill is a method of adding extra practice outside of the structured team meetings normally associated with sports and is often used to further enhance the improvement of athletes. Mental imagery has been effectively used to rehearse specific muscle movements (Wright & Smith, 2009; Wakefield & Smith, 2011), techniques (Baron, 2000; Guillot, Genevois, Desliens, Saieb, & Rogowski, 2012), and even team strategy/tactics (Guillot, Nadrowska, & Collet, 2009). Implemented with a specific purpose in mind, mental imagery can and has been used to increase sport performance (e.g. Blair et al, 1993; Ramsey, Cumming, & Edwards, 2008; Smith et al., 2007; Smith, Wright, & Cantwell,

2008). For example, in the absence of the required elements of a sport such as golf clubs and a golf course, an American prisoner of war during Vietnam was able to mentally imagine playing and subsequently course every day during a seven year prison sentence that he improved on his previous round scores in the first round that he physically played after completing his sentence. Although this man's story was not performed in a controlled, experimental setting, it does mirror the results observed by Post, Wrisberg, and Mullins (2010) who observed that female high school basketball players made a significantly higher number of free throws when they imaged successfully making free throws prior to a game than when the team did not practice imagery before a game. Mental imagery is a tool that when utilized in sport can aid in the process of improving the performance of a skill or technique.

Historically, mental imagery's successes in sport have been attributed to the functional equivalence hypothesis. This hypothesis states that mental imagery functions in the same manner as physical action because they share neural pathways due to the similar modality of perception (e.g., Finke, 1980; Jeannerod, 1994; Decety, 2011) While this hypothesis can be used to explain the positive results seen after performing mental imagery, the general nature of the definition for the functional equivalence of imagery has given rise to over a decade of confusion in sport imagery literature over the precise relationship between the functional equivalence hypothesis and specific mental images. More recently, the functional equivalence of mental imagery has been explained as areas of similar activation during mental imagery that correspond to specific areas of activity in the brain observed during the same physical activity (Lotze et al., 1999; Buccino et al., 2001; Ehrsson et al., 2003; Miller et al., 2010). Mental imagery has been successful at increasing performance for years without the existence of a definitive definition for

the functional equivalence of those images, suggesting that a definition is not necessary for successful performance increases to be observed following an imagery intervention.

The importance placed on exact functional equivalence to creating a successful mental image has decreased since the creation of the PETTTLEP imagery model but a successful mental imagery program aids the person in creating as similar an image to the desired situation as possible. A general understanding of the functional equivalence of imagery with physical movement is that in both cases, similar regions of the brain are utilized when creating a mental representation of an action during imagery as are used in physically performing the same action (Fadiga et al., 1999). Although the significant improvements in the technology originally used to support the success of imagery interventions such as fMRI have provided us with a much clearer understanding of neural functional equivalence, they have also shown us that Holmes and Collins' (2001) definition of functional equivalence used in designing the PETTTLEP model may no longer hold true (Wakefield, Smith, Moran, & Holmes, 2013). Wakefield et al. (2013) go on to suggest that imagery models such as the PETTTLEP model that was designed before many of these advances in technology, can still be supported by the literature. The concept of behavioral matching can also explain the form of matching characteristics of a physical skill to the imagery conditions to activate similar brain regions. The goal of mental practice is to use imagery to create a mental simulation of a perceptual experience (Moran, 1996), matching the behaviors present in the skill without physically practicing the skill at the same time. The PETTTLEP imagery model can and has been used successfully to increase performance when the image created is highly similar to the desired situation even if it is not functionally equivalent to that situation.

As important as recreating the desired situation is to successfully creating an image, the imagery model used and perspective from which it is should not be forgotten aspects of a mental imagery intervention. With the understanding that imagery can be used to increase performance of a specific, desired situation, those aiming to implement an imagery intervention will require further information about the elements present in successful interventions. First, a person designing an imagery program should identify the target behavior or situation that they are looking to improve. This is vital because it should be used to select the type of imagery that is utilized as well as the perspective from which the performer experiences the situation (Martin, Moritz, & Hall, 1999). Seeing the image from an internal (e.g. first person) visual perspective is recommended by Holmes and Collins (2001) for most imagery practice. When imaging form-based skills like those seen in gymnastics or karate (Hardy & Callow, 1999), an external (e.g. third person) visual perspective can be as effective as an internal visual perspective (Holmes & Collins, 2001). Before attempting to build an effective image, the researcher should decide the visual perspective as well as the model that will be utilized to structure the mental imagery intervention.

After selecting the perspective from which the imagery is seen, the next step in creating a successful imagery intervention is to build a detailed, high quality image. Finch (2011) said that, “Quality images are vivid, clear, and accurate.” As important as the method or model of imagery chosen is the process of collecting as much detail as possible, relevant to the targeted situation. Imagery can be more effective after the athlete has had practice doing the desired task because that will allow them to develop a strong internal representation of the desired skill (Blair et al., 1993). Part of accuracy in vivid imagery is a detailed knowledge of the task as well as the avoidance of negative images in to the skill learning process. Extra practice time allows the

athlete to better avoid devoting attentional capacity to negative images that bring inconsistency in to performance (Murphy, 1994). A quality image should also take in to account and include the same emotions as the person feels during the physical experience into the image because this helps to create a more vivid experience during an imagery session (Wakefield & Smith, 2012). Personalized imagery scripts that include emotions in the imagery experience lead to higher levels of muscle activity as well as greater imagery vividness than generic imagery scripts based off those used in similar interventions (Wilson, Smith, Burden, & Holmes, 2010). It is important to the success of an imagery program that a personalized imagery script includes as many details about the target situation as possible including emotions, environmental details, and current skill knowledge.

Creating a vivid image is not a skill that humans are born with but can be improved with practice. Imagery ability is a mediator for the effects of imagery on performance (Murphy, 1994) and athletes from different competitive levels or who have undergone different amounts of practice have reported different levels of imagery ability (Williams & Cumming, 2011). Imagery ability is a skill that naturally varies between individuals but through training can reach an acceptable level that facilitates a planned imagery intervention. Imagery is a skill that can be improved with practice, as Rodgers, Hall, & Buckolz (1991) demonstrated in their study of Canadian figure skaters. Response training is one suggested method of training athletes to improve their imagery ability (Williams, Cooley, Burns, & Cumming, 2013). Response training consists of the environmental elements of a scenario providing the stimulus, the things that the person would feel or hear which are known as response propositions, and finally create meaning propositions by combing the stimulus and response propositions (Lang, 1979). Wakefield and Smith (2012) suggest that response training for athletes should focus on the physiological and

behavioral responses that exist in the scenario that they will be imaging so that these extra details can be included into their subsequently more vivid imagery sessions. Greater improvements have been seen in penalty flick performance following imagery interventions for field hockey players that included stimulus and response propositions compared to imagery containing only stimulus propositions (Smith, et al., 2001). Williams et al. (2013) offer Orlick's (2007) suggestion that imagery programs for those who are inexperienced with imagery should begin as short sessions focusing on experiencing a high quality images and then be slowly increased in duration as the target participant becomes more familiar with performing imagery and imagery scripts. With practice, athletes in team sports should be able to imagine a variety of situations that will help them to react effectively in each specific environment (Weinberg, Butt, Knight, Burke, & Jackson, 2003). Mental imagery is mediated by imagery ability but the effect of training can negate initial variance in imagery ability enough to see successes of imagery interventions.

Generally, the path to success in sports should be viewed as a journey and the same can be said for the process of implementing an imagery intervention into a practice regimen. Wakefield and Smith (2012) suggest that anyone embarking on a mental imagery program should be cautious to assess the effectiveness of that program too soon because imagery is a skill that takes time and practice to master. Those undergoing a mental imagery intervention should be as patient with the effects of imagery training as they are in waiting to see the effects of practice on sport skill. The outcome of an imagery program is also related to the user's belief in imagery as a method of improving performance and their desire to improve their imagery ability. The personal attribution of imagery as helpful or hurtful has an effect on the resulting performance (Ramsey, Cumming, & Edwards, 2008). With this in mind, those implementing imagery interventions should make an effort to promote the past successes of athletes using

imagery in sports when introducing athletes to imagery because after beginning an imagery program, continued imagery practice can also improve a person's views of mental imagery. In a survey of 523 athletes competing in sports at two NCAA Division I schools, Weinberg (2003) found that the athletes who frequently use imagery find the techniques and strategies behind the skill to be more effective at reaching their specific goal. Mental imagery is a skill similar to those learned during normal sport practice in that it takes a desire to learn and practice to improve one's ability to use as a form of sport practice.

With the understanding that imagery is only improved over time through practice, the next step in imagery research should be to establish, the volume and frequency of imagery sessions required to produce optimal results. Wakefield and Smith (2012) suggest that researchers need to identify "how much?" and "how often?" PETTLEP imagery sessions should take place to enable intervention's effects to be maximized. In an effort to clarify the number of PETTLEP imagery sessions required each week to observe performance increases, Wakefield and Smith (2009) found that netball shooting performance was improved when imagery sessions took place at least three times per week but if they took place less frequently than that, the PETTLEP approach was less effective at helping the subjects increase performance. Wakefield and Smith's (2009) research suggested that practicing a minimum of three PETTLEP imagery sessions per week is necessary to see results but they did not venture to suggest the potential increased effect of more than three PETTLEP sessions per week. In furthering this line of research, another study was performed investigating the effect of imagery session frequency on bicep curl performance. This study investigated the effect of less than three PETTLEP imagery sessions per week on performance of the bicep curl. Those who completed a PETTLEP imagery session at least once a week reported significant strength increases but the greatest degree of

improvement was seen in the groups that completed the imagery sessions three times a week (Wakefield & Smith, 2011). Weinberg (2008) noted that future research should investigate the conditions under which imagery is the most effective at increasing performance. While Wakefield and Smith (Wakefield & Smith, 2009; Wakefield & Smith, 2011) have continued this line of research, they have only been able to provide the basic guideline of practicing at least three PETTLEP imagery sessions per week to see successful performance increases. Future research should continue to investigate how long a person needs to practice imagery and how often those sessions need to take place in order to maximize the performance increases resulting from a PETTLEP imagery intervention.

Individual imagery scripts

After establishing the effect of the function, model, perspective, and quantity of imagery on an intervention's success, those seeking to develop an imagery program should address the vividness of the image provided by the imagery script that is used to guide each session. Holmes and Collins (2001) warn those planning an imagery program to be wary of the 'one size fits all' problem which states that, although there are similarities across many imagery designs, the same instructions or scripts will not work as effectively for different individuals. People inherently experience different emotions even when experiencing an identical stimulus situation such as taking penalty shots in field hockey or soccer. In a study of forty-eight field hockey players, comparing the effects of three different six week imagery training programs (e.g. field hockey clothing and field condition, field hockey clothing only condition, and a standard imagery condition) with normal practice, Smith et al. (2007) found that all imagery conditions improved penalty shooting performance significantly from pre-test to post-test compared to the control group. The field hockey environment condition improved more than the field hockey clothing

condition, who improved more than the standard imagery condition (Smith et al., 2007) which suggests that the more personal details included in the script, the greater improvement a person experiences in athletic performance. To further illustrate the need for individualized imagery scripts, athletes whose scripts were created by taking in to account individual preferences in the method of performing imagery were more likely to be motivated to follow the imagery intervention's instructions (Wakefield & Smith, 2012). Personalized imagery scripts appear to increase the probability of successfully improving performance following an imagery intervention because the script utilizes personal details that aid in increasing the vividness of the images that they see.

The speed at which the athlete moves through the image should in most cases be in seen in real time to lead to a successful imagery program but may be performed at other speeds if the participant feels more comfortable with that speed. Gould and Damarijan (1997) suggest that imagery should be performed at the desired technique's natural pace because the technique is rarely otherwise practiced at a pace that is slower or faster than normal. By performing imagery at the natural or real-time pace, athletes are adding to the similarity between the imaged situation and the actual, physical stimulus. When investigating the kinesthetic imagery experiences of elite canoe-slalom competitors, Moran and MacIntyre (1998) found that the time taken to image the race was highly correlated with the actual time that each person took to complete the race. Not all researchers suggest that athletes perform imagery in real-time. In contrast, Holmes and Collins (2001) suggest that imagery can be performed using slow-motion images to slow down and focus on specific elements of a skill. Following this suggestion in the original PETTLEP article, O and Munroe-Chandler (2008) studied the effect of image speed on soccer dribbling performance and did not find a significant effect of image speeds on the resulting performance.

More research needs to be completed to clarify this issue but currently, it appears that imagery speed should match the demands of the task in question.

Successful imagery interventions should include psychological states and task cues specific to the athlete as well as focus on the current understanding of the desired outcome variable (e.g., skill level, conceptual understanding, etc.). When designing the mental imagery script of an imagery intervention, the content of the imagery should be tailored to the skill level as well as the individual preference of the athlete. This is because elite and non-elite athletes each focus their attention on different aspects of a desired performance (Konttinen, Lyytinen, & Konttinen, 1995). Wakefield and Smith (2012) provide the example of elite tennis players focusing on their hip rotation during the swing of the racquet while novice players' focus more on basic aspects of the skill such as watching the racquet head while swinging. As is often the goal in sports, an athlete will, with practice naturally improve in their skill level over time. Imagery interventions should be updated to mirror to changes in the participant's skill level as well as psychological state (ex. confidence and motivation) that may change as their skill level increases (Wakefield & Smith, 2012). As athletes become accustomed to improvements in skill level, their psychological state will adapt to match this increased understanding of the skill. It has been reported that changing specific psychological states such as the participant's level of relaxation as a part of the imagery program have not yielded any significant benefits to the effect of imagery alone (Hamberger & Lohr, 1980; Weinberg, Seabourne, & Jackson, 1981; Gray, Haring, & Banks, 1984). Visek, Harris, and Blom (2013) provided a review of the developmental considerations that should be taken in to account such as appropriateness of the script's vocabulary, the creativity of the creativity, desire to accomplish goals, and available attention span of the target population for the program. All of these qualities vary in importance

throughout the developmental processes present during childhood and adolescence. Due to variance in psychological states and emotions observed between individuals, successful mental imagery scripts should be personalized to the skill level and conceptual understanding of the athlete implementing the imagery program.

Mental imagery in sport

Mental imagery can be implemented with the goal of helping an athlete reach, maintain, or return to a desired anxiety or arousal level in a sports setting. In sports, mental imagery programs can also be designed to prepare a participant to improve sport specific confidence, improve the performance of a technical skill, practice through injury, implement team strategy, mentally practice to aid in the process of learning a skill, and to prime the muscles for a specific task. Music was combined with an imagery intervention prior to English university level soccer player's games, the players reported better general match performances and increased flow state scores compared to the imagery alone and pre-competition music conditions (Pain, Harwood, & Anderson, 2011). Flow state is a concept used to designate the optimal psychological state that humans can experience when they perceive a balance between their own abilities and the challenges that face them (Csikszentmihalyi, 1990). This state is often known as the ideal mental state to experience when participating in a sporting situation because it often accompanies the highest levels of performance. The results of Pain et al. (2011) suggest that the use of imagery combined with music prior to a game resulted in the athlete's reaching flow state which, requires the combination of the desired arousal level in conjunction with a lack of anxiety. The ability to maintain a consistent arousal level can be as important to improving performance as technical ability in sports. Twenty-seven male club-soccer players were able to manage anxiety and maintain self-confidence during important games after completing an imagery intervention in

which they were asked to image successful performances in important games while simultaneously feeling the anxiety related symptoms associated with these events (de la Pena, Khoo, & Murray, 2010). Mental and emotional processes naturally occur when taking part in sports and depending on how the athlete views them, they can affect an athlete's performance. Similarly, Bandura (1997) also noted that imaging one's previously successful performances was a method of increasing this same person's self-efficacy. In sports, mental imagery is generally utilized to increase performance and that can be accomplished through imagery concerning the psychological state of the athlete rather than focusing imagery solely on the performance of skills.

Research concerning mental imagery in a sports setting has most often focused on aiding athletes to improve their performance. Most frequently in sport, these interventions have been successfully used to increase the performance of athletes using both stand-alone imagery interventions and multimodal packages in lab settings, in practices as well as games (Weinberg, 2008). Lab settings often have the advantage over natural settings in that they allow a researcher the most control and specifically in this setting, imagery has been used to increase performance on a driving video game (Wright & Smith, 2007), a putting task (Ramsey, Cumming, & Edwards, 2008), and in increasing bicep muscle strength in a lab setting created in a university gym (Wright & Smith, 2009). In a more traditional setting for athletes such as practice, imagery has been effective at increasing the shooting performance of field hockey penalty flicks in practice (Smith et al., 2007), serving regularity and accuracy in tennis (Guillot, Genevois, Desliens, Saieb, & Rogowski, 2012), by aiding physical practice in improving bunker shots in golf (Smith, Wright, & Cantwell, 2008) and by increasing youth players performance on a soccer task, both in terms of speed and accuracy (Blair et al, 1993). In the most difficult setting to control, competition, imagery has been included as a part of a mental training program that

increased the number of wins and grade point averages of a major college football team (Fenker & Lambiotte, 1987) as well as in improving the successful passing rates of elite soccer players over the course of competitive games (Seif-Barghi, Kordi, Memari, Mansournia, & Jalali-Ghomi, 2012). Mental imagery has successfully increased the performance of athletes when combined with tasks related to their sport performance but may also be useful to those who are unable to participate in sport practice. An athlete who sustains an injury or is overly fatigued may use mental imagery as a form of mental practice to increase performance throughout the time period in which their body prevents them from physically practicing the desired skill. This concept has been examined by comparing the effects of physical practice to PETTLEP imagery. Those who completed a PETTLEP imagery intervention increased the weight that they able to lift while performing a bicep curl by 23.29%, while those who physically practiced the skill only improved by 2.27% more over the same period of time (Wright & Smith, 2009). This research suggests that undergoing a PETTLEP imagery intervention may be almost as effective at increasing performance as completing a physical practice regimen over the same time period. Athletes can and have successfully utilized mental imagery when attempting to increase their performance in practice, games, and even when they are prevented from physically practicing by an outside force such as injury.

Mental imagery utilized as a form of mental practice for a sport specific technique has successfully resulted in the increased future performance of that same specific task or technique. Mental practice has been defined as, “the symbolic rehearsal of a physical activity in the absence of any gross muscular movements” (Richardson, 1967). This definition is very similar to mental imagery utilized as a technique to increase performance outside of physical practice. In this way, imagery can be seen as a form of deliberate practice (Cumming & Hall, 2002). For our purposes,

mental imagery and mental practice will be used interchangeably as the differences between the two terms are often the result of variations in field describing them. Mental practice has also been seen to have a relationship with improved performance (Hinshaw, 1991). When utilized specifically as a form of mental practice, (Wakefield & Smith, 2011) found that a six-week imagery intervention in which the content of the imagery was updated regularly to reflect the progress of the participants was very successful in enhancing performance on a bicep curl. In this study, the researchers had the athletes re-recorded their imagery videos half way through the study to ensure that the video being watched for imagery still provided an accurate representation of their skill level. This step of updating the imagery script to include the athlete's current understanding of the skill further supports the previous suggestion that mental imagery interventions should be personalized to the skill level of those using it. Mental practice that takes place prior to physical practice resulted in stronger improvements in free throw shooting performance compared to physical practice alone when administered as a form of training for adolescents with mental retardation because it was created specifically for this population (Hemayattalab & Movahedi, 2010). When investigated with those who are already skilled in their field, mental practice has promoted motor anticipation in skilled music performers (Bernardi, Buglio, Trimarchi, Chielli, & Bricolo, 2013) and some elite-level golfers (Ploszay, Gentner, Skinner, & Wrisberg, 2006). Mental imagery can be utilized as a method of mentally practicing specific sport skills outside of practice with the goal of increasing the performance of those skills when the athlete is back in the sport setting.

In the sport context, mental imagery has been used as a form of mental practice for the integration of team strategy, mental rehearsal or to aid in the process of learning a skill, as well as, muscle priming to accompany the physical practice regimens already designed and

implemented by coaches. Youth naturally use mental imagery to rehearse sequences as well as strategies in sports (Weiss, 1991) so, implementing a formal imagery program can be the logical step in working to increase the effect of their sport practice. When mental imagery was investigated in soccer through the use of cognitive general imagery, it did not appear to be an effective method of improving the execution of those soccer strategies (Munroe-Chandler, Hall, Fishburne, & Shannon, 2005). Although the results of implementing soccer strategies via imagery interventions may not appear to be effective increasing overall soccer game performance, it does still appear to be effective when aiming to increase the performance of a specific skill. Jeannerod (1999) found that, motor imagery combined with time spent observing a demonstration or watching a video of oneself, produced selective enhancement of neural activity in motor pathways concerned with the stimulated areas. This method of utilizing imagery is also known as mental rehearsal and has been described as a method of practice that is performed without physically performing the actual movements involved in the task (Moran, Guillot, MacIntyre, & Collet, 2012). Further supporting the positive effects of mental rehearsal on performance, a review of mental rehearsal literature in motor and sport related skills revealed that it “can positively affect skilled motor performance (Corbin, 1972). Athletes should be aware of the potential in improving their performances as a result of mentally rehearsing sport specific skills outside of their normal physical practice.

The PETTLEP model and other models of implementing mental imagery

Mental imagery has been successfully utilized to increase sport performance enough that researchers have created models for the implementation of mental imagery programs specific to the sports setting. Mental imagery can serve multiple functions but the function of imagery chosen should match the intended outcome of the program (Matin et al., 1999). To help guide

this selection, Salmon, Hall, and Haslam (1994) used Paivio's general analytic framework to separate the forms of imagery used by athletes into two primary functions, motivation and cognition. The functions of imagery use were then broken down further by utilizing the Imagery Use Questionnaire for Soccer Players that was developed for this study (Salmon et al., 1994). This survey separated the larger categories of motivational and cognitive imagery into more narrow categories of specific and general types of imagery. This model may be easier to utilize by coaches and athletes because it combines Hall et al.'s (1998) motivational general-mastery and motivational general arousal forms of imagery thus, simplifying the choices available for those planning to implement an imagery intervention. In youth soccer players, motivational general-mastery imagery accounted for more of the variance in general self-confidence and self-efficacy in soccer than motivational general-arousal and motivational specific imagery (Munroe-Chandler et al., 2008). This research suggests that imagery aimed at soccer works to increase soccer specific states of self-confidence and self-efficacy. Later, using a cognitive specific imagery intervention rather than motivational general-mastery imagery, Munroe-Chandler et al. (2012) was able to increase the soccer skill performance of young athletes from sixteen different soccer teams. The functions of imagery described in these models have been successfully implemented individually with athletes seeking to improve their personal performance but they must be chosen with the athlete's desired outcome of intervention in mind to be successful.

Further investigating the specific content of imagery used in a youth sport setting to guide its implementation, Munroe-Chandler et al. (2007) found that athletes used four main types of imagery: visual, auditory, tactile, and kinesthetic. Rather than defining an imagery intervention by the type of skill that is imaged, these authors chose to define the types of imagery implemented by athletes by the primary senses utilized as a part of the imagery intervention.

They also suggest as a result of additional information gained from their survey of the types of imagery used by athletes that all of them use visual and auditory imagery but they believe that coaches should generally wait until athletes are eleven years old to begin using kinesthetic imagery (Munroe-Chandler et al., 2007). This is one of the rare suggestions directed to coaches looking for guidance in the implementation of imagery in to sports practice and bases it's guideline on the time that athletes naturally begin using kinesthetic imagery rather than referring to the time when they are able to successfully utilize kinesthetic imagery. Athletes aged 7-14 years old found imagery to be effective at increasing physical performance which suggests that coaches can begin structured imagery programs early into a child's athletic career because it may help them benefit to a greater degree from it's effects in the long-term (Munroe-Chandler et al., 2007). As previously mentioned, mental imagery has been effective at increasing the performance of athletes as young as seven years old through the use of a variety of models all aimed at different focuses for the intervention. Few, if any have distinguished themselves as practical implementation models designed specifically for the most common use of mental imagery for athletes, increasing technical performance.

Over time, researchers have adapted and amended imagery models as needed to fit sport specific circumstances as well as to reflect an increased understanding of the field of mental imagery. Mental imagery can do much more for an athlete than just supply a method for mental practice. Imagery has the ability to effect many mental processes as they relate to sport. To ensure that the correct type of imagery was chosen to most effectively affect the participant, Hall et al. (1998) identified five specific types of imagery; *Motivational-specific* is imagery representing specific goals or goal oriented behaviors. This method of imagery use has been investigated by Munroe-Chandler et al (2000). *Motivational general-mastery* imagery focuses on

effective coping such as staying in control and self-confident in challenging situations. This method of increasing sport confidence has been investigated by Callow et al. (2001). Imagery focused on feelings of relaxation, stress, arousal, and anxiety in conjunction with sport competition are termed, *Motivational-general arousal*. This has been investigated with the aim of decreasing anxiety by Vadocz et al., (1997). *Cognitive general* imagery focuses on competitive strategies while *Cognitive specific* imagery is involves images of specific sport skills. *Cognitive general* imagery has been utilized to practice sport strategies by Fenker and Lambiotte (1987) and more recently by Evans, Jones, and Mullen (2004). The bulk of imagery research has examined the use of cognitive-specific imagery to enhance learning and performance of motor skills (Martin et al., 1999). The focus of cognitive-specific imagery seems natural for athletes as it most closely parallels the normal habit of practicing specific skills to improve them for future sport competitions.

The many models of implementing imagery programs in a sports setting have successfully increased the resulting performance of athletes but there is still very little agreement as to the best model for those seeking to increase technical sport performance. Even without a consensus on type, focus or function, imagery remains a viable and frequently utilized part of sport for those with the expertise to implement it into training programs. Specifically, mental imagery has been successfully used to decrease the time that it took an individual to complete a lap in a driving video game (Wright & Smith, 2007); improve strength when performing a bicep curl (Wright & Smith, 2009); and increase technical skills in sport (Wakefield & Smith, 2009). These studies exhibit the positive effects of mental imagery on the performance of a specific technical skill but it is rare in a natural sport setting that skills are utilized individually. Employing an ecological imagery intervention, Seif-Barghi et al. (2012) noted that imagery

could lead to an increase in successful passing rates during competitive games of elite soccer players between the ages of 13 and 32. Even in this ecological imagery intervention, the experimenters were only able to assess successful passing rates, which are only one of the many qualities desired in a successful soccer performance. Seif-Barghi et al.'s (2012) results suggest that the successful increase in performance seen following the imagery intervention may be a result of gaining similar, physical practice rather than specific practice of all the types of passing skill that are used in a game. This research suggests that the practice of a skill through imagery may result in the transfer of basic soccer skills that can improve general performance in a competition setting.

The PETTLEP imagery model was designed for athletes seeking to improve their sport specific technical performance through the use of mental imagery as a form of practice. This model has been utilized for almost fifteen years to successfully increase the performance of technical sports skills and tasks regardless of the sport or ability level of the individual undertaking the program. A common issue that has arisen in previously suggested tips to improve imagery interventions are that they frequently lack theoretical rigor (Vealey & Greenleaf, 2010). The PETTLEP model offers a solution to this issue because it was designed and based on findings taken from the fields of sport psychology, cognitive psychology as well as neuro-science. It's aim is to serve as an applied set of guidelines to aid in the effectiveness of imagery use (Wakefield & Smith 2012). The PETTLEP imagery model was developed as a simple 7-point checklist framework by Holmes and Collins (2001) for the successful implementation of a mental imagery program. Using an acronym as its name, the Physical, Environmental, Task, Timing, Learning, Emotion and Perspective elements were reported to be helpful in creating a functional equivalent mental image (Holmes & Collins, 2001). The goal

being to create an image in the mind that is functionally equivalent to the physical action desired on the field. Table 1 below, provides an in-depth explanation as well as a practice soccer example for each element of the PETTTLEP imagery model.

Table 1. PETTTLEP element overview and examples for implementing a PETTTLEP imagery intervention in soccer (based on Wright et al., 2007)

Element	How to achieve this stage	Example in soccer
Physical	Athletes should mirror the imaged situation as closely as possible. This includes body positioning, clothing, and props normally used in the imaged setting.	The athlete should wear soccer shorts, a jersey, shin guards, cleats with a ball at their feet.
Environmental	Athletes should complete the imagery session in the same environment (if possible) as the imaged setting. If this is not possible, the athlete can use videos, photos, or a similar environment as a substitute.	The athlete should perform the imagery sessions standing on a soccer field.
Task	The thing being imaged should be exactly the same as the target situation. This should be updated as the athlete’s skill level increases.	The athlete should mimic the exact technical motions used to complete the skill. The player should see the ball exactly as the foot moves to manipulate it.
Timing	This is the speed with which the image is completed in the mind. It should be completed in “real time.” Which means, that the image should take as long as it normally takes to complete the task in the physical environment.	If performing a dribbling task through a maze of cones, the athlete should complete each image in the time that it would take them to physically complete it.
Learning	The athlete’s imagery should be equivalent to their current level of understanding of the task. This should be updated as the athlete’s skill level increases.	As the athlete increases their knowledge of a technical skill, more detailed elements of the task should be added to keep up with their understanding of the skill.

Emotion	The imagery should include any emotions or anxiety that is normally associated with the situation or skill being imaged by the athlete.	The athlete should include any anxiety or other emotions felt while physically performing the skill in the desired environment (e.g. practice or a game).
Perspective	This is the viewpoint from which the athlete sees during the imagery session. It is normally completed from a 1 st person point of view but can also be from a 3 rd person point of view for technical skills and can be aided by the use of a video.	If performing a dribbling task through a maze of cones, the athlete should see the ball and cones below them as they weave through the maze.

The PETTTLEP imagery model provides a practical framework for the structure of an imagery intervention aimed at increasing the physical performance of athletes who undertake a mental imagery program. One of the primary premises behind the PETTTLEP model of mental imagery is that the imagery session should include all details associated with the execution of the desired skill/situation while taking particular attention to the sensations present throughout physical execution as well as the emotions that they invoke (Wakefield, Smith, Moran, & Holmes 2013). Many researchers at the time of the creation of the PETTTLEP model believed in the postulated equivalence between physical movement and imagery, sometimes termed ‘functional equivalence’ as evidenced by their research interests (Decety, Philippon, & Ingvar, 1988; Decety, Jeannerod, & Prablanc, 1989; Dominey, Decety, Broussolle, Chazot, & Jeannerod, 1995; Frak, Pavlignan, & Jeannerod, 2001). The PETTTLEP model is particularly useful when utilizing imagery to improve technical ability. As they note in their review of the PETTTLEP imagery model, Wakefield et al. (2013) suggest that researchers should be careful when describing functionally equivalent imagery because the “equivalence” portion of the term refers to the similarity experienced between the image and actual behavior rather than the accuracy of

the imagery. Wakefield et al. (2013) also note that the PETTTLEP imagery model of particular does not require exact functional equivalence of the script to the desired task to effectively increase an athlete's performance of that task.

A key premise behind the PETTTLEP imagery model is that it requires a mental image to be functionally equivalent to the desired situation to be successful but the meaning of and importance placed on the term functional equivalence has changed as the body of research surrounding mental imagery has grown over time. As is often the case in research, prominent theories in the field change and adapt over time. This is the case with the PETTTLEP model of mental imagery and its assertion that this model is successful due to the functional equivalence of the elements of imagery that it includes and that of the actual physical movement. The functional equivalence of imagery is defined as the similarity between the brain regions that are activated when performing a motor task and the brain regions activated during imagined movement (Decety, 1996). While the vague definition of functional equivalence may have led to years of confusion as to its relation to successful mental imagery, it has also allowed researchers to continue the use of the PETTTLEP imagery model. With that said, the importance of the relationship between achieving exact functional equivalence and the effectiveness of an imagery intervention as noted by Holmes and Collins (2001) is still unknown. Some have even gone as far as to say that the functionally equivalent requirement of the mental image could be removed without damaging the positive effects observed with PETTTLEP imagery (Wakefield & Smith, 2012). This can only be possible if a more general form of matching the image to the actual behavior replaced the functionally equivalent requirement. The mechanisms determining the effect of the PETTTLEP model are most likely based off the concept of behaviorally matching the action to the imagery and personalized imagery likely results in a closer behavioral match

than it does a functional equivalence (Wakefield et al., 2013). The researchers continue to explain that a behavioral match between the actual movement and the imagined movement may create similar neural equivalence but is primarily successful due to matching at the behaviors in both circumstances (Wakefield et al., 2013). Those currently and successfully using the PETTLEP imagery model have adapted the definition of functional equivalence used in the original study (Holmes & Collins, 2001) to the current understanding of the connection between the process of creating mental images and physical movements (e.g. Wakefield et al., 2013).

PETTLEP imagery interventions have successfully resulted in increased performances of a specific task in controlled lab settings. Smith, Wright, Allsopp, and Westhead (2007) found that the implementation of a short-term PETTLEP imagery program increased performance on a driving video game more effectively than visualization-based methods of imagery. Imagery interventions based on the PETTLEP model appear to have a greater effect on improving technical performance than other forms of imagery. Imagery interventions based on the PETTLEP model have resulted in significant improvements in skill as well as strength when compared to traditional forms of imagery interventions (Wakefield et al., 2013). In addition to providing a greater effect on performance, the PETTLEP model appears to be more engaging to athletes than traditional technical imagery models. Follow-up interviews done as part of Wakefield and Smith's (2011) study investigating the effect of differing frequencies of PETTLEP imagery on bicep curl performance revealed that athletes found the PETTLEP model of imagery to be "very novel, engaging, and enjoyable". The PETTLEP imagery model provides an engaging and effective method of structuring mental imagery interventions for those seeking to improve the technical performance of athletes.

Building on the success of interventions observed in a lab setting, the PETTLEP imagery model has been tested and yielded increased performance of sport skills in the practice setting. A PETTLEP imagery intervention focusing on the emotional element of the model was used to investigate its effect on penalty taking in soccer. Not only was this intervention one of the first to investigate the emotion aspect of the model, it also investigated the effect of PETTLEP imagery on the performance of a sport skill in a practice setting (Ramsey et al., 2010). In this study, the skill based and emotion based imagery groups both increased penalty taking performance significantly more than the stretching, non-imagery group but did not find a significant difference in performance between the two imagery intervention groups (Ramsey, Cumming, Edwards, Williams, & Brunning, 2010). These results suggest that imagery is an effective method of increasing performance of a soccer penalty-taking task, no matter what type of imagery is utilized as a form of practice for the penalty-taking task. In investigating the environment and task elements of the PETTLEP model, hockey penalty flick performance increased significantly in the sport (hockey) specific and clothing specific imagery groups (Smith et al., 2007). This research provided evidence to the importance of including the physical (clothing) group and environmental (hockey-specific group) elements of the PETTLEP model in achieving successful performance increases. As an additional part of the same published study, Smith et al. (2007) found that the fully implemented PETTLEP imagery model was correlated with significantly greater performance on a gymnastic balance beam skill than the stimulus imagery condition. Again but this time in the sport of gymnastics, the PETTLEP imagery model was successful in facilitating the improvement of sport performance more than an imagery intervention focused on the stimuli that are present when performing a technical balance beam skill (Smith et al., 2007). The PETTLEP imagery model has been used in soccer, hockey, and

gymnastics practice settings to successfully increase performance to a greater degree than other models of implementing mental imagery.

After continuing to discover successful results of implementing the PETTLEP imagery model by itself to increase performance in laboratory and practice settings, researchers have discovered that the model implemented in conjunction with physical practice of a skill results in further increases of that skill beyond those experienced when an athlete participates in physical practice alone (e.g. Blair et al., 1993; Martin et al., 1999; O & Munroe-Chandler, 2008; Munroe-Chandler et al., 2012). In a study of physical strength following imagery implementation, to examine the “physical” portion of the model, the authors suggested that the athletes sit at the bicep curl machine and grip the handles while completing imagery sessions (Wright & Smith, 2009). Wright and Smith (2009) discovered that PETTLEP imagery, physical practice, and the combination of both resulted in significant improvements in performance of a bicep curl. Also of note from this study, the combination of physical practice with PETTLEP imagery significantly increased performance more than imagery or physical practice of the skill alone (Wright & Smith, 2009). This research provides evidence to suggest that the use of the PETTLEP imagery model in conjunction with normal sport practice can lead to the increased technical performance of athletes beyond the level that they experience while participating in physical practice alone. These results suggest that mental imagery is a beneficial practice technique for athletes to perform in addition to a physical practice regimen to further improve performance. Performance of bunker shots in golf has also been increased as the result of a undergoing a PETTLEP intervention. Again in this study, the PETTLEP, physical practice and PETTLEP combined with physical practice methods of practice all helped to increase the athlete’s performance on bunker shots (Smith & Wright, 2008). Contrary to the finding of no significant differences between the

increases in performance of the PETTLEP, physical practice, and combination groups seen on the bicep curl task in this study, Smith and Wright (2008) found that PETTLEP imagery combined with physical practice improved golf shot performance significantly more than either individual method alone. This is an important to note because most often, the opportunity to implement imagery in sport will be while an athlete is healthy and currently taking part in physical practice for their respective sport. Coaches considering implementing an imagery program for their players should be encouraged by the finding that the PETTLEP imagery model combined with physical practice improves the performance of athletes more than standard practice regimens alone.

Mental imagery in soccer

Mental skills training programs have been successfully implemented in to soccer player's training regimen to improve the individual's soccer skills both mentally and physically. In a survey of 25 collegiate soccer players, it was discovered that psychological skills such as activation, relaxation, imagery, goal-setting, self-talk, automaticity, emotional control, and negative thinking were used more often during home games than away (Thelwell, Greenlees, & Weston, 2009). This research suggests that soccer players are utilizing psychological skills more in the comfort of their home game routine than they are in the more unfamiliar environments on offer at away games. The authors also noted that experienced players utilized psychological skills more often than less experienced players (Thelwell et al., 2009). This may be a result of the experienced players being more familiar with their surroundings throughout the season or because they understand the positive effects associated with of performing mental imagery more than novice players. Salmon et al. (1994) echoed these findings, stating that elite soccer players use imagery more than novice players but also continued on to note that players use motivational

imagery more than cognitive imagery. Soccer players also employ imagery more in the competition setting than as a part of training sessions (Salmon et al., 1994). Athletes appear to be using mental imagery most to prepare themselves mentally for an impending contest. These two results together provide evidence to suggest that soccer players still do not understand the positive potential that they may experience if they added a mental imagery program to their normal training schedule. Researchers should strive to promote the skill of mental imagery because, despite the positive results attributed to imagery interventions in sport, coaches still have issues either finding a guideline or the motivation to incorporate imagery in to practice or competition (Finch, 2011). The implementation of mental skills training programs in soccer have led to a variety of imagery models being developed and utilized for their own specific purposes but the PETTLEP imagery model provides the most appropriate model for implementing imagery to improve the performance of a variety of soccer specific tasks more than physical practice alone.

Mental skills training performed by soccer players in a practice setting has directly transferred to and improved their resulting soccer performance in a competition setting. In a case study of soccer-specific psychological skills (self-talk, relaxation, and imagery) on three amateur midfield players over the course of eight competitive games, passing, first touch, and tackling performance were assessed (Thelwell, Greenlees, Weston, & Neil, 2010). These skills are considered to be the most basic skill elements of field players in soccer. In this study, all participants increased their performance during the second half of games for at least two of the three assessed skill subcomponents and the authors suggested that these results provide evidence that psychological skills may affect performance in different ways throughout the process of the competition (Thelwell et al., 2010). The focus Thelwell et al. (2010) was on the effect of the

training regimen but was also indirectly examining the effects of mental skills training performed in conjunction with standard physical soccer practice on improving the performance of soccer players in games. In a previous study, the primary author Thelwell, reported small improvements in the midfielder's first touch, passing and tackling throughout the season in a similar study that they performed previously (Thelwell, Greenlees, & Weston, 2006). As is often the case with ecological approaches, the authors noted that it is difficult to rate a player's specific skills when all players do not possess the same strengths and weaknesses in terms of soccer ability (Thelwell et al., 2006). Thelwell was cautioning researchers from assuming that all players can improve their technical performance as a result of implementing psychological skills training but that they should not expect to improve at the same rate on all of those skills because soccer players naturally differ in their technical strengths prior to beginning this extra form of practice. As mentioned previously, video-aided imagery focusing on specific player's passing performance in actual soccer games resulted in significant increases in passing success (determined through video analysis of the games) in the imagery groups compared to the control groups (Seif-Barghi et al., 2012). Mental skills training and imagery in particular provides an opportunity for soccer players to improve their performance in competition to a greater extent than if they only participate in standard team practices that focus on physical training.

The types of imagery that have been successfully used as a tool of increasing soccer performance vary by the age group of the target players but none the less, provide evidence for imagery to be implemented in addition to the practice regimen of those seeking to improve. In youth sports, imagery is often suggested as a tool to aid learning. This concept is supported by the significant improvements observed in the performance of a closed motor skill (e.g. throwing a ball with the non-dominant hand) on a transfer test for youth who underwent an imagery

program along with physical practice compared to those who only performed physical practice of the task (Taktek, Zinsser, & St-John, 2008). Specific to soccer, a study of young, Russian players found that the younger athletes (ages 8-10 years old) generally use motivational imagery and then transition to a state where they combine it with other, cognitive types of imagery as they age in to their teens (ages 14-16 years old) (Aleksander & Aleksandra, 2012). The field of mental imagery in sports deserves further investigation to guide youth soccer players who are already making an effort to improve their performance through the natural use of imagery. Through the use of Hall et al.'s motivational general-mastery type of imagery, both recreation and competitive soccer players between the ages of eleven and fourteen years old have increased their self-confidence as well as self-efficacy (Munroe-Chandler et al., 2008). Research in to the motivational types of imagery that can be implemented in a soccer setting is beginning to establish an evidence base that can be used to structure mental imagery programs for those as young as seven years old from which they can build their skill at imagery along with their skills on the field.

Soccer provides a unique but previously successful challenge for imagery research because it combines a wide variety of both technical and tactical skills in to an open, free flowing sport setting. In an effort to provide a comprehensive measure of the skills used by field players in soccer, Blair et al. (1993) developed a three part test that combines a dribbling, passing, and finally a shooting section to provide a quantifiable score representing soccer skill. These three attributes represent the three primary skills that are utilized by field players during a soccer game. After developing this comprehensive skills test, the researchers used it to examine the effect of mental imagery on the performance of these skills. Blair et al. (1993) found that players who implemented an imagery program improved performance times on the task significantly

more than the control (game strategy) groups. Blair's comprehensive test of soccer skill was adapted by Munroe-Chandler, Hall, Fishburne, Murphy, and Hall (2012) to investigate the effect of mental imagery on only the dribbling performance of youth soccer players. Following completion of the study, the authors reported that the seven to eight year old group was the only age group between 7 and 14 year olds to increase the use of cognitive-specific imagery following an imagery intervention (Munroe-Chandler et al., 2012). They also noted that the 7-10 year old age groups receiving cognitive-specific imagery improved the time that it took them to complete a soccer-dribbling task (Munroe-Chandler et al., 2012). Together these results provide evidence to suggest that contrary to previous findings, mental imagery can be successfully utilized to increase the technical performance of soccer players as young as seven years old and may be more beneficial to children than adolescents. According to the results of this study, mental imagery appears to be more effective at improving the soccer performance of younger children than teenagers but generally can be beneficial to athletes of all ages and skill levels who desire to increase their technical performance in soccer.

In studies of imagery in soccer, the PETTLEP imagery model has been utilized to create imagery interventions that improved performance of technical soccer skill to a greater extent than other models of implementing imagery to increase technical skill (e.g. Taktek et al., 2008; O & Munroe-Chandler, 2008; Smith et al., 2008; Wright & Smith, 2009). In Holmes and Collins (2001) study developing the PETTLEP imagery approach, they suggested that some athletes may choose to use slow-motion images to target and focus on specific elements of a skill. This suggestion refers to the timing element of the model and has been tested by O and Munroe-Chandler (2008), who examined the effect of differing image speeds on soccer dribbling performance. Although they did not find an effect of differing image speeds on the resulting

performance as they expected, the imagery and physical practice groups all showed a greater increase in performance than the control group, which played a card game involving memory and matching. There were no significant differences found between the experimental imagery conditions in terms of an increase in performance on the adapted portion of Blair et al.'s (1993) soccer dribbling task (O & Munroe-Chandler, 2008). These results are surprising and contrary to most appearing in imagery research in that imagery in addition to physical practice has generally been more effective at increasing performance than physical practice alone (e.g. Taktek et al., 2008; O & Munroe-Chandler, 2008; Smith et al., 2008; Wright & Smith, 2009) but as the authors note, this may be due to the single day nature of the study (O & Munroe-Chandler, 2008). By requiring the soccer players to perform the baseline test, intervention session, and post-test on the same day, the athletes in this study may not have had enough time to practice imagery to have a significant effect on the resulting performance. As mentioned previously in a more longitudinal study investigating the effect of PETTLEP imagery on penalty kicks at soccer practice over two six week periods, it was reported that both the emotion based imagery condition and the skill based imagery condition improved the performance of participants from an English university soccer club significantly more than the control group which performed a stretching routine for soccer that did not include imagery (Ramsey et al., 2010). This study also found that the emotion condition of the PETTLEP imagery program implemented in practice did have an effect on the participant's self-efficacy or anxiety measures for the six participants that had the opportunity to take a penalty kick during a game (Ramsey et al., 2010). This suggests that the PETTLEP imagery model may have an effect on performance variables outside of technical soccer skills making it a more universal model for increasing sport performance than many of the other models available to athletes. The authors note that these results should serve as a guideline to

coaches seeking to implement imagery in to their coaching practice. They found that the imagery condition specified that the athletes see themselves performing the shots in practice and as a result, the author's believe that this was the reason that the mental imagery intervention was not as effective at increasing their penalty taking performance during games as it would have been during practice (Ramsey et al., 2010). PETTLEP imagery interventions have historically improved the resulting performance of those who participate in them and should be further investigated to provide further instructions for those seeking to implement mental imagery in to a standard practice program.

Summary

Interest in mental skills training has grown in the sports field as well as in the general public in recent years even without a large body of research specifically providing guidance to those seeking to implement the most effective imagery program in to normal sports practice. Mental imagery is one of the most researched mental skills available in a sport's psychologist's toolbox yet the wealth of options provided by researchers to improve specific components of performance may be causing confusion for those interested in utilizing the skill. To fill the voids in the suggestions for implementing an imagery program discovered as a result of the growing interest in sports performance, more guidelines for the instruction and implementation of mental imagery are necessary to continue the human progression towards the ultimate performance. Imagery is a skill to be learned just as athletes are learning sport specific technical skills and to help this process, researchers should work to identify a model that can be utilized when performing multiple types of imagery in sports.

Mental imagery research has continued to grow and provide evidence for its use as a method of improving sport performance following the continued successes of each subsequent

study. Originally, imagery research focused on the concept of creating a functionally equivalent image of the desired event but do to confusion over the definition of functional equivalence as well as improvements in brain imaging technology have led the field away from this concept in favor of creating a situation that matches the desired behavior as close as possible. Over time, researchers have suggested different types of imagery that have been evaluated in a lab setting as well as through research in to their effects when utilized in sports as well. Through this research, a basic set of instructions can be compiled to aid in improving the effectiveness of most mental imagery programs. No single aspect has emerged as the most crucial element required guarantee success in terms of achieving the desired goal but the PETTLEP imagery model may provide a standard outline for the successful implementation of mental imagery programs with a variety of purposes.

Mental imagery is a complex process that researchers have sought to simplify through the creation of models such as the PETTLEP imagery model that provides a simple framework for the creation of a successful imagery program. As a result of the subsequent and rather lengthy set of suggestions that have emerged as methods of improving mental imagery practice, some researchers have sought to create specific models that can be used to simplify the implementation of a mental imagery-training programs. Holmes and Collins (2001) created the PETTLEP imagery model to serve this purpose as well as to create an outline for creating functionally equivalent mental images. Over time, each aspect of this model has been studied and when combined with the field separating itself from the concept of strict functional equivalence, the PETTLEP imagery model has been adapted and continued to provide a framework for the successful implementation of mental imagery in sports. The PETTLEP imagery model has previously been effective at increasing performance in fields as diverse as skilled trade (e.g.

Wright, Hogard, Ellis, Smith, & Kelly, 2008) and sport skill (e.g. Wakefield & Smith, 2009; Wakefield & Smith, 2011; Wright & Smith, 2009). As encouraging as these findings and others are to the field as a whole, there are still gaps in the literature in terms of theoretically guiding coaches through the successful implementation of mental imagery within sports (O & Munroe-Chandler, 2008; Vealey & Greenleaf, 2010). Coaches and parents appear to understand that imagery can help them improve the performance of their players (Finch, 2011) but in the absence of guidelines for specific aspects of implementation such as the most appropriate time to begin an imagery program for a new, specific, novel skill, imagery is not being utilized as effectively as it could be to increase performance.

This research will be seeking to fill one of these holes in the guidelines for successfully implementing an imagery program by investigating the concept of the most appropriate understanding of a cognitive specific (soccer-dribbling) task necessary to provide an optimal internal representation that may increase the effects of imagery. Blair and Hall's (1993) finding that there were no significant differences between the performance of novice and skilled soccer players following an imagery intervention focused on the dribbling task do not clear up the remaining holes in the literature over the most appropriate mental representation of a task required to implement mental imagery in to the process of learning a motor skill to improve performance to the greatest extent. This research inadvertently sought to identify whether soccer skill or imagery skill was more important to improving the performance of athletes who undergo an imagery intervention based off contrasting suggestions from Wrisberg and Ragsdale (1979) and Denis (1985). Since Blair and Hall's (1993) study, the sport psychology research community has investigated and subsequently failed to provide research to clarify this question. Research in to mental imagery interventions since this time has found that these interventions have resulted

in an increased performance on a novel soccer-dribbling task (O & Munroe-Chandler, 2008) so this study will be building on these findings by investigating the most appropriate time for a coach to introduce an imagery intervention into the learning process of competitive youth soccer players to maximize the improvement of performance. Defining the most appropriate time during the season for a coach to implement mental imagery in reference to a learning a specific technical skill will help them plan and improve their instructional methods so the youth will be able to improve to the highest levels possible.

CHAPTER 3: METHODS

The effect of using the PETTTLEP imagery model to improve the performance of a technical soccer dribbling skill may not have been investigated directly as the current study aimed but the PETTTLEP imagery model has been previously associated with improvements in the performance of a similar skill, a soccer penalty-shooting task (Ramsey et al., 2010). Since youth soccer organizations are often associated with teaching the youth technical soccer skills, it is important to continue evaluating mental imagery as a method of increasing learning and performance with this population. This research will aid soccer clubs and coaches in the investigation of the PETTTLEP imagery model as a tool for increasing the dribbling performance of youth soccer players. A second aim of this study was to identify a time within the learning process of a novel task to begin implementing mental imagery to receive the greatest benefits of its use as an additional practice tool to improve performance. Both of these aims are in line with the growing desire to increase the professionalization and performance of those taking part in youth sports. This study investigated the effect of mental imagery on physical soccer performance. Focusing specifically on the effect of a PETTTLEP imagery intervention introduced at various times on youth soccer players' performance of a soccer-dribbling task. The participants were youth soccer players from the Wilmington, North Carolina area due to a pre-existing relationship between the researcher and the Wilmington Hammerheads Youth FC soccer club located there.

Participants

Initially, $N = 68$ competitive youth soccer players participating at a single club representing six different teams in Eastern North Carolina were recruited to participate.

Descriptive and demographic data of the participants can be viewed in Table 2 Thirteen participants were classified as 2001 team members (12 or 13 years of age), 22 players were classified as 2002 team members (11 or 12 years of age), and 33 players were classified as 2003 team members (10 or 11 years of age). Participants' ages were reported by age group because youth soccer teams are composed of participants representing multiple biological ages and the conditions were divided by team in order to maintain conditional similarity. During initial testing, there were 34 males and 34 females taking part in the study. The experimental groups were initially composed of the first imagery group ($N = 25$), the second imagery group ($N = 33$), and the control/stretching group ($N = 20$). This 68 participant sample was reduced to 63 participants as the result of a failure of five participants to complete performance test one. At the conclusion of the study, only eight participants completed all requirements of the study and were used for data analysis.

Table 2 Initial Participant demographic characteristics

Variable	Sample Size	Percent
<i>Gender</i>		
Male	34	50.0
Female	34	50.0
<i>Age Group</i>		
2001	13	19.1
2002	22	32.4
2003	33	48.5
<i>Experimental Group</i>		
Imagery Group 1	25	36.8
Imagery Group 2	23	33.8
Stretching Group	20	29.4

Youth athletes were selected as the study's population due to research suggesting a greater effect of imagery on cognitive specific performance with youth participants rather than teenagers (Munroe-Chandler et al., 2012). The teams were recruited by initially contacting the

executive director of the Wilmington Hammerheads Youth FC to receive permission to speak to the club's coaches. After receiving this approval, the individual team's coaches were contacted via email or telephone communication before speaking with their team managers (parent contacts) who serve as an intermediary between the club/coach and the player's parents. As a result of working with youth soccer players, the consent of the athlete's parents as well as the assent of the individual athletes was required before they participated in this study. Before asking the parents to give consent and the youth to give assent, it was clearly explained to the athletes, parents, and their respective coaches that all procedures performed, as a part of this study were first approved by East Carolina University's Internal Review Board. Following the completion of and calculation of all team's MIQ-R data, it was determined that all of the participants with the exception of two individuals had adequate mental imagery ability to participate in the study and teams were randomly assigned to the experimental and control conditions.

Measures

Demographic data, The Movement Imagery Questionnaire-Revised, an Imagery Diary, and a Post-experimental Manipulation Check were used to collect data from the athletes as a part of this study.

Demographic Information

Demographic data was obtained from all participants at the pre-intervention survey session and included their team's age group, sex, and team's league (level). The athletes' age groups provided further information about the soccer experience of the individuals who took part in this study.

Movement Imagery Questionnaire-Revised

The Movement Imagery Questionnaire-Revised was used to assess each athlete's imagery ability twice as a part of this study. Hall and Martin (1997) created this revised questionnaire specifically to assess an athlete's visual and kinesthetic imagery abilities. While mental imagery is a technique that is learned and improved with practice, the relatively short nature of this intervention, all participants may not have had the time necessary to adequately experience these effects and as a result, all participants were required to be able to adequately create a mental image prior to beginning the imagery intervention. The Movement Imagery Questionnaire-Revised was used to ensure that the athletes have can create adequate imagery clarity to participate in the mental imagery conditions of this study. This questionnaire has been successfully used to assess the imagery ability of youth athletes between the ages of seven and fourteen years old (Munroe-Chandler & Hall, 2012). Adequate imagery clarity was defined as it has been in previous studies as a score of 16 or above on both the visual and kinesthetic scales (e.g., Callow et al., 2001; O & Munroe-Chandler, 2008; Munroe-Chandler et al., 2012; O et al., 2014). A score of 16 on each subscale indicates the mid-point or moderate imagery ability and anyone scoring below that point on both scales would be excluded from the study. Implementing a minimum level of imagery ability required prior to participating in an imagery intervention has been used in previous interventions aimed at improving physical performance through the use of imagery (O & Munroe-Chandler, 2008).

The Movement Imagery Questionnaire-Revised (MIQ-R) is an 8-item questionnaire that asks the athlete to physically perform four different movements before attempting to mentally image performing the same movements. These movements involve an arm, leg and whole body movement. After physically performing these movements, the athletes are asked to rate on a 7-point Likert scale how well they can visually and kinesthetically image the four movements. On

the 7-point Likert scale, 1 = very hard to see or feel and 7 = very easy to see or feel. High correlations ($r=-.77$, $p<.001$ for both subscales and $r=-.87$ overall) were found between the visual and kinesthetic subscales of the original Movement Imagery Questionnaire (MIQ) (Hall & Pongrac, 1983) and The Movement Imagery Questionnaire-Revised (Hall & Martin, 1997). The negative correlations are due to the use of reverse scoring on the MIQ-R in comparison to the MIQ. When the test-retest reliabilities were calculated using a sample of 325 athletes/dancers, the researchers discovered a .80 reliability for the visual subscale and .81 reliability for the kinesthetic subscale (Monsma, Short, Hall, Gregg, & Sullivan, 2009). Specifically, in reference to youth population utilized for this study, the MIQ-R has shown adequate reliabilities when used with participants aged 12-21 years old ($\alpha = .85$ for visual imagery and $\alpha = .83$ for kinesthetic imagery) (Monsma & Overby, 2004). This adolescent age group includes the older portion of participants that were used as a part of this sample. A copy of this questionnaire can be found in the Appendix.

Imagery Diary

The athletes were given printed copies of an imagery diary when they are taught PETTLEP imagery in which, they were asked to document each mental imagery session that they completed. The participants were asked to fill in the time period and date in the form immediately following each completed PETTLEP imagery session. The data from these completed forms served, as an experimental manipulation check to insure that the participants follow the experimenter's instructions about completing four PETTLEP imagery sessions required a week as part of the intervention. Smith et al. (2007) successfully employed an Imagery Diary as a self-report instrument accessing the participant's use of the imagery intervention. Similarly in this study, for each session to be considered complete by the

researchers it must have been documented on these forms and these forms must be turned in to the researchers by the post-test session of the study. The Imagery Diary used as a part of this study consisted of 20 copies of the form for imagery group 1 and 12 copies of the form for imagery group 2. A copy of this blank form page can be found in the Appendix. There was also space for them to note the specifics of their imagery session as well as any difficulties that were experienced while performing imagery but this additional information was not required for an imagery session to be considered complete. If provided by the participants, the data from these open-ended questions may have been used to provide additional insights in to the results but was not necessary to assess the performance of the participants.

Post-experimental Manipulation Check

The athletes were asked to complete a post-experimental manipulation check at the final data collection session of the study. A copy of this document can also be found in the Appendix. This post-experimental manipulation check first asked the participants if they felt that they knew enough details about the soccer-dribbling task to successfully create a mental image when they began the imagery intervention as well as if they felt the imagery intervention was useful in improving their soccer-dribbling performance. This check also asked participants if they utilized imagery at any other times throughout the duration of the intervention period outside of what was required by the experimenters. The fourth and final question included in the post-experimental manipulation check asked the participants if they would continue to use mental imagery as a part of their normal practice regimen. The data collected from the post-experimental manipulation check was used similarly to the imagery diary's open-ended questions, as it was used along with the performance data to provide additional insights in to the resulting performances of each group.

Tasks

Soccer-dribbling task

This study employed the dribbling portion of Blair et al. (1993) soccer performance test that was created to assess the technical performance of soccer players on common skills used during competition. The dribbling portion of this test was obtained and adapted as a stand-alone test by O and Munroe-Chandler (2008). This test was used to assess the dribbling time, error penalties, and to calculate the resulting performance time for each participant taking part in the study. Performance time is a measure that was created to provide a single, comparable score for each participant at each testing session. This performance time was calculated by adding the individual's dribbling time and corresponding error penalties.

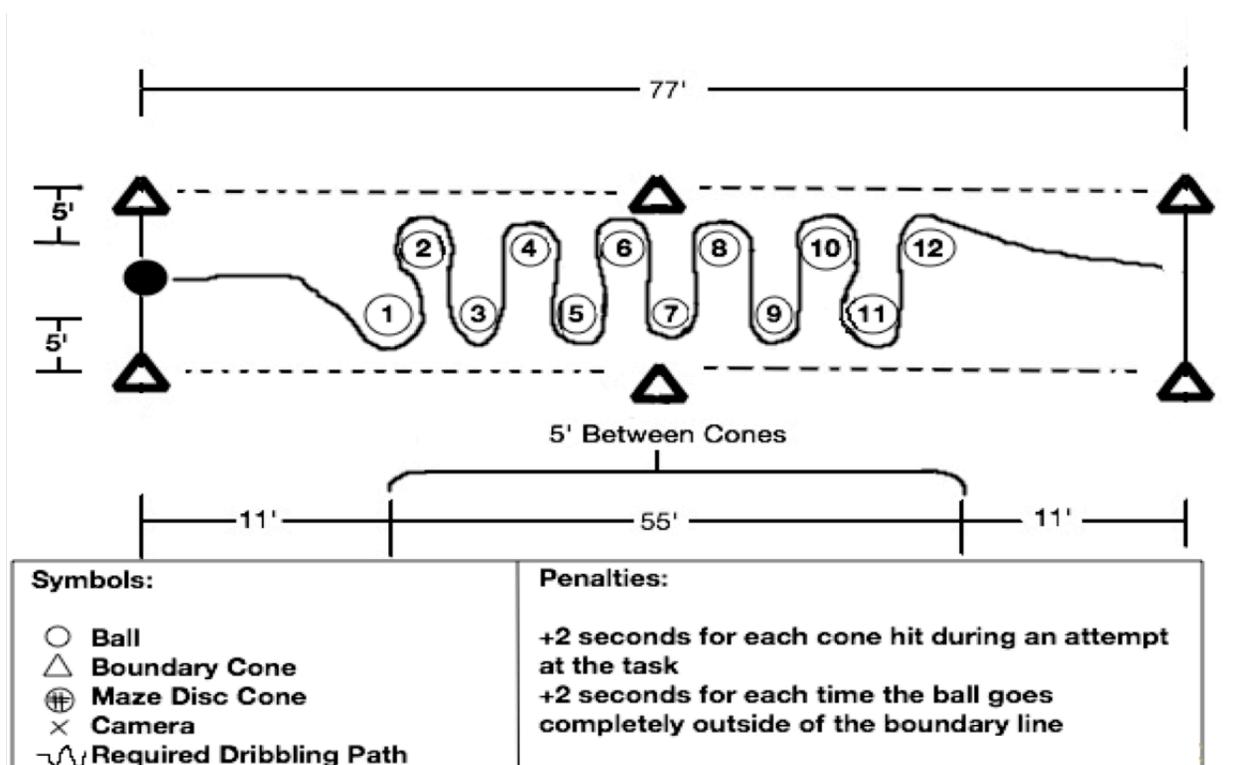


Figure 1. The Soccer-Dribbling Task course specifications

The time penalties that were imposed and distances measured for this task were adapted from Blair et al.'s (1993) original task for soccer players of any level and adjusted for pre adolescents and adolescents between seven and fourteen years of age (Munroe-Chandler et al., 2012). This age group likely has less technical skill as well as less experience than older athletes with drills similar to the performance test. In addition, the chosen age group allowed for a greater possibility of observing differences between participants as a consequence of the intervention compared with using technically skilled or elite players. When originally investigating this soccer-dribbling task, Blair et al. (1993) found that performance increases were measurable for both the novice and skilled players used as a part of their study. These results suggest that the chosen sample of our current study would be able to exhibit changes in performance as a result of an intervention.

Each participant was allowed three attempts of the task and the data will be recorded from their best performance at each performance testing session. A video camera stood on a tripod ten feet behind the finish line to record each attempt at completing the soccer-dribbling task by all players. This camera was placed in at the end of the task because it will allowed the researcher to clearly record any instances in which the ball makes contact with the cones as the participant attempts to complete the task. This camera's video footage was used to ensure that all time penalties are assessed for hitting cones and losing control of the ball are accurately counted and was reviewed before final scores are recorded for each session.

Procedures

European clubs have developed a system of youth sport training as a part of the academy system that encompasses physical soccer training, primary education, and mental training to prepare athletes for life and sports. American club soccer has modified these methods of teaching

to fit its culture but attempts to keep pace by training athletes eleven months out of the year. As a result of this calendar, American youth club teams generally meet to practice two to three times per week while playing games on the weekends. Wilmington Hammerheads Youth FC holds practices for all travel teams at one of three locations grouping the teams by age groups on Monday, Tuesday, and Thursday throughout the regular season.

Contact was first be made with Wilmington Hammerheads Youth FC through email communication with the director of the club and primary club staff. Following the approval of the director, a list of the coach's contact information was obtained and each coach was contacted individually to explain the requirements of study participation as well as the benefits to their team before asking them for consent to work with their team. Once a team's coach had given permission and shown interest in taking part in the study, that team's manager was contacted to via email and phone communication directly from the experimenter to begin spreading the word to the athlete's parents about the opportunity to participate in the study and the required meeting before participation is allowed.

Pre-study meeting

Prior to the week one performance pre-test, the primary researcher met with the parents and athletes from each team to introduce himself, answer further questions, and fill out the necessary forms. Due to the age of the athletes that took part in this study, their respective parents/guardians were asked to fill out an informed assent while the athletes were asked to fill out an informed consent form prior to participating in this study. The athletes completed the Movement Imagery Questionnaire-Revised (Hall & Martin, 2007) and provided demographic information about themselves during this initial session as well as, following the completion of the post-test during week eight of the intervention. Completing the questionnaire and

demographic information will take approximately fifteen to twenty minutes each time that it is administered. The initial meeting and post-test sessions took a total of approximately thirty to forty-five minutes to complete. Administration of the soccer-dribbling task took approximately ten minutes when included as a part of practice by coaches and between twenty and thirty minutes per team, when it was administered by the experimenters as a performance test.

Performance testing

Over the course of the study, all players completed three performance tests that took place in the form of the soccer-dribbling task. While this task may be similar to soccer-dribbling drills that they have completed in the past, the exact dimensions of this course likely made the task novel to the participants. These tests occurred at the same time as team's normal practice sessions in weeks one, three, and six. Data collection took place by utilizing the adapted soccer-dribbling task (O & Munroe-Chandler, 2008) on the soccer field at the team's regularly scheduled practice sessions and will follow this schedule: (1) Players warmed up (if necessary); (2) the purpose and rules associated with the task were verbally explained; (3) individual performance testing. The participants individually completed the soccer-dribbling task three times per week at one of their regular practice sessions throughout the duration of the study. The suggestion of three attempts at the soccer-dribbling task is in following the method of O and Munroe-Chandler (2008) who adapted and previously observed the effects of imagery on youth using this soccer-dribbling task. Average performance errors committed, the time that it takes to complete the task were assessed, and the resulting performance time was calculated prior to the introduction of PETTLEP imagery and again during weeks one, three, and six for all participants.

Before administering the task to the youth participants, the primary researcher trained the volunteers who helped with the administration of this task in one session prior to their involvement in a testing session to ensure that everyone assisting in performance assessment did so in a consistent and similar manner. At this training session, the experimenter gave the coaches a printed outline of the soccer-dribbling task, instructed them on the method at which the players should complete it, and provided contact information to use if they ever have any questions or concerns regarding the study. The experimenter checked in with each team's coach weekly over the entirety of the study to ensure that each team practiced the task in the required manner and at the required frequency as prescribed by the study.

There were two volunteers at each of the athlete's performance assessment sessions assisting the primary investigator in administering the task (three people total). One volunteer stood with and operated a camera throughout the entirety of the performance test. He or she began a new clip when the first athlete stepped up to the start line and ended the clip when the last participant from that same team completed each session. A second volunteer was in charge of preparing the athletes on the start line with a ball and replacing any cones that are knocked out of place during each attempt at the performance test. The investigator stood even with the finish line and was in charge of recording the start and completion times of each participant using a stopwatch and a notepad. This person began the stopwatch at the same time as the participant first made contact with the soccer ball and pressed the button to stop the timer as the participant crossed the finish line that was indicated by two orange disc cones. The investigator also counted and recorded the errors committed during each attempt of the task on a notepad that included the participant identifier, date and corresponding attempt number. An error was counted and

recorded once for every instance in which the participant caused the ball to either roll outside of the cones designating the course area or change course as the result of hitting a cone.

All participants completed the performance test of the soccer-dribbling task during week one of the intervention to provide baseline values for all individuals and groups. Each team's initial performance test as well as all subsequent soccer-dribbling performance tests were administered to participants at a time similar to their regularly scheduled team practice sessions on a grass soccer field that the teams utilized for practice on a regular basis. The testing time for each team was kept consistent with the initial pre-testing time (before or after their regularly scheduled practice time) throughout the entirety of the study. The teams who completed the pre-test prior to their regularly scheduled practice were allowed a five-minute warm-up period before they began the testing session to ensure that all participants are prepared to complete the task. The teams who completed the pre-test following their regularly scheduled practice were assumed that they were already warmed up because they have completed the practice so they were not be given this five-minute warm-up period. The participants lined up before individually taking three turns each completing the soccer-dribbling task while having the opportunity to rest between attempts as they walk back to the starting line of the drill. After completing each performance test, participants were given the opportunity to go home. The less players present during the test, the less opportunity there would have been for an observation effect to influence the participant's performance on the soccer-dribbling task.

The test was planned for week three to assess the performance level of Imagery group 2 as they began the PETTLEP imagery intervention. Week six served as the dribbling task post-test for all groups. The data collected at all sessions was used to compare the effects of mentally imaging the task on the resulting physical performance. Groups (teams) were assessed

individually at these three performance tests over the course of the study to reduce the possibility of groups sharing intervention information. A performance score was calculated for each participant following each performance test by multiplying the two-second penalty for committing errors by the average number of errors that they committed over the course of the three performance tests and then adding the resulting number to the average seconds that they required to complete the soccer-dribbling course.

Table 3 Outline of the performance-testing schedule

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Imagery Group 1	Test	Practice	Test	Practice	Practice	Test
Imagery Group 2	Test	Practice	Test	Practice	Practice	Test
Stretching Group (Control)	Test	Practice	Test	Practice	Practice	Test
Legend:	Test =Performance Test					
	Practice =Practice Task					

Performance testing consisted of three phases and is detailed in Table 3 above. The first was the baseline-testing phase and will occur at one single session prior to any of the teams beginning the imagery intervention. The second phase was the intervention period, where participants participated in physical practice of the task as well as three experimenter assessed performance tests. The third and final phase of the study consisted of a post-test performance and data collection session that occurred during the sixth and final week of the study.

Group conditions were assigned to individual teams and all participants had their imagery ability assessed using the MIQ-R prior to completing the baseline assessment soccer-dribbling

task and introduction of the PETTLEP imagery model to ensure that the participants had adequate imagery ability (a score of over sixteen on both subscales). Requiring a score of sixteen or more on each of the subscales has been used successfully as a marker for those with enough imagery ability to experience the performance increases previously associated with regular imagery practice (Callow et al., 2001; O & Munroe-Chandler, 2008; O et al., 2014). The teams assigned to the control condition met once prior to or following their normal team practice to learn four exercises from the FIFA 11+, which served as an attentional control for this group over the course of the experiment. The participants on these teams were asked to practice the four exercises from the FIFA 11+ four times per week outside of practice to make these participants think that they are completing similar tasks as a part of this study as the imagery groups.

While the random assignment of group conditions to individual participants would be preferred, the choice to assign conditions to entire teams was more practical due to the structure of the club's practice schedule and discouraged the athletes from sharing intervention information with members of the other groups. The practice and game schedules surrounding youth sports often lead to these teams fostering the youth's friendships with other team members so if they are under the same conditions, this hopefully reduced the number of instances in which group conditions were discussed between individuals of different groups outside of sessions supervised by the experimenter. If it had been necessary, the control condition would have been assigned to the teams which possessed inadequate imagery ability and the experimental groups would have been randomly designated an imagery condition as long as the majority of team members possess adequate imagery ability. Since all teams possessed adequate imagery ability, teams were randomly assigned to one of the three experimental conditions.

Teaching and practice of PETTLEP mental imagery

The imagery intervention conditions were introduced and taught in the same manner for all groups participating in the imagery conditions. The PETTLEP imagery intervention study lasted for a total of six weeks during the spring 2015 soccer season. The imagery intervention groups (teams) had different start dates for beginning to practice PETTLEP imagery depending on the condition being imposed. Prior to beginning this PETTLEP imagery intervention, the investigator met with each team individually to introduce the concept of mental imagery and specifically, the PETTLEP imagery model that was utilized by this study. The introductory information session was accomplished by spending approximately twenty minutes total with each team. The participants were presented with White and Hardy's (1998) definition of mental imagery (i.e. Mental imagery is a volitional experience involving the use of one or more sense to create, or recreate a specific sport situation or skill), the elements of mental imagery that are highlighted in the PETTLEP acronym, they were instructed on the uses of imagery, and were given examples of successful athletes that have publically noted their use of imagery. A copy of the chart that was given out to each team on their first day of the PETTLEP imagery intervention to teach them and serve as a reminder of the elements included in a PETTLEP imagery script can be found in Table 1 (based off Wright et al., 2007). Following an explanation of PETTLEP imagery, the experimenter asked the athletes if there are any questions concerning the information that had been presented up to that point.

At this same session, participants were also given a copy of the PETTLEP imagery script that they used for all subsequent imagery sessions. A copy of this script can be found in the Appendix. At this time, the experimenter read the script to the athletes and explained that the imagery script was to be used as a guide for practicing the soccer-dribbling task through the use

of mental imagery. This script was based off a combination of the cognitive specific imagery script used by the creators of this adapted soccer-dribbling task (O & Munroe-Chandler, 2008) and the detailed PETTLEP imagery script used in a dissertation investigating the repeated attempts of a dart throwing task (Knackstedt, 2011). Ideally each participant's PETTLEP imagery script would have been personalized for each individual participant but the initial six-team sample and other time constraints associated with traveling to collect data cause the creation of this many scripts to not be feasible. This approach may actually be the method used by a coach seeking to implement a mental imagery program to a large team. In an effort to still create personalized scripts, the PETTLEP imagery script used as a part of this study included sections with parentheses highlighting options of words that can be inserted in that space to personalize the standard PETTLEP imagery script given to all athletes taking part in the intervention groups. The addition of the participant's choice of descriptor words in the PETTLEP script used to describe the steps of completing the soccer-dribbling task was made to satisfy the suggestion that personalized imagery scripts are more effective at facilitating vivid images that may increase in the performance of those using them to help increase sport performance (Wilson et al., 2010).

During this initial teaching session of the PETTLEP imagery script, the printed copy of the PETTLEP imagery script (a copy can be found in the Appendix) that was utilized in this study was read and explained by the experimenter. The experimenter stopped reading at each instance in the script where the athletes could personalize their script by choosing the most appropriate word from a list of multiple words that could be used in the space outlined by the parentheses or by adding their own, similar term. Again, the opportunity for each player to personalize their imagery script is in following the suggestion of (Wilson et al., 2010) who

observed that personalized and updated imagery scripts were more effective at helping to increase the vividness of the task being imaged than a single, standard script. If they had any questions about the meaning of any words or phrases within the PETTTLEP imagery script while the group was reading through it, then the experimenter made himself available to answer these questions during the first and all subsequent sessions.

After completing a group reading of the imagery script, the experimenter handed out the Imagery Diary forms to each individual athlete at this meeting. The experimenter was present at least once weekly to provide more copies of the imagery script as well as to encourage the completion of mental imagery practices sessions. At this same time, the athletes were told to use these forms to record of their imagery practice at home. Home imagery sessions were explained as four sessions each week that were to be performed at home, in as similar an environment as they can create to their practice field. The importance of completing these at home sessions, to improving performance of the task at practice was stressed at this and all subsequent meetings with the athletes once they began the imagery intervention. The PETTTLEP imagery script remained the same through the entirety of the intervention but the athletes were encouraged each week to mentally add more detail to their images as they could. These sessions performed by the participants at home were not be monitored by the experimenters but the athletes were be asked to record and date each completed imagery session in an Imagery Diary that was handed out at the mental imagery instruction session and collected at the completion of the study. A copy of the pages of the Imagery Diary can be found in the Appendix. The participants were also be asked to note the specifics of their personal imagery sessions, as well as any difficulties that were experienced while performing PETTTLEP imagery on each page of the Imagery Diary but it was not mandatory for the athletes to answer these questions to receive credit for a completed home

imagery practice session. At the end of this session as well as all others, the experimenter again made his contact information known while encouraging the athletes to ask any questions that they may have. Following the introduction to PETTLEP imagery sessions, the experimenter contacted that team’s parents/guardians in person or via email to give them an overview of the tasks expected and they were encouraged to remind their athletes to read the script as prescribed as mental imagery practice.

The investigator was available at one of each team’s practices or games that include imagery sessions to answer any questions that may arise as a result of practicing mental imagery and continue to help the athletes clarify their script as necessary. The athletes were encouraged to always image themselves successfully completing the soccer-dribbling task as quickly and accurately as they can. This is suggested because positive images are encouraged as they have been seen to aid athletes in achieving real life success of the task or mind-state that is imaged (Short et al., 2002; Weinberg & Gould, 2003). The schedule detailing the PETTLEP practice schedule of each group taking part in the current study is displayed in table 4.

Table 4 Experimental Groups Individual Home Imagery Practice Schedule

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Imagery Group 1	PETTLEP	PETTLEP	PETTLEP	PETTLEP	PETTLEP	PETTLEP
Imagery Group 2	None	None	PETTLEP	PETTLEP	PETTLEP	PETTLEP
Stretching Group (Control)	None	None	None	None	None	None
Legend:	PETTLEP =Practice PETTLEP Imagery					
	None =No Practice					

At the end of each meeting session in which the experimenter was present, the athletes were reminded to include all of the elements of the PETTLEP imagery model into their image in the following ways. The physical element of the model should be represented by imaging themselves in full practice attire; the environmental element should be represented by imaging themselves on the soccer field, standing in grass; the timing element should be represented by imaging themselves performing at the same speed as in practice; the task element should be represented by imaging themselves performing the soccer-dribbling task in its entirety; the learning element should be represented by imaging themselves performing around the ability that they believe they normally practice with; the emotion element should be represented by imaging themselves as calm and focused on the task at hand; and finally the perspective element should be represented by imaging themselves performing the task in a first person perspective.

Creating the control group and teaching the FIFA 11+ stretching routine

Participants in the control condition were asked to work through four exercises included in the FIFA 11+ warm-up routine for players less than fourteen years of age while also completing the soccer-dribbling task three times per week at practice. The FIFA 11+ program was designed for use by soccer teams to reduce the number of physical injuries that result from participation in soccer practices and games (F-Marc, 2013). It has been successfully implemented to reduce major injuries of adolescent soccer players by 50% during a single season (F-Marc, 2013). The full version of the FIFA 11+ routine takes approximately fifteen minutes to complete and as suggested, when utilizing this routine with athletes who are under fourteen years old, it was abbreviated to four exercises and the participants were asked to perform it less vigorously than the full version presented in the manual (F-Marc, 2013).

All athletes and coaches taking part in this group were contacted and notified that they will be participating in the stretching group. Athletes were taught and began practicing the abbreviated version of the FIFA 11+ following an introduction session that taught the four-exercise routine and was conducted by the experimenter. At this session, the experimenter first introduced the athletes to the FIFA 11+ stretching routine by explaining its goals and origin. After verbally explaining these goals, the experimenter handed out a list of the exercises that were to be performed as a part of the routine, the link to the full FIFA 11+ book, as well as the experimenter's contact information to help answer any questions that may arise concerning the practice of the FIFA 11+.

After giving the athletes approximately 30 seconds to look over these exercises, the experimenter will ask the athletes to form a large circle with the experimenter in the center. From this position, the group will begin working through the exercise routine with the experimenter. This formation was chosen as it is often used for group stretching by both club and school soccer teams in the participant's local area. It is from this setting that all stretches and exercises were demonstrated before the participants will complete and practice them. During this time, the experimenter opened the floor for any questions concerning the performance of these exercises and verbally noted any mistakes being made in each athlete's form while performing the exercises as a method of helping the athletes complete the exercises correctly. The program was designed to flow from one exercise to another, warming up the body in a sequence and as a result, the routine will be performed in the same order as is suggested in the manual (F-Marc, 2013). The four exercise abbreviated list of exercises that was utilized as a part of this study as well as a link to a full copy of the FIFA 11+ warm-up routine can be found in the Appendix. that will be made available via a link to the official website can also be found in the Appendix. The

athletes completing this stretching routine as a part of the study were asked to perform the FIFA 11+ outside of practice three times per week as suggested by F-Marc (2013) to further improve their muscle flexibility to hopefully help them avoid injury during participation in soccer. In addition to this potential benefit to the participants, this choice also allowed for greater similarity between all teams taking part in the study as the mental imagery groups were asked to perform mental imagery four times per week outside of practice.

Post-test and data collection session

The soccer-dribbling task post-testing session was administered in the same manner as all other formal performance testing sessions except that the athletes were asked to complete the MIQ-R again in the same manner as it was administered at the initial data collection session. Completing the MIQ-R the same day as the final performance test allowed the researchers to identify the current imagery ability of the athletes at the time in which they are performing the soccer-dribbling task for the last time. Following the recommendation of previous imagery research utilizing this soccer-dribbling task, this study asked each participant to complete an additional post-experimental manipulation check at this final data collection session (O & Munroe-Chandler, 2008). The athletes were also given the opportunity to ask any final questions about the study as they turn in their imagery diary forms with a completed copy of the post-experimental manipulation form. As each athlete turned in these two documents to the experimenter or an assistant, they were reminded of the experimenter's contact information and urged to use it if any future questions were to arise. The experimenter attended one of the weekly practices for each team to encourage the participants to complete and record their required imagery practice sessions outside of the team's practices.

Procedure summary/overview

Table 5 Schedule of teaching and practicing PETTLEP imagery and the FIFA 11+ stretching routine

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Imagery Group 1	Learn	4-PETTLEP	4-PETTLEP	4-PETTLEP	4-PETTLEP	None
Imagery Group 2	None	None	Learn	4-PETTLEP	4-PETTLEP	None
Stretching Group (Control)	FIFA 11+	FIFA 11+	FIFA 11+	FIFA 11+	FIFA 11+	None
Legend:	Learn=Teach PETTLEP Imagery 4-PETTLEP= 3 PETTLEP Sessions FIFA 11+= Perform the FIFA 11+ Warm-up					

Once the participants began the mental imagery intervention they were asked to complete one PETTLEP imagery session four times per week at home, for a total of no less than three and no more than six weeks according to the time when their group is scheduled to begin the PETTLEP imagery intervention during the spring soccer season. A summary of the required PETTLEP imagery sessions and FIFA 11+ sessions for each group can be viewed in table 5. Group one began the PETTLEP imagery intervention in week one and group two during the first practice of week three. A six-week study duration was chosen because it will allow at least two of the imagery intervention teams to complete at least six weeks of imagery practice. While an optimal length of imagery intervention has not been discovered, previous studies have found successful performance increases through the use of a six-week mental imagery program (Blair et al., 1993; Smith et al., 2007; Ramsey et al., 2010). The control group participated in a portion of the FIFA 11+ warm-up and stretching routine (F-Marc, 2013) beginning following the baseline performance test and concluding the week of performance post-test. This warm-up routine was developed to help prevent muscle injuries as a result of playing soccer and hopefully provided the two teams utilizing it with a routine that they can utilize in the future if they feel that it worked better than their current warm-up regimen.

Each team's coach was asked to include a task similar to the performance test as a drill once per week as a part of their practice sessions. No data was collected at the coach-run practice sessions of the soccer-dribbling task as their purpose was to provide all participants with physical practice of the soccer-dribbling task. The investigator and volunteers were present and collected performance data from all groups during weeks one, three, and six. These data collection sessions lasted for approximately thirty to forty-five minutes per team. Table 6 and Table 7

together, illustrate the soccer-dribbling task practice and performance test schedules that were followed for all participants taking part in the study.

Table 6 The weekly practice schedule (pre-intervention to week 4) for all groups

	Pre- Intervention Session	Week 1		Week 2		Week 3		Week 4	
		Day 1	Day 2	Day 1	Day 2	Day 1	Day 2	Day 1	Day 2
Imagery Group 1	DC	Test	Teach	PT	Practice	Test	Practice	PT	Practice
Imagery Group 2	DC	Test	PT	PT	Practice	Test	Teach	PT	Practice
Group (Control)	DC	Test	TF	PT	FIFA 11+	Test	FIFA 11+	PT	FIFA 11+
Legend:	<p>DC=Data Collection</p> <p>Test=Performance Test</p> <p>Teach=Teach PETTLEP Imagery</p> <p>PT=Practice Task</p> <p>FIFA 11+=Perform FIFA 11+ at Practice</p> <p>Practice=Regular Practice</p>								

Table 7 Participants practice schedules for weeks five and six

	Week 5		Week 6	
	Day 1	Day 2	Day 1	Day 2
Imagery Group 1	Test	Practice	PT	Test/DC
Imagery Group 2	Test	Practice	PT	Test/DC
Stretching Group (Control)	Test	FIFA 11+	PT	Test/DC
Legend:	<p>DC=Data Collection Test=Performance Test Teach=Teach PETTLEP Imagery PT=Practice Task FIFA 11+=Perform FIFA 11+ at Practice Practice=Regular Practice</p>			

After completing the baseline testing session, group one started the PETTLEP imagery intervention the following session. The investigator again met with group one during the second practice of week one after their respective team practice to teach PETTLEP imagery and to supervise their first imagery session. All participants were given instructions for personalizing their PETTLEP imagery script as well as how and how often they were required to complete PETTLEP imagery sessions each week. All groups performed the soccer-dribbling task as a performance test during week one. It was planned that imagery group two and the control group would not meet with the experimenter again for a performance test until week three, when all groups completed this performance test. While a portion of the control group met for this performance test, imagery group two dropped out of the study due to scheduling issues associated with the rainy weather causing the team's practices to be rescheduled. The control group met with the investigator and stretched following practice during week one. Also following this test during week three, it was planned for imagery group two to begin the PETTLEP imagery intervention at the second practice of the week while group one continued the imagery intervention. Again, imagery group two dropped out of the study prior to this second performance test and as a result, were never taught how to use PETTLEP imagery. An additional result of this group dropping out prior to being introduced to the PETTLEP imagery model is that this study was unable to assess hypothesis two as, only imagery group one practiced PETTLEP imagery as a part of the study. The members of the control group were asked to continue stretching as instructed. Both groups performed the soccer-dribbling task as a performance post-test during the sixth week. Teams participating in the experimental groups received the same PETTLEP imagery intervention script, instruction, and aid from the experimenter starting the week that the PETTLEP imagery intervention was implemented with

their respective group (teams). A copy of the script used in this study can be found in the Appendix. During week six, all of the athletes were asked to turn in their Imagery Diaries along with the completed a post-experimental manipulation check, and a completed MIQ-R packet for the second time. The information included in the Imagery Diary was as a manipulation check to ensure that athletes have performed imagery as instructed. The second administration of the MIQ-R provided information that could be used to investigate the effect of imagery practice on imagery skill. The experimental group was compared to the control group to see if the athlete's imagery skill improves will practice.

The overall participant practice schedule is presented above in Table 6 and Table 7. This information had to be broken in to two separate tables so it would fit on a single page in this document. Table 6 illustrates the practice and imagery schedule for the pre-intervention data collection session until week four of the study. Table 7 illustrates the practice and imagery schedule for week five until week six of the study. A legend that defines the actions listed for each session can be found directly below each table. It should be noted that imagery group 2 is still included on these tables so future researchers can assess this study in its entirety, as it was planned even though this group dropped out of the study.

CHAPTER 4: RESULTS

Preliminary analysis

The MIQ-R was used to assess the participant's mental imagery ability. The participant's average scores on the initial MIQ-R test are reported by both group and sex for both the visual and kinesthetic subscales in Table 8. The first and third testing sessions included a measure of imagery ability (MIQ-R), 8 participants (12.70% of the initial sample) were included in the final data analysis of the MIQ-R results displayed in table 9. This sample included four male and four female participants. While there were originally participants in the 2001 age group (12 to 13 years of age), the final sample included one member of the 2002 age group (11 to 12 years of age) and seven members of the 2003 age group (10 to 11 years of age).

On average, participants reported greater mean scores than the suggested minimum score of sixteen on each subscale to indicate that they had adequate imagery ability to participate in the study. Three participants failed to meet the required minimum score of 16 on one of the two subscales but no participants failed to meet the minimum score on both subscales at any single test. These three participants' teams were randomly assigned to the control condition so they were allowed to continue as a part of the study as the control group was not required to participate in mental imagery.

Males in Imagery group one (IG1) had the greatest mean score on the kinesthetic scale of ($M = 22.90$, $SD = 4.07$) of any group or sex. The female participant's highest mean score on the kinesthetic scale was from the members of Imagery group two (IG2) ($M = 22.42$, $SD = 1.98$) The lowest kinesthetic scale scores for each sex were made by the males of the stretching group (SG) ($M = 21.09$, $SD = 6.53$) and the females of IG1 ($M = 21.50$, $SD = 3.29$).

Table 8 Descriptive Statistics of the MIQ-R Pre-test Scores

Subscale	Group	Sex	Mean	Std. Deviation	N
Kinesthetic	Imagery Group 1	Male	22.90	4.067	10
		Female	21.50	3.289	12
	Imagery Group 2	Male	21.30	2.983	10
		Female	22.42	1.975	12
	Stretching Group	Male	21.09	6.534	11
		Female	21.63	2.825	8
Visual	Imagery Group 1	Male	25.60	2.591	10
		Female	25.00	3.838	12
	Imagery Group 2	Male	22.40	4.326	10
		Female	25.08	3.579	12
	Stretching Group	Male	25.00	4.626	11
		Female	23.37	4.809	8

Participants of both sexes from all groups scored higher on the visual scale of the MIQ-R than the kinesthetic scale except for the males of IG2 ($M = 22.40$, $SD = 4.33$). The lowest score reported on this scale for females was performed the members of the stretching group ($M = 23.37$, $SD = 4.81$). The highest score for males on the visual subscale was recorded from the MIQ-R results of IG1 ($M = 25.60$, $SD = 2.59$). IG1's score was also the highest average score on either subscale at the first MIQ-R testing session. The highest score for females on the visual subscale was recorded from IG2 ($M = 25.08$, $SD = 3.58$).

As a result of participant attrition throughout the course of the study, the intended three group study design was reduced to two groups. All members of the second imagery group failed to complete performance sessions two and three. The initial sample of 63 participants was further reduced to the final sample of 8 participants after scheduling conflicts resulted in participants' failure to complete the three required performance testing sessions.

Table 9 Descriptive Statistics of the MIQ-R Pre- and Post-test Scores

Subscale	Group	Mean 1	SD1	Mean 2	SD2	N
Kinesthetic	Imagery Group 1	19.80	3.564	20.40	3.647	5
	Stretching Group	21.33	7.638	26.00	2.000	3
Visual	Imagery Group 1	22.00	4.637	22.00	3.391	5
	Stretching Group	25.67	4.041	27.33	0.577	3

At the MIQ-R pre-testing session, the members of the stretching group reported the highest scores on both the kinesthetic ($M = 21.33$, $SD = 7.638$) and visual subscales ($M = 25.67$, $SD = 7.638$). This same stretching group also reported the highest scores on both the kinesthetic ($M = 26.00$, $SD = 2.000$) and visual subscales ($M = 27.33$, $SD = 0.577$) at the post-testing session. The average member of both imagery group 1 and the stretching group improved their scores on the MIQ-R from pre- to post-test while only the stretching group improved their scores on the visual subscale over this same time period. The average member of imagery group 1 scored a 22 on the visual subscale but the standard deviation of these scores was 4.637 at pre-test and 3.391 at the MIQ-R post-testing session. These results suggest that the average participant from each group improved their score on the MIQ-R, if only to a small degree over the duration of the study.

Hypothesis one: Analysis of the participant's dribbling speed

As a result of imagery group two failing to complete the study's three required performance testing sessions, no comparisons could be made between the two mental imagery groups that began this study. A univariate analysis of the two groups (IG1 and stretching) that completed this study was performed in response to this issue on the data obtained at each individual performance testing session. A 2 (Group) x 3 (Session) repeated measures ANOVA

was utilized to test the effects of imagery use on dribbling speed ($N = 8$). This analysis revealed a non-significant effect for Speed, $F(2, 5) = 1.64, p = .28, \eta^2 = .40$ and Group, $F(2, 5) = 5.31, p = .06, \eta^2 = .68$. However, there was a significant Group x Session interaction ($F(2, 12) = 7.19, p < .01$). These results suggest that practice of the soccer-dribbling task did not significantly improve the time that it took for youth soccer players to complete the soccer-dribbling task over the duration of the study but there was a significant difference in the response of the participants to the introduction of PETTLEP imagery relative to the stretching group who were never introduced to any form of mental imagery.

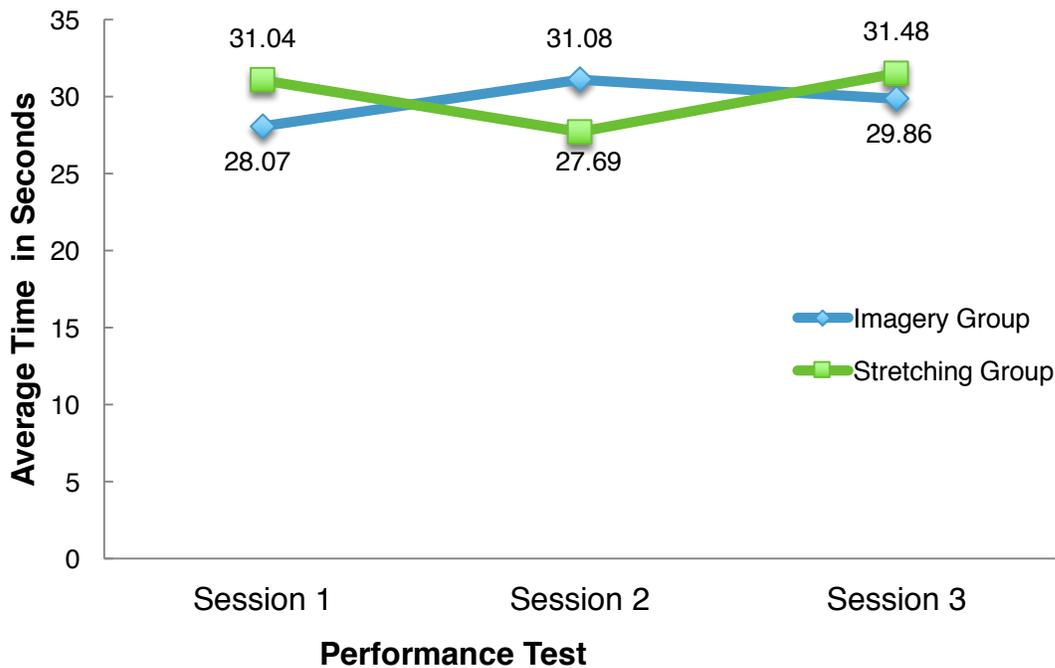


Figure 2 Average participant dribbling course times reported in seconds

At time one, imagery group one ($N = 5$) took 2.98 seconds less than the stretching group ($N = 3$) to complete the soccer-dribbling task. An independent samples t-test indicated that dribbling speed was not significantly faster for the members of imagery group one and the control (stretching) group at testing session one ($t(6) = -1.90, p = .11, d = 1.47$). The effect size for this analysis ($d = 1.47$) was found to exceed Cohen's (1988) suggestion for a large effect ($d =$

.80). These results indicate that participants in imagery group one did not perform the soccer-dribbling task significantly faster than the stretching group but there was a large difference in the groups dribbling times. At time two, the groups switched positions as SG completed the task 3.40 seconds faster than the group that began practicing mental imagery during week one. An independent samples t-test indicated that this was not a significant difference in the dribbling speed of the two groups of youth soccer players to complete the soccer-dribbling task at the second testing session ($t(4.70) = 0.14, p = .09, d = 1.40$). At this second testing session, imagery group one was did not complete the soccer-dribbling task significantly faster than the stretching group. Although, the results of Cohen's d (1988) ($d = 1.40$) can be interpreted as having a large effect, meaning that the two groups had a large difference between dribbling times. The introduction of PETTLEP imagery to imagery group one between the first and second testing sessions may have been related to their slowing dribbling time that were not experienced by the stretching (control) group. This difference was further amplified by the improvements seen in the dribbling time of the average member of the stretching group who were not introduced to any form of mental imagery but still participated in physical practice of the soccer-dribbling task. At testing session number three, IG1 ($M = 29.86, SD = 3.52$) was again the fastest group on average to complete the soccer-dribbling task. An independent samples t-test indicated that this was not a significant difference in the dribbling speed of the two groups of youth soccer players to complete the soccer-dribbling task at the third session ($t(6) = -0.71, p = 0.51, d = 0.56$). At this third and final time point, the members of the first group to begin mental imagery practice completed the soccer-dribbling task 1.62 seconds faster than the stretching (control) group and as this the t-test indicated, this is not a significant difference. These results indicate that participants in imagery group one did not perform the soccer-dribbling task significantly faster than the

stretching group and there was a smaller difference in the groups dribbling times than at any other session. Cohen's (1988) suggestion for measuring effect size would classify the differences between the dribbling times of imagery group one and the stretching group as a medium effect ($d = .50$) at the third testing session ($d = 0.56$).

Table 10 Dribbling times of the average member of each group while completing the soccer-dribbling task

Session	Group	Mean	Standard Deviation	N
1	Imagery Group	28.07	2.38	5
	Stretching Group	31.04	1.57	3
2	Imagery Group	31.08	3.33	5
	Stretching Group	27.69	0.79	3
3	Imagery Group	29.86	3.52	5
	Stretching Group	31.48	2.13	3

The stretching group completed the soccer-dribbling task with the fastest time ($M = 27.69$, $SD = 0.79$) at testing session two. The fastest time recorded for the average member of the imagery group ($M = 28.07$, $SD = 2.38$) occurred at testing session one. The slowest dribbling time recorded for the average member of the imagery group occurred at session two ($M = 31.08$, $SD = 3.33$) and the slowest dribbling time for the stretching group occurred at session three ($M = 31.48$, $SD = 2.13$). While neither group significantly improved their dribbling speed over the duration of the study, the reversal of the groups order of the two groups average dribbling speeds at performance session 2 ($t(4.70) = 0.14$, $p = .09$, $d = 1.40$). This large effect size seen between the two groups at this session may suggest that the introduction of PETTLEP imagery to imagery

group one effected the performance of those participants.

Hypothesis one: Analysis of errors committed by participants

A 2 (Group) x 3 (Session) repeated measures ANOVA was utilized to test the effects of imagery use on errors committed by the average participant in each group. This analysis revealed no significant effects for Errors, $F(2, 5) = 5.64, p = .05, n^2 = .69$ or Group, $F(2, 5) = 12.85, p = .01, n^2 = .84$. However, there was a significant Group x Session interaction ($F(2, 12) = 9.30, p < .01, n^2 = ?$). The errors committed by imagery group one continued to decrease from 1.47 ($SD = .38$) errors per attempt of the task at the first testing session over the two subsequent performance-testing sessions (see figure 3) whereas errors by the stretching group were 1.00 ($SD = 0.33$) at session one before improving to 0.33 ($SD = 0.33$) at session two, to return to 1.00 ($SD = 0.58$) at session three. This reduction in errors committed over the course of the three sessions by the imagery group suggests an improvement in the control with which the players are completing the soccer-dribbling task.

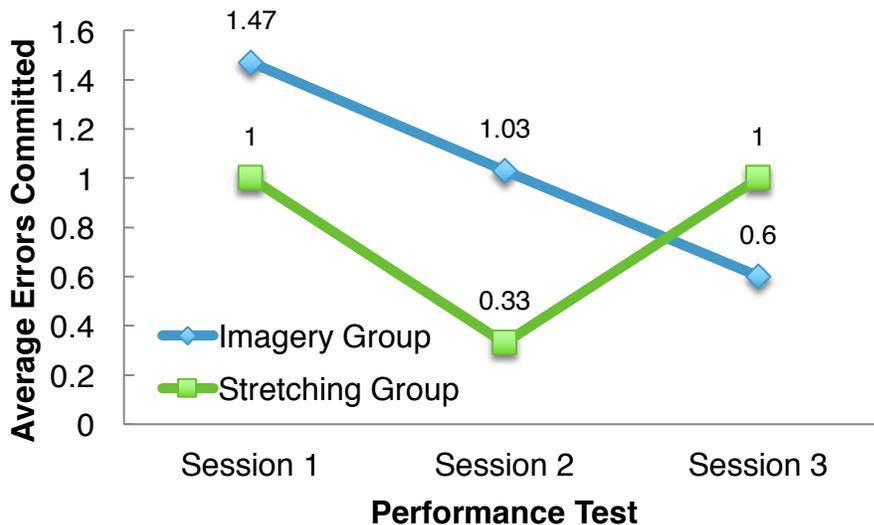


Figure 3 Errors Committed by the average member of each group while completing the soccer-dribbling task

The stretching group committed the lowest number of errors on average of any group during the second performance test when, they reported 0.33 ($SD = 0.33$) errors per attempt of the soccer-dribbling task. This failure of the stretching group to maintain at least the level of 0.33 ($SD = 0.33$) errors committed per attempt of the soccer-dribbling task resulted in an interaction with imagery group one who improved to their lowest number of errors committed by their group ($M = 0.60$, $SD = 0.55$) at the third performance session. More detailed information for each testing session can be found in table 11.

Table 11 Errors committed by the average member of each group while completing the soccer-dribbling task

Session	Group	Mean	Standard Deviation	N
1	Imagery Group	1.47	.38	5
	Stretching Group	1.00	.33	3
2	Imagery Group	1.03	.48	5
	Stretching Group	.33	.33	3
3	Imagery Group	.60	.55	5
	Stretching Group	1.00	.58	3

Hypothesis one: Analysis of participant’s calculated performance times

Performance times were calculated for each participant by adding the average dribbling time to the average error penalties for the individual participants at the corresponding performance testing session. The resulting performance times were assessed using a repeated-measures ANOVA to compare the calculated performance times by the average participant from imagery group one and the stretching (control) group members to complete the soccer-dribbling task at each performance testing session. Performance times are suggested as a singular,

generalized measure of performance on the task and were calculated for each individual participant by adding the corresponding performance times with the error penalties at the same trial. This measure was calculated to serve as an overall measure of performance at each session. A 2 (Group) x 3 (Session) repeated measures ANOVA was utilized to test the effects of imagery use on the performance time of the average participant in each group. This analysis revealed a non-significant effect for Performance time, $F(2, 5) = 0.48$, $p = .65$, $\eta^2 = .16$ and Group, $F(2, 5) = 3.54$, $p = .11$, $\eta^2 = .59$.

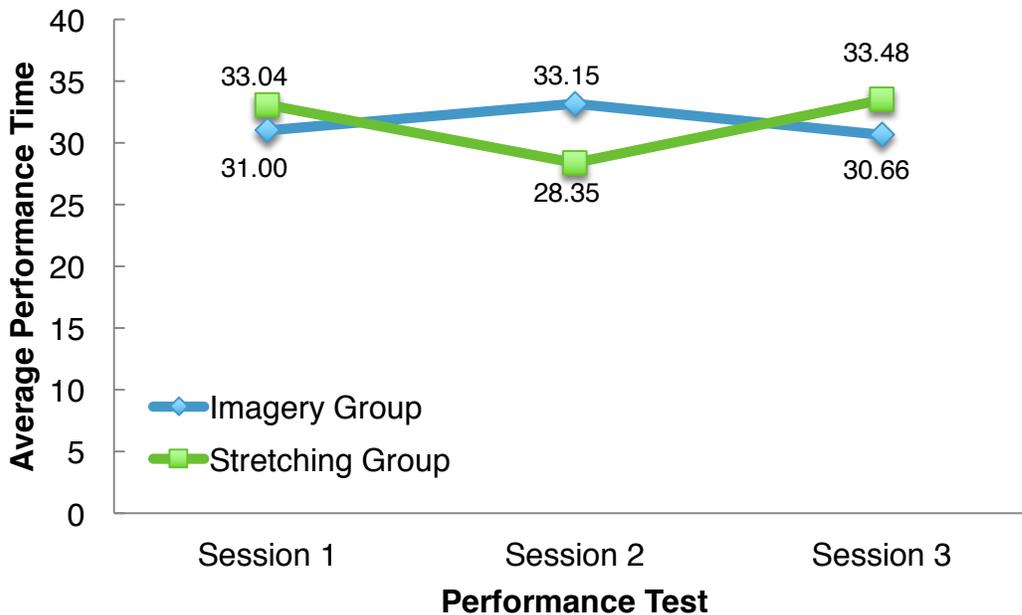


Figure 4 Calculated performance times by the average member of each group while completing the soccer-dribbling task

Similar to the dribbling time measure, there was a significant Group x Session interaction ($F(2,12) = 7.19$, $p < .05$) between the average performance time of imagery group one and stretching group. An independent samples t-test indicated that performance time was not significantly faster for the members of imagery group one and the control (stretching) group at testing session one ($t(6) = -1.25$, $p = .26$, $d = 0.93$). The effect size for this analysis ($d = 0.93$) was found to exceed Cohen's (1988) suggestion for a large effect ($d > .80$). These results indicate

that participants in imagery group one did not perform the soccer-dribbling task significantly faster than the stretching group but there was a large difference in the groups dribbling times at testing session one. Since dribbling time served as a large portion of the calculated performance time measure, it logically follows that there was a large difference in the performance times of the two groups at session two as there appeared to be with the dribbling time measure. Imagery group one, who were tasked with performing PETTLEP mental imagery outside of practice saw an overall decrease in their performance score from session one to session three but this difference was not significant ($d = 0.11$). A decrease in the overall performance time indicates that these participants actually improved the speed and accuracy with which they were completing the soccer-dribbling task on an average attempt but according to Cohen's (1988) suggestion, this effect size would only be considered small ($d < 0.2$). The stretching group initially improved their performance time from time one ($M = 33.04$, $SD = 2.03$) to time two ($M = 28.35$, $SD = 1.36$) but returned to a score similar to their initial pre-test by the third and final performance test ($M = 33.48$, $SD = 3.18$). The stretching group reported the fastest performance time of any group taking part in the study during their performances at session two ($M = 28.35$, $SD = 1.36$). The opposite trends in performance by these two groups can be seen most clearly in figure 4.

Table 12 Performance times by the average member of each group while completing the soccer-dribbling task

Session	Group	Mean	Standard Deviation	N
1	Imagery Group	30.99	2.34	5
	Stretching Group	33.04	2.03	3
2	Imagery Group	33.15	4.25	5
	Stretching Group	28.35	1.36	3
3	Imagery Group	30.66	3.89	5
	Stretching Group	33.48	3.18	3

These results of an independent samples t-test also suggest that there were no significant differences in the calculated performance times that it took for the two groups of youth soccer players to complete the soccer-dribbling task at any session but the differences in these times were greatest at the second testing session ($t(5) = 2.34, p = .07, d = 2.09$). According to Cohen (1988), the effect size between groups ($d = 2.09$) is a large effect as it is greater effect than the large effect ($d > .80$) defined in his research. This large difference between the performance of the two groups at testing session two, following the introduction of the PETTLEP imagery may suggest that the imagery intervention have had a different effect on the performance of the participants in imagery group than the stretching (control) group (who only physically practiced the task) but this effect did not significant. At this session, imagery group one earned their worst performance time ($M = 33.15, SD = 4.25$) while the stretching group earned their best performance time of the study ($M = 28.35, SD = 1.36$). There were no significant differences between the calculated performance scores of the two groups at the first ($t(6) = -1.25, p = .26, d$

= 1.02) or at the last ($t(6) = -1.05, p = .33, d = .85$) testing session. For a review of this data, see table 11 and figure 4.

Hypothesis two and the post-experimental manipulation check

This study was unable to assess the second hypothesis concerning any differences that may exist between the performances of two groups beginning a PETTLEP imagery intervention after different levels of practice of the soccer-dribbling task in question. Only one group was instructed on the use of PETTLEP mental imagery over the course of the study which prevented this study from performing a multivariate analysis of variance (MANOVA) to assess the change in errors committed and overall performance scores of the PETTLEP imagery groups and the stretching (control) group over the course of the study.

Only one participant turned in a completed imagery diary and this page included information from a single week of documented imagery practice. A total of 12 participants completed the post-experimental manipulation check that was distributed at the final performance testing session at the suggestion of previous research (O & Munroe-Chandler, 2008; Short et al. 2002). In response to the first question, “did you know enough detail of the task when you began using imagery to create a clear image?”. 8.30% of participants responded “not at all”, 50.00% of the participants responded that they “had enough”, 41.70% “had more than enough” and no participants reported that they “needed a little more detail” to create a clear mental image. In response to the second question posed on this questionnaire, “did you utilize imagery outside of the study requirements?”, 41.7% said that they had while 58.30% of the participants reported that they had not utilized imagery outside of these requirements. The final question on the post-experimental manipulation check asked the participants if they “will continue to use imagery in

the future?”. 25.00% of the participants answered that they would continue to utilize mental imagery while the other 75.00% of the participants said that they would not.

CHAPTER 5: DISCUSSION

Following the line of inquiry established by Blair et al. (1993), the current study sought to use a similar soccer-dribbling task to assess the effect of mental imagery on physical sport performance. Specifically, our research sought to compare the effects of mental imagery on a soccer-dribbling performance when the amount of previous experience prior to beginning mental imagery is varied. The opinion of researchers has been divided towards the importance of possessing a strong internal representation of a task prior to beginning a mental imagery program designed around that same task (e.g. Blair et al., 1993; Denis, 1985; Wrisberg & Ragsdale, 1979). Some research suggests that imagery is most effective when the person utilizing it possesses a strong internal representation of the task (Denis, 1985); while other research suggests that mental imagery is most effective when it is early in the process of a person learning a new task (Wrisberg & Ragsdale, 1979). Identifying the most appropriate knowledge of a task necessary to improve performance will provide another guideline to help coaches and athletes successfully employ mental imagery as a part of their training programs.

This current study aimed to add to the field of literature concerning the most effective ways to implement mental imagery into a youth sports context. Specifically, a guideline directing coaches, parents, or athletes towards the most appropriate time to begin performing mental imagery in conjunction with the youth's normal physical practice routines to improve performance. The primary hypothesis was developed following the suggestion of Blair et al. (1993) who sought to clarify the contrasting suggestions of Denis (1985) and Wrisberg and Ragsdale (1979). Denis (1985) that found that if a mental imagery intervention was introduced prior to the participant achieving a strong internal representation of the task then, it was suggested that the resulting weak internal representation may lead to the participant using an

incorrect or under detailed image that may have negative effect on their performance. Wrisberg and Ragsdale (1979) suggested in their research that mental imagery introduced early in the process of learning a motor skill facilitated performance improvements more than imagery that was introduced later in the process of learning a motor skill.

Effects of PETTLEP imagery on dribbling speed, errors committed, and performance time

The primary hypothesis of this study concerned the effect of PETTLEP mental imagery on the dribbling performance of youth soccer players. Each participant's performance was measured by recording dribbling speed, error performance and calculated performance time at each performance testing session. The results indicated that the dribbling time of the participants in this study was not significantly affected by the addition of a PETTLEP imagery program to physical practice of a soccer-dribbling task. Neither the PETTLEP imagery group nor the stretching group significantly improved the time that it took them to complete the soccer-dribbling task from pre- to post-test. This lack of improvement is in line with the finding of O and Munroe-Chandler (2008) who also found that none of the groups participating in their study using the same task. Contrary to the findings of this study and that of O and Munroe-Chandler (2008), Blair et al. (1993) saw a significant difference between the dribbling time of the experimental and control groups, with the experimental group performing significantly faster at the post-testing session.

Previous studies have utilized a multi-week design to allow the mental imagery intervention enough time for an observable effect on the participant's performance separate from any practice effects resulting from consecutive completions of the same task (e.g. O & Munroe-Chandler, 2008; Wright & Smith, 2009; Wakefield & Smith, 2011). The decision to design this study as a

six-week, three-session performance test was made in an effort to increase the chances that any potential impact of the experimental conditions can be differentiated from the impact of any practice effects. The finding that neither group who completed this study significantly improved their dribbling performance from the pre-test performance session suggests that there were not any significant differences in the participant's performances resulting from the experimental manipulation. It should be noted that the two groups taking part in the current study appeared to follow opposite directions in terms of dribbling performance improvement following the initial performance test but neither showed a significant trend in either direction over the course of the study. At the second performance testing session, there was a significant difference between the dribbling times of the two groups. This difference is likely coincidental rather than a result of the experimental manipulation due to the failure of the participants in the PETTLEP imagery group to complete their assigned mental imagery practice sessions each week. The failure to complete the suggested mental imagery practice likely led to the similarity between groups as this practice was the primary difference between the PETTLEP imagery and control (stretching) conditions. The soccer-dribbling task utilized as a part of the current study was adapted from the test first utilized by Blair et al. (1993) and then used again by Munroe-Chandler (2012). The stable dribbling times between the members of both groups taking part in the current study is in contrast to research performed by Munroe-Chandler (2012). In Munroe-Chandler's (2012) research, all age groups improved the time that it took for them to complete the entire soccer performance test from the pre- to post-testing sessions. In both previous cases (e.g. Blair et al., 1993; Munroe-Chandler, 2012), the participants taking part in these studies improved the time that it took them to complete the assigned task and future research should not hesitate to use any or all of the Blair et al. (1993) task to assess the soccer performance of youth players.

Although there were no significant changes in the dribbling time of each group over the course of the three performance testing sessions, there were differences in the average number of errors committed by the players participating as a part of the PETTLEP imagery group. The members of this group improved (reduced) the number of errors that they committed at each session over the course of the study. These improvements were not significant but appeared to be a greater reduction in error scores than those recorded by the average member of the stretching group. This stretching (control) group ended the study at the same average level of committing one error per trial that they recorded at the first session. This group had a finding of note, as they committed the fewest errors by a group at any session during their second soccer-dribbling test. This difference was not statistically significant from the pre- or post-testing sessions but stands out because the members of the PETTLEP imagery group did not experience this improvement in performance. We are unable to speculate on the cause of this difference but future research should be aware of and look for this potential difference to appear again.

The current study appears to be a departure from previous research such as O and Munroe-Chandler (2008), who used the same task soccer-dribbling task, found that their groups initially performed a higher number of errors per trial than the members of this study. While all groups in O and Munroe-Chandler's (2008) study committed an average number of errors similar to the findings related to the groups taking part in our study with 2.77 errors per trial. The physical practice group in O and Munroe-Chandler (2008), utilizing the same task committed the most average errors at pre-test with 4.00 errors per trial ($SD = 2.56$) and the imagery groups who completed mental imagery practice at different speeds committed between 2.95 and 3.61 errors per trial. The differences displayed in the comparison between the initial errors committed by the participants in O and Munroe-Chandler (2008) may be a result of an improvement in the average

American player since 2008 or may simply be a difference in the participants sampled for the two studies. Another influence on this initial discrepancy between the errors committed in O and Munroe-Chandler (2008) and the current study may have been the club's stated focus on the technical skill of its members. This added emphasis on technical skill by the coaches may mean that the soccer-dribbling task used as a part of this study was not novel to the participants as they have completed similar tasks at previous practices or with previous teams. The participants in O and Munroe-Chandler (2008) completed all trials of the test in a single day and as they noted, this repetition of the task in such a short time period may have resulted in the improvement seen in all groups. At post-test, the real time imagery group committed the fewest errors per trial ($M = 1.30$, $SD = 1.31$) physical practice and all other imagery groups committed between 1.80 and 1.87 errors per trial (O and Munroe-Chandler, 2008). Future research involving the performance of youth soccer players should continue to note the errors committed by its participants because the dribbling control of competitive youth soccer players taking part in the current study appears to display an improvement at baseline compared to the results of O and Munroe-Chandler's college aged, recreational level participants, published in 2008.

The third measure derived from the participant's completion of the soccer-dribbling task, performance time was created to further assess the overall technical improvement of youth soccer players and was calculated by combining the participant's corresponding dribbling time and error scores from each session. Performance times allowed the calculation of a single, standard score that could be used to characterize the participant's performances at each session. The PETTLEP imagery group that completed this study showed a non-significant improvement in their performance times from pre- to post-test. The stretching group taking part in this study recorded the fastest performance time of the study at session two but actually failed to

significantly improve their performance from pre- to post-test. This means that the participants completing physical practice of the soccer-dribbling task along with the FIFA 11+ stretching routine failed to show a significant overall improvement in performance times across the three testing sessions along with weekly practice of the task.

Previous mental imagery research (e.g. Blair et al., 1993; O & Munroe-Chandler, 2008) did not combine time and error performance to create an overall performance time so we are unable to compare the lack of any significant differences between the calculated performance scores of the participants in the current research with other youth soccer players. It is assumed that any significant improvements in the dribbling time or errors committed by participants in future research would likely correspond with a significant improvement in the performance time measure. Of note, session two was also the time at which the stretching group performed the fewest errors of any group. As mentioned previously, this similarity is a result of the formula used to calculate performance scores, which includes the error scores for each corresponding participant. The current study was unable to establish any significant differences between the performances of either of the groups that completed the required performance tests. Future research should continue to investigate the differences that may exist between youth soccer players who complete a mental imagery training program and those that simply physically practice technical soccer skills.

Effects of PETTLEP imagery introduced to youth athletes at differing times

The second hypothesis of this study involved the investigation of any differences that may exist between the performance and error scores of the two groups assigned to complete the PETTLEP imagery intervention along with physical practice of the soccer-dribbling task. Results concerning the effect of a PETTLEP imagery intervention introduced at different times over the

course of the study cannot be suggested because participant adherence for the second group to begin mental imagery was very poor as no one from this group completed all three performance testing sessions. The two teams that were randomly assigned to the experimental condition of beginning mental imagery after some experience with the soccer-dribbling task were never instructed how and when to perform PETTLEP mental imagery and as a result never implemented mental imagery practice along with physical completion of the task at the team's practice sessions. A portion of Imagery group 1 and the Stretching groups participated in the final data collection, which allowed us to assess improvement on the dribbling task from the first session until the last session. This information was used to investigate any differences that may exist between the groups that were tasked with practicing PETTLEP mental imagery and the team that practiced a stretching condition intended to serve as an attentional control.

Further compounding the limitation of participant attrition, the PETTLEP imagery group did not return completed mental imagery diaries, indicating that they did not complete their required mental imagery sessions so the lack of significant differences between the remaining PETTLEP imagery group and the stretching (control) group was expected. Future research should seek to answer the hypothesis concerning potential differences in the resulting performance of groups who undergo a PETTLEP imagery intervention with varied knowledge of a task. New information provided by future research would benefit those seeking to employ PETTLEP mental imagery in addition to physical soccer practice by establishing the most effective time to begin employing mental imagery when learning a new task or skill.

Since no comparisons could be made between the two mental imagery groups that began this study, a univariate analysis of the two groups (IG1 and stretching) that completed this study was performed on the data obtained at each individual performance testing session. The current study

began with both groups achieving similar calculated performance scores, which indicates that they were at roughly the same level of performance when they began the study. This similarity at pre-test is ideal when assessing the performance effects of multiple experimental conditions on different age groups as was this study's aim.

The PETTLEP imagery group (Imagery Group 1) reduced the average errors that they committed while completing the soccer-dribbling task by one from pre- to post-test ($M = 1.47$, $SD = .38$; $M = .60$, $SD = .55$; respectively) while the stretching group saw no changes in error performance over the same time period. The Stretching Group appeared to decrease their performance in terms of the time that it took them and the errors that they committed while attempting to complete the over the course of the study. The only significant difference between the groups that completed this study occurred at the second performance testing session (Cohen's $d = 1.94$) while measuring the group's performance scores. This is considered a large effect when compared with Cohen's (1988) rules for interpreting a significant difference between the errors committed by the two groups at session is of note because it represents an initial difference in the effects of PETTLEP mental imagery on soccer-dribbling performance. Of note is that the stretching (control) group improved their performance on the soccer-dribbling task while the group that was introduced to PETTLEP mental imagery completed a worse performance time than they did at the pre-testing session. These results were unexpected after observing the results of previous research (e.g. Post et al., 2010; Ramsey et al., 2010; Seif-Barghi et al., 2012) but may suggest that the PETTLEP imagery group produced a worse performance time after being introduced to a second method of practicing the soccer-dribbling task.

The stretching group produced a more stable error performance compared to the PETTLEP imagery group who, on average, committed the same number of errors on the pre-test as they did

on the post-test ($M = 1.00$, $SD = .33$; $M = 1.00$, $SD = .58$; respectively). These results are both contrary to the results of O and Munroe-Chandler (2008) who noted no significant changes in the errors committed by the control group. In their case, they found a significant improvement in the number of errors committed by the members of the experimental (imagery) group from pre- to post-test (O & Munroe-Chandler, 2008). Our study had hoped to improve the chances of identifying significant changes in each group by extending the time period and amount of practice of the soccer-dribbling practice from the single day format instituted by O and Munroe-Chandler (2008) and return to a schedule more similar to the one successfully utilized by Blair et al. (1993) in their original study assessing the effect of mental imagery on soccer performance. Longitudinal research allows for greater variation in the participant's internal representation of a task. This internal representation can also be described as the previous knowledge of the task such as the feelings experienced while completing the task and the steps required to complete the task. To achieve the most realistic practice setting, future researchers should continue the practice of multi-session studies in youth sport but should work to avoid the limitations highlighted in the following sections. Due to the limitations previously discussed and other limitations addressed in the following section, we were unable to add any significant knowledge to the literature concerning the most effective times to implement mental imagery into the practice regimen of youth soccer players to allow those players to experience the greatest improvement in performance.

Limitations and future research

The greatest benefit of this investigation into the effect of PETTTLEP mental imagery on soccer dribbling ability may be found in the lessons that can be applied to future research rather than the answers provided by the hypotheses guiding this study. Future researchers should use

the lessons learned while creating this study to further investigate the most effective ways to implement mental imagery into youth sports to improve the athlete's resulting performances. When doing research with youth sports populations, researchers should be aware that limitations must often be accepted when working with this population such as issues with self-report measures of imagery ability, maintaining a meeting schedule, the athletes potentially sharing their condition with members of another group, participants practicing mental imagery outside of the study's aims, and participant attrition in longitudinal research designs. In spite of these limitations, we suggest that future researchers continue to do research to help improve the use of mental imagery in youth sports populations.

A limitation that must be addressed by any study utilizing a self-report method of assessing mental imagery such as the Mental Imagery Questionnaire-Revised (Hall & Martin, 1997) prior to their participation in a study involving the effect of mental imagery on performance is the potential for participants to provide positively biased results. This potential always exists with self-report questionnaires because youth athletes are often trained to believe that higher numbers or scores are associated with more positive results such as winning. Before administering the MIQ-R (Hall & Martin, 1997), participants were instructed that they were to complete the task to the best of their ability and that there were no right or wrong answers to the questions that would be posed to them. The MIQ-R (Hall & Martin, 1997) was chosen because it has been previously found to be reliable enough to be utilized as a measure of imagery ability in youth athletes (Monsma, 2004; Munroe-Chandler & Hall, 2012). In a similar study to this one utilizing a more complete assessment of technical soccer ability, the MIQ-R was used to assess the mental imagery ability of youth soccer players (Munroe-Chandler & Hall, 2012). Munroe-Chandler and Hall's (2012) study found that all of their participants ages seven through fourteen

years of age had adequate mental imagery ability to experience the positive effect of a mental imagery program on soccer performance. In light of the potential issues associated with the self-report nature of the MIQ-R (Hall & Martin, 1997), the results of Munroe-Chandler and Hall (2012) as well as the eight participants that fully completed this study suggest that this questionnaire can still be used in the future as a measure of mental imagery ability for studies involving youth soccer players.

While the current investigation did not have any issues with the participant's lacking the necessary mental imagery ability for the skill to affect performance, this study did experience multiple issues with both the participants performing and subsequently recording their required mental imagery practice sessions. Contrary to previous research (Monsma, 2004; Munroe-Chandler & Hall, 2012) and efforts made by the primary investigator to follow-up at each team's weekly practice, an imagery diary was not a successful method of encouraging or ensuring that participants completed their required mental imagery sessions. While we do not suggest avoiding an imagery diary as a method of tracking participant's mental imagery practice, it is suggested that researchers seek to put in to place a more stringent or convenient method of encouraging the practice of mental imagery in future studies. A mobile app or online version of the mental imagery diary could be utilized in the future to make the process of prompting and subsequently documenting mental imagery sessions more convenient for participants. These methods of tracking imagery use could be programed to remind users to complete their required sessions and would remove the risk of participants misplacing a physical imagery diary as it could travel with them on their personal, mobile device. Applied mental imagery research is difficult to accomplish but should continue to be investigated to provide potentially valuable information for

coaches and athletes seeking to employ imagery as a method of increasing performance along with their normal physical practice habits.

The results obtained from the current investigation can benefit future researchers by providing an analysis of the commonly used experimental design and measures we employed even though there were issues with participant adherence to the study's protocols. Specifically, previous mental imagery research within youth athletics has found that assigning an imagery diary is a sufficient method of documenting and monitoring the prescribed use of mental imagery outside of the practice setting (Smith et al., 2007). Smith et al. (2007) reported that only three of the forty-eight participants taking part in their study failed to document their required imagery sessions while they investigated the effect of the physical and environmental components of the PETTLEP imagery model albeit this may have been a result of the participant sample being older in Smith et al. (2007) (*mean age of 20.37*) than those used as a part of this study (Smith et al., 2007). The participants in the current study also appeared to have issues with turning in their completed imagery diaries. Throughout the course of the study, participants routinely requested replacement mental imagery scripts and diary forms. Future research should seek to employ a more formal method of organizing the participants in the mental imagery manipulation groups than handing out individually printed papers as this study attempted to do. Although it may be a more expensive than the method implemented by this study, future researchers may seek to utilize a small bound notebook or a mobile app that may make the imagery materials and script easier to maintain for the longevity of the study. Researchers may also include a recorded version of the mental imagery script on a mobile app to remove any issues that may arise by requiring the participants to read the script themselves. Establishing a more successful method of

maintaining the participant's imagery materials will increase the likelihood that future imagery research is completed as the researchers intended.

An additional result of the participants failing to turn in their imagery diaries indicated that they might not be an effective method of tracking participant's mental imagery sessions that they complete outside of practice as Smith et al. (2007) suggested. None of the participants taking part in the experimental groups in our study completed all of the prescribed mental imagery sessions according to the returned mental imagery diaries; which makes it difficult to say that all experimental group members adequately completed the experimental manipulation as prescribed. Future research should seek to identify and implement a system of recording completed imagery sessions that provides a stronger incentive for participants to complete a larger percentage of prescribed mental imagery sessions in their imagery diaries. In our case, since none of the participants turned in a completed imagery diary the included all required mental imagery sessions, we cannot surmise if these diaries alone are an effective method of tracking the participant's mental imagery sessions. Some participants verbally reported that they were not turning in their imagery diaries because they'd forgotten to complete the assigned imagery sessions. Future investigations should seek to identify and employ methods that provide greater experimenter supervision of mental imagery sessions or involve the participant's parents to a greater degree to ensure that the mental imagery practice sessions are completed as prescribed. Even if the participants meet the prescribed mental imagery ability level, those who do not practice mental imagery are guaranteed to miss out on its potential benefits to their performances. For future researchers to be successful in investigating the effect of mental imagery on youth athletic performance, it is vital that the participants complete the required mental imagery practice sessions as the investigator prescribes them.

As many studies (e.g. Munroe-Chandler et al., 2007; Smith et al., 2007; Ramsey et al., 2010) of sports encounter, limited resources require researchers to accept limitations associated with sampling bias as well as the generalizability of results that may arise when performing research with a single sports organization. The participants taking part in this study played for the same youth soccer club based in the same small city, which increases the chances of a sampling bias. Therefore, our sample may not accurately represent the larger population of youth athletes because all of the participants were recruited from a single club in the southeastern United States. The generalizability of the results is also limited by the method in which teams from this club were selected to participate in this study. To help increase the chances that the coaches would follow the study protocols, the first teams whose coaches showed an interest in taking part in the study were selected for participation. The individual coach's interest in taking part in this study was a beneficial asset and should be used in future studies to increase the chances that coaches encourage their athletes to practice mental imagery as well as include the physical practice session of the soccer-dribbling task each week as a part of the team's regularly scheduled practice. The choice to assign entire teams to a condition was made because encouraging the participants to complete the assigned mental imagery regimen was deemed more important at this time than the potential of this sample not accurately describing the larger population of youth soccer players that may have utilized its results for guidance in implementing a PETTLEP imagery program in to their normal practice habits. Future research should seek to identify any differences that may exist between the affects of mental imagery on the technical dribbling skill of youth soccer players from different parts of the country or world.

When doing research with youth sports teams from the same area, there is the possibility that participants in different experimental groups may share the details of their condition with a

member of another experimental group. This risk is greater when all of the teams participating in the study are members of the same youth club as the participants of this study were. Sharing information between members of different groups may be detrimental to the experimental control of the study because exposure to knowledge about mental imagery may cause participants who would have not otherwise known how, to practice some form of mental imagery on their own. This potential un-prescribed imagery practice could influence their performance on subsequent performance assessments and ruin the study's experimental control and may be unavoidable when performing research with a single youth sports club. The participants of this study were all members of the same youth soccer club in Coastal North Carolina and many of them live within the same city. The potential for overlap between the participant's extracurricular activities as well as attendance at local schools provides opportunities for the youths to interact with members of the other groups. At these alternative settings, these interactions between members of different teams would likely occur outside of researcher supervision and as a result, the conversations that take place could not be controlled. While this was likely not an issue in this study due to the loss of the second imagery group, future studies may experience this issue. The potential for participants to share the details of their condition became less likely since no one assigned to the PETTLEP imagery condition in our study completed the required mental imagery practice sessions. Future mental imagery research should seek to avoid utilizing multiple teams within a single age group of the same club to reduce the chance of experimental groups sharing the details of their condition with members of another group and thus influencing the results of the study.

Following the suggestions of previous research (e.g. Blair et al., 1993; Munroe-Chandler, 2012) employing a similar soccer-dribbling task, participants completed testing weeks apart to create a retention test scenario for the effects of mental imagery on soccer-dribbling

performance. The limitation that must be accepted along with this choice is that it is more difficult to meet with the participants at multiple different times following an initial baseline testing session. In this case, our study was able to assess the longitudinal performance improvements of youth athletes in an environment that is more similar in time and amount of practice to the standard practice regimens of these youth athletes than assessing their performance in a single day session. Participant attrition must be accepted as a limitation when designing multi-week studies in youth sports, but they should not be avoided after reading about this study because they have been successful in the past (e.g. Blair et al., 1993; Munroe-Chandler, 2012).

The final limitation addressed as a part of this study concerns the risk of participant attrition when completing longitudinal research, particularly when performing research related to youth sports. There are many individuals and schedules that must be coordinated in order for the youth to attend practices and games. Participants in youth sports must rely on their club organization to provide fields, the coaches must organize and run practices, and the parents must provide transportation to and from practice to ensure adherence to the study's requirements. Efforts were made to maintain the original participant pool such as speaking with team managers rather than simply communicating with the coaches but the risk of participant attrition cannot be avoided when working with youth athletes due to the potential for school or family commitments and even transportation issues.

In spite of the teams being randomly assigned to groups, inclement weather resulted in both teams assigned to the second imagery group to cancel all practices during the week of the second performance test. The time period in which this study took place was a rainy, wet month in eastern North Carolina. During this time, a tropical storm as well as rain showers resulted in

the club's outdoor practices fields being too wet to hold practices safely. Some teams were able to move their practices inside on a turf field while others were forced to cancel practices entirely for multiple weeks. The significant change in playing surface that would have been experienced had the participants been tested on a wet field or on turf would have likely effected the participant's performance scores so the decision was made to reschedule performance testing to a later date. Scheduling issues provide a limitation that cannot be avoided through planning and is a risk that must be accepted when doing applied research with youth athletics just as coaches face when instructing their players in mental imagery or any sport-specific skill. Future researchers should continue to utilize this type of research because longitudinal studies are necessary to move forward with establishing the most effective methods of utilizing mental imagery in the youth sport context as they provide greater ecological validity for athletes than is possible through the use of single day mental imagery research. While some of the limitations addressed previously cannot be planned for and avoided such as the weather reducing practice sessions, steps such as developing a mobile app or creating a bound notebook for recording mental imagery sessions may encourage participants to complete a longitudinal, mental imagery study as intended by the researcher.

Conclusion

The current study investigated the potential change in the soccer-dribbling performance of competitive youth soccer players as a result of undergoing a PETTLEP imagery program or a stretching program along with physical soccer practice. Due to the attrition of a large majority (88%) of the initial sample, this study was unable to assess the differing effect of PETTLEP mental imagery on soccer-dribbling performance when it is introduced at multiple time periods throughout the process of learning a technical soccer task. Following research originally

investigated by Blair et al. (1993) and later by O and Munroe-Chandler (2008), mental imagery appears to improve the performance of youth soccer players when coupled with physical practice of the same soccer-dribbling task when mental imagery is introduced to the participants on the same day as the soccer-dribbling task. Contrasting research by Denis (1985) suggested that a mental imagery intervention introduced prior to a participant achieving a strong internal representation of the task in question would result in the person creating a weak internal representation that may then lead to this person using an incorrect or under detailed image that may have negative effect on their resulting performance. It is hoped that future researchers will continue the study of this topic in an attempt to fill the large hole in the field concerning the best time to implement a mental imagery program as a form of physical performance enhancement (Smith et al., 2007). This information will allow researchers to provide coaches, parents and athletes with a guideline for the most effective time when practicing a new skill to begin practicing mental imagery in an effort to improve performance to the greatest degree.

CHAPTER 6: REFERENCES

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APPENDIX A

INSTITUTIONAL REVIEW BOARD APPROVAL LETTER



EAST CAROLINA UNIVERSITY
University & Medical Center Institutional Review Board Office
4N-70 Brody Medical Sciences Building · Mail Stop 682
600 Moye Boulevard · Greenville, NC 27834
Office **252-744-2914** · Fax **252-744-2284** · www.ecu.edu/irb

Notification of Initial Approval: Expedited

From: Social/Behavioral IRB
To: [Joshua Basnight](#)
CC: [Nicholas Murray](#)
Date: 3/19/2015
Re: [UMCIRB 15-000133](#)
Most appropriate time to implement PETTLEP imagery in soccer

I am pleased to inform you that your Expedited Application was approved. Approval of the study and any consent form(s) is for the period of 3/19/2015 to 3/18/2016. The research study is eligible for review under expedited category # 4, 6, 7. The Chairperson (or designee) deemed this study no more than minimal risk.

Changes to this approved research may not be initiated without UMCIRB review except when necessary to eliminate an apparent immediate hazard to the participant. All unanticipated problems involving risks to participants and others must be promptly reported to the UMCIRB. The investigator must submit a continuing review/closure application to the UMCIRB prior to the date of study expiration. The Investigator must adhere to all reporting requirements for this study.

Approved consent documents with the IRB approval date stamped on the document should be used to consent participants (consent documents with the IRB approval date stamp are found under the Documents tab in the study workspace).

The approval includes the following items:

Name	Description
Basnight Thesis Chapters 1-3	Study Protocol or Grant Application
Club Email-Phone Recruitment Script minor assent document	Recruitment Documents/Scripts Consent Forms
Movement Imagery Questionnaire-Revised	Surveys and Questionnaires
Parent Email-Phone Recruitment Script parental consent	Recruitment Documents/Scripts Consent Forms
PETTLEP Imagery Script	Additional Items
Post-Experiment Manipulation Check.docx	Surveys and Questionnaires
verbal assent ages 7-11	Consent Forms

The Chairperson (or designee) does not have a potential for conflict of interest on this study.

IRB00000705 East Carolina U IRB #1 (Biomedical) IORG0000418
IRB00003781 East Carolina U IRB #2 (Behavioral/SS) IORG0000418

APPENDIX B
INFORMED CONSENT



Parental Consent to Participate in Research

Information to consider before taking part in research that has no more than minimal risk.

Title of Research Study: Most appropriate time to implement PETTLEP imagery in soccer
Principal Investigator: Joshua S. Basnight (Person in Charge of this Study)
Institution, Department or Division: East Carolina University, Department of Kinesiology
Address: Minges Coliseum Greenville, North Carolina 27858
Telephone #: 910-262-0686

Researchers at East Carolina University (ECU) study issues related to society, health problems, environmental problems, behavior problems and the human condition. To do this, we need the help of volunteers who are willing to take part in research.

Why is my child being invited to take part in this research?

The purpose of this research is to find out the best time to start practicing mental imagery to most quickly improve dribbling a soccer ball. Your child is being invited to take part in this research because they are a member of a competitive youth soccer team. The decision to take part in this research is yours and your child's to make. By doing this research, we hope to learn the most effective time to implement mental imagery in to soccer practice to improve soccer performance. If your child volunteers to take part in this research, you will be one of about 80 people to do so.

Are there reasons my child should not take part in this research?

Your child should not take part in this study if they are not a part of one of the team's chosen by the club to participate in this study.

What other choices does my child have if he/she does not take part in this research?

Your child can choose not to participate.

Where is the research going to take place and how long will it last?

The research will be conducted at the normal practice site and time for your child's club soccer team. Your child will need to come to practice at least 8 times during the study. The total amount of time your child will be asked to volunteer for this study is approximately 8 hours outside of practice over the next 8 weeks.

What will my child be asked to do?

Your child will be asked to do the following:

- Your child will be asked for their sex, age and number of years that they have been playing competitive soccer at the same session at which they will be asked to give their assent to participate.
- At the first official practice of the study, your child will be asked to complete the Movement Imagery Questionnaire-Revised, which was developed, by Hall and Martin in 1997 to assess how well a person can feel and see themselves performing four specific

movements immediately after physically performing them. This same questionnaire will also be administered for a second time at the final testing session. The information collected from this questionnaire will be used to signify each participant's imagery ability and to see if any changes occur in their mental imagery ability as a result of participating in this study.

- Your child will be asked to keep an Imagery Diary detailing the date and time of each mental imagery session that they complete outside of their team practice sessions.
- Your child will complete a performance test four times over the course of the study. These tests will consist of your child completing three attempts at each session of the same slalom cone course while dribbling a soccer ball as quickly and accurately as possible. The performance test will take place for all teams during weeks 1, 3, 5, and 8. All teams will also practice this task at least once per week for the duration of the eight-week study but these practice sessions will be run by your child's coach and will not be recorded or measured as a part of this study in any way.
- Your child will be videotaped each time that they perform the performance test to ensure that the time and error score that will be recorded as they complete each trial of the task was reported correctly. The video camera will be placed at the end of the course and will be focused on the feet and ball of each participant but they may be identifiable still as they move through the course. No one outside of the research team, not even your child will be given access to these video files. These video files will be kept in accordance with the American Psychological Association Guidelines for five years after the completion of the study and will be stored on the principle investigator's password protected hard-drive. After this five-year window is over, the video footage will be permanently deleted from the principle investigator's password protected hard-drive.
- Following the completion of the final performance test in week eight of the study, your child will be asked to complete a questionnaire consisting of three questions regarding their use of mental imagery in relation to soccer. This information will help the researchers to better understand the results of the study.

What might my child experience if he/she takes part in the research?

Other children who have taken part in this type of research have experienced improvements in both their mental imagery ability and their performance of the soccer dribbling drill. By participating in this research study, your child may also experience these benefits.

Will my child be paid for taking part in this research?

We will not be able to pay your child for the time your child volunteers while being in this study.

Will it cost my child to take part in this research?

It will not cost your child any money to be part of the research.

Who will know that my child took part in this research and learn personal information about him/her?

ECU and the people and organizations listed below may know that your child took part in this research and may see information about him/her that is normally kept private. With your permission, these people may use your child's private information to do this research:

- The University & Medical Center Institutional Review Board (UMCIRB) and its staff have responsibility for overseeing your welfare during this research and may need to see research records that identify you.

How will you keep the information you collect about my child secure? How long will you keep it?

To help protect confidentiality, the athlete's performance scores, videotapes of the performance tests, and any other information obtained as a part of this study will be kept secured by the PI in a large brown envelope once all athletes have completed each session. This envelope will be personally handled by the PI and kept sealed until the data within is returned to Greenville so it may be stored in a locked box in the PI's mentor's office. This information will be returned to Greenville between each session and no data will be taken back to the fields after it is collected. At the testing and practice sessions of the task, at no time will the participants approximate performance times or scores be shared with any individual participant. They may be told that they did "better" or "worse" than their last attempt if they ask immediately following that attempt but no two participants will ever be compared. Data collected from the surveys administered will not be shared with anyone outside of the research team and participants will be asked to complete the written portions without discussing or sharing their answers with any other participants or coaches.

Your child's performance data will only be viewed by members of the research team and coaches will not be given access to any individual's performance information. The numerical data will be stored on a computer file and the videos will be kept in a locked box in the PI's mentor's office. After the study, performance data and videos will be stored in the PI's mentor's office. In accordance with the American Psychological Association, all raw data, computerized data, and video footage will be stored and maintained for at least five years after the publication of research findings.

What if my child decides that he/she does not want to continue in this research?

Your child can stop at any time after it has already started. There will be no consequences if your child stops and your child will not be criticized. Your child will not lose any benefits that you normally receive.

Who should I contact if I have questions?

The people conducting this study will be able to answer any questions concerning this research, now or in the future. You may contact the Principal Investigator at 910-262-0686 Monday through Friday, between 10:0am and 5:00pm.

If you have questions about your rights as someone taking part in research, you may call the Office of Research Integrity & Compliance (ORIC) at phone number 252-744-2914 (days, 8:00 am-5:00 pm). If you would like to report a complaint or concern about this research study, you may call the Director of the ORIC, at 252-744-1971.

I have decided I want my child to take part in this research. What should I do now?

The person obtaining informed consent will ask you to read the following and if you agree, you should sign this form:

- I have read (or had read to me) all of the above information.
- I have had an opportunity to ask questions about things in this research I did not understand and have received satisfactory answers.

- I know that my child can stop taking part in this study at any time.
- By signing this informed consent form, I am not giving up any of my or my child's rights.
- I have been given a copy of this consent document, and it is mine to keep.

Participant's Name (PRINT) _____

Parent/Guardian Name (PRINT) _____
Signature **Date**

Person Obtaining Informed Consent: I have conducted the initial informed consent process. I have orally reviewed the contents of the consent document with the person who has signed above, and answered all of the person's questions about the research.

Person Obtaining Consent (PRINT) **Signature** **Date**

APPENDIX C
INFORMED ASSENT



IRB Study # UMCIRB 15-000133

Title of Study: Most appropriate time to implement PETTLEP imagery in soccer

Person in charge of study: Joshua S. Basnight

Where they work: Graduate Student at East Carolina University

Study contact phone number: (910) 262-0686

Study contact E-mail Address: basnightj06@students.ecu.edu

People at ECU study ways to make people's lives better. These studies are called research. This research is trying to find out the best time to start practicing mental imagery to most quickly improve dribbling a soccer ball.

Your parent(s) needs to give permission for you to be in this research. You do not have to be in this research if you don't want to, even if your parent(s) has already given permission.

You may stop being in the study at any time. If you decide to stop, no one will be angry or upset with you.

Why are you doing this research study?

You are being asked to take part in research about new ways of making soccer practice more effective at improving performance.

Why am I being asked to be in this research study?

You are being asked to take part in this research because we need to have soccer players who use different ways of practicing a dribbling drill and then perform the drill at practice.

How many people will take part in this study?

If you decide to be in this research, you will be one of about 80 people taking part in it.

What will happen during this study?

You will practice the same soccer-dribbling drill each week for 8 weeks. This will be videotaped 4 times total at practice and the videos will be kept at ECU and not shared with your coaches at any time. These videos will be used to make sure that all scores on the soccer-dribbling drill are recorded correctly. All players will practice the drill in other ways at practice and some will even be asked to practice the drill at home (10-15 minutes each time). This study will take place at your regularly scheduled soccer practice and will last for fifteen minutes each day.

Check the line that best matches your choice:
_____ OK to record me during the study
_____ Not OK to record me during the study

Who will be told the things we learn about you in this study?

Your name and personal performance will not be shared with anyone outside of the research team.

What are the good things that might happen?

Sometimes good things happen to people who take part in research. These are called “benefits.” The benefits to you of being in this study will be that you will be taught new ways of practicing and improving your soccer skill outside of your regular team practices. There is a chance you will benefit from being in this research and sometimes you may even become a better dribbler after participating in this study.

What are the bad things that might happen?

Sometimes things we may not like happen to people in research studies. These things may even make them feel bad. These are called “risks.” These are no risks of this study other than what you would normally have at practices or games. You may or may not have these things happen to you. Things may also happen that the researchers do not know about right now. You should report any problems to your parents and to the researcher.

Will you get any money or gifts for being in this research study?

You will not receive any money or gifts for being in this research study.

Who should you ask if you have any questions?

If you have questions about the research, you should ask the people listed on the first page of this form. If you have other questions about your rights while you are in this research study you may call the Institutional Review Board at 252-744-2914.

If you decide to take part in this research, you should sign your name below. It means that you agree to take part in this research study.

Sign your name here if you want to be in the study

Date

Print your name here if you want to be in the study

Signature of Person Obtaining Assent

Date

Printed Name of Person Obtaining Assent

APPENDIX D

STUDY PARTICIPATION SCRIPTS

Club Email/Phone Recruitment Script

Dear Youth Soccer Club,

I am contacting you to gauge your interest in your club working as a part of a thesis research study that will take place at youth soccer practices that will help us learn more about methods of practice used to improve the performance of youth athletes most effectively.

The fundamental goal of this research study is to investigate the addition of specific psychological skills (mental imagery) commonly used by sports psychologists to improve the affect of physical practice on improving physical soccer performance. I believe this study will provide guidance to coaches/organizations that are interested in utilizing mental imagery as well as serve as an opportunity to introduce the benefits of mental imagery to your players.

This study will require 6-8 of your competitive travel soccer teams consisting of players between the ages of 7 and 14. Teams participating in this study will be asked to practice a soccer dribbling drill once per week at practice and the researcher will hold 4 videotaped testing sessions over the course of the study to assess physical performance of the drill. The researcher will hold one session with each team per week to be available to answer any of the participant's questions and practice the study's required procedures. As a part of this study, some players will be asked to complete a short script guided mental imagery session four times per week outside of practice while others will complete a portion of the FIFA 11+ warm-up/stretching routine.

Following the completion of the study, the researcher will teach any players/coaches that were interested but did not learn as a result of the study how to utilize mental imagery in a soccer.

I will be in town this (insert date) for the weekend if you have 20-30 minutes to sit down and talk about my study as well as the opportunity for your teams/players being a part of it. If this weekend does not work for you, you'd rather meet at another time, or discuss this over the phone, I can make myself available. Please just let me know! You can reach me at this email address (Basnightj06@students.ecu.edu) or my cell phone (910-262-0686).

Thanks for your time and consideration,

Joshua S. Basnight

Manager/Parent Email/Phone Recruitment Script

Dear Team Manager or Parent/Guardian,

I am presently working on my Master's of Science in Sport and Exercise Psychology at East Carolina University. As part of my degree requirements, I am planning a research project to take place at youth soccer practices that will help me to learn more about methods of practice used to improve the performance of youth athletes most effectively. The fundamental goal of this research study is to investigate the addition of specific psychological skills commonly used by sports psychologists to improve the affect of physical practice on improving physical soccer performance.

As part of this research project, your child will participate in soccer dribbling drills as well as additional soccer focused methods of practice both in the practice setting and at home over the next six to eight weeks that will allow me to track the affect of different methods of practicing a soccer-dribbling task on the resulting physical performance of the same soccer-dribbling task. Teams participating in this study will be asked to practice a soccer dribbling drill once per week at practice and the researcher will hold 4 videotaped testing sessions over the course of the study to assess physical performance of the drill. Only members of the research team will see these video files along with all data recorded during this study and all identifying information will be permanently deleted after 5 years, in accordance with the American Psychological Association's Guidelines . There will be 6 to 8 teams in total participating in this research study. As I am a researcher rather than a member of your child's coaching staff, the results of your child's participation **will not** affect your child's participation on the team or playing time.

I am requesting permission from you to use your child's data in my research study. Please know that your child's participation is entirely voluntary and they may choose to no longer participate in the study at any point in time without penalty.

If you have any questions or concerns, please feel free to contact me at school at (910) 262-0686 or by emailing me at joshsgb4@ec.rr.com. If you have questions about your child's rights as someone taking part in research, you may call the Office of Research Integrity & Compliance (ORIC) at phone number 252-744-2914 (days, 8:00 am-5:00 pm). If you would like to report a complaint or concern about this research study, you may call the Director of the OHRI, at 252-744-1971.

I will be contacting your team's manager in the near future with scheduling information about a meeting that will be held before the study begins. Thank you for your interest in my research study.

Sincerely,

Joshua S. Basnight

APPENDIX E

MOVEMENT IMAGERY QUESTIONNAIRE-REVISED

East Carolina



University

**Movement Imagery Questionnaire-Revised
(MIQ-R; Hall & Martin, 1997)**

Title of Research Study: Examining the implementation of PETTLEP-based imagery in youth soccer-dribbling performance

Principal Investigator: Joshua S. Basnight (Person in Charge of this Study)

Institution, Department or Division: East Carolina University, Department of Kinesiology

Address: Minges Coliseum Greenville, North Carolina 27858

Telephone #: 910-262-0686

Instructions:

This questionnaire concerns two ways of mentally performing movements, which are used by some people more than y others, and are more applicable to some types of movements than others. The first is attempting to form a visual image or picture of a movement in your mind. The second is attempting to feel what performing a movement is like without actually doing the movement. You are requested to do both of these mental tasks for a variety of movements in this questionnaire, and then rate how easy/difficult you found the tasks to be. The ratings that you give are not designed to assess the goodness or badness of the way you perform these mental tasks. They are attempts to discover the capacity individuals show for performing these tasks for different movements. There are no right or wrong ratings that are better than others.

Each of the following statements describes a particular action or movement. Read each statement carefully and then actually perform the movement as described. Only perform the movement a single time. Return to the starting position for the movement just as if you were going to perform the action a second time. Then depending on which of the following you are asked to do, either (1) form as clear and vivid a visual image as possible of the movement just performed, or (2) attempt to feel yourself making the movement just performed without actually doing it.

After you have completed the mental task required, rate the ease/difficulty with which you were able to do the task. Take your ratings from the scales below. Be as accurate as possible and take as long as you feel necessary to arrive at the proper rating for each movement. You may choose the same rating for any number of movements “seen” or “felt” and it is not necessary to utilize the entire length of the scale.

Rating Scales:

Visual Imagery Scale

1	2	3	4	5	6	7
Very hard to see	Hard to see	Somewhat hard to see	Neutral (not easy, not hard)	Somewhat easy to see	Easy to see	Very easy to see

Kinesthetic Imagery Scale

1	2	3	4	5	6	7
Very hard to feel	Hard to feel	Somewhat hard to feel	Neutral (not easy, not hard)	Somewhat easy to feel	Easy to feel	Very easy to feel

1. Starting Position: Stand with your feet and legs together and your arms at your sides.

Action: Raise your knee as high as possible so that you are standing on your left leg with your right leg flexed (bent) at the knee. Now lower your right leg so that you are again standing on two feet. Perform these actions slowly.

Mental Task: Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating:

2. Starting Position: Stand with your feet slightly apart and your hands at your sides.

Action: Bend down low and then jump straight up in the air as high as possible with both arms extended above your head. Land with your feet apart and lower your arms to your sides.

Mental Task: Assume the starting position. Attempt to see yourself making the movement just performed with as clear and vivid a visual image as possible. Now rate the ease/difficulty with which you were able to do this mental task.

Rating: _____

3. Starting Position: Extend your arm of your non-dominant hand straight out to your side so that it is parallel to the ground, palm down.

Action: Move your arm forward until it is directly in front of your body (still parallel to the ground). Keep your arm extended during the movement and make the movement slowly.

Mental Task: Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating: _____

4. Starting Position: Stand with your feet slightly apart and your arms fully extended above your head.

Action: Slowly bend forward at the waist and try and touch your toes with your fingertips (or if possible touch the floor with your fingertips or hands). Now return to the starting position, standing erect with your arms extended above your head.

Mental Task: Assume the starting position. Attempt to see yourself making the movement just performed with as clear and vivid a visual image as possible. Now rate the ease/difficulty with which you were able to do this mental task.

Rating:

5. Starting Position: Stand with your feet slightly apart and your hands at your sides.

Action: Bend down low and then jump straight up in the air as high as possible with both arms extended above your head. Land with your feet apart and lower your arms to your sides.

Mental Task: Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating:

6. Starting Position: Stand with your feet and legs together and your arms at your sides.

Action: Raise your knee as high as possible so that you are standing on your left leg with your right leg flexed (bent) at the knee. Now lower your right leg so that you are again standing on two feet. Perform these actions slowly.

Mental Task: Assume the starting position. Attempt to see yourself making the movement just performed with as clear and vivid a visual image as possible. Now rate the ease/difficulty with which you were able to do this mental task.

Rating:

7. Starting Position: Stand with your feet slightly apart and your arms fully extended above your head.

Action: Slowly bend forward at the waist and try and touch your toes with your fingertips (or if possible, touch the floor with your fingertips or hands). Now return to the starting position, standing erect with your arms extended above your head.

Mental Task: Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating:

8. Starting Position: Extend your arm of your non-dominant hand straight out to your side so that it is parallel to the ground, palm down.

Action: Move your arm forward until it is directly in front of your body (still parallel to the ground). Keep your arm extended during the movement and make the movement slowly.

Mental Task: Assume the starting position. Attempt to see yourself making the movement just performed with as clear and vivid a visual image as possible. Now rate the ease/difficulty with which you were able to do this mental task.

Rating:

APPENDIX F
IMAGERY DIARY

Imagery Diary

Instructions: Fill this out following each imagery session that you complete at home. This must be filled out and turned in at the end of the study to get credit for completing imagery at home.

Today's Date: _____

Imagery Session Start Time: _____

Imagery Session End Time: _____

1. Did you use the imagery script during this imagery session?

Yes

No

APPENDIX G

POST-EXPERIMENTAL MANIPULATION CHECK



Post-Experiment Manipulation Check

Title of Research Study: Examining the implementation of PETTLEP-based imagery in youth soccer-dribbling performance

Principal Investigator: Joshua S. Basnight (Person in Charge of this Study)
Institution, Department or Division: East Carolina University, Department of Kinesiology
Address: Minges Coliseum Greenville, North Carolina 27858
Telephone #: 910-262-0686

Instructions: Please answer all questions to the best of your ability. Circle the answer choice that best represents your feelings in response to the question. The information collected from these questions will help me with the results of this study and will not be shared with anyone outside of the research team. There are no right or wrong answers.

1. Do you feel like you knew enough details about the soccer-dribbling task to create a clear mental image when you began practicing imagery?

1 2 3 4
(Not at all) (Needed a little more) (Had enough) (Had more than enough)

2. Did you use imagery at any other time(s) throughout the study at any time that was not required by the coach?

Yes No

3. Will you continue to use mental imagery after the study is complete?

Yes No

APPENDIX H

STRETCHING GROUP ASSIGNMENT GUIDELINES

Stretching Group Assignments:

1. Jogging with hip out

- i. Alternate raising your legs and rotating your hip outward every 5 yards for 20 yards. Do 2 sets of this exercise.

2. Jogging with hip in

- i. Alternate raising your legs and rotating your hip inward every 5 yards for 20 yards. Do 2 sets of this exercise.

3. Plank /“Static Bench”

- i. Do 2 sets of 20 seconds planks.

4. Plant and Cut

- i. Jog 5 steps and then plant your foot firmly before cutting and exploding in to a sprint in the opposite direction. Alternate plant foot and run for 20 yards total. Do 2 sets of this exercise.

Tips to Remember:

- Practice the stretches 4 times a week at home
- Don't talk to other teams about what your team is doing
- Ask any questions that you may have at any time!
- If you decide that you need to quit, you can at any time without penalty, choose to quit. No one will be mad at your and how you do at this task will not affect your playing time. Just simply let us know that you are quitting.

APPENDIX I

PETTLEP EXAMPLE CHART FOR SOCCER DRIBBLING TASK

Element	How to achieve this stage	Example in soccer
Physical	Athletes should mirror the imaged situation as closely as possible. This includes body positioning, clothing, and props normally used in the imaged setting.	The athlete should wear soccer shorts, a jersey, shin guards, cleats with a ball at their feet.
Environmental	Athletes should complete the imagery session in the same environment (if possible) as the imaged setting. If this is not possible, the athlete can use videos, photos, or a similar environment as a substitute.	The athlete should perform the imagery sessions standing on a soccer field.
Task	The thing being imaged should be exactly the same as the target situation. This should be updated as the athlete's skill level increases.	The athlete should mimic the exact technical motions used to complete the skill. The player should see the ball exactly as the foot moves to manipulate it.
Timing	This is the speed with which the image is completed in the mind. It should be completed in "real time." Which means, that the image should take as long as it normally takes to complete the task in the physical environment.	If performing a dribbling task through a maze of cones, the athlete should complete each image in the time that it would take them to physically complete it.
Learning	The athlete's imagery should be equivalent to their current level of understanding of the task. This should be updated as the athlete's skill level increases.	As the athlete increases their knowledge of a technical skill, more detailed elements of the task should be added to keep up with their understanding of the skill.
Emotion	The imagery should include any emotions or anxiety that is normally associated with the situation or skill being imaged by the athlete.	The athlete should include any anxiety or other emotions felt while physically performing the skill in the desired environment (e.g. practice or a game).
Perspective	This is the viewpoint from which the athlete sees during the imagery session. It is normally completed from a first person point of view but can also be from a 3 rd person point of view for technical skills and can be aided by the use of a video.	If performing a dribbling task through a maze of cones, the athlete should see the ball and cones below them as they weave through the maze.

APPENDIX J

SOCCER-DRIBBLING TASK PETTLEP IMAGERY SCRIPT

Soccer-Dribbling Task PETTLEP Imagery Script

Stand on your toes, in a patch of grass with a soccer ball at your feet. Now close your eyes and imagine that you are standing on your big, green practice field. Take this image and picture it in your mind. Look up and see the other soccer fields around you, the (metal/weathered metal/chain link) fences around the complex, the tall, thick hedges separating the fields, the dusty, (loud/crackling/popping) gravel parking lot, and finally the construction zone in the distance. Feel the light breeze moving across the big, open, soccer complex. The (heat/warmth) of the sun in the sky above you and the sound of voices behind you talking and laughing as your teammates wait for their turn to compete. There is excitement in the air and you will feed off of it.

Now let all of that fade away as you focus only on the task in front of you. Start by finding the four, tall orange cones standing up out of the grass creating the boundaries of the task area. Be confident that you will keep the ball inside this area throughout each attempt at the task. You will move through the maze with good speed and accuracy. You shift your focus to the maze in front of you, staring with the (Adidas/Nike) ball at your feet and the cones to your left and right marking the starting line. Raising your head as you spot the first low, round, disc cone and then the place to its right where you will make your first (turn/cut). See across the gap between the start line and the first cone and the (green/greenish-yellow/brown/thick green) blades of grass standing between you and that first turn.

Feel your cleats as the studs (dig/plant) into the ground at the starting line. Take a full, deep breath. Hear the air going in your nose and filling your lungs. Let your shoulders relax as you slowly, exhale, letting that air back out. You're now standing ready for the coach to your right to say "go". With this word, you feel an explosion of energy throughout your entire body.

You push hard off the ground with your back foot as you accelerate forward. Feel your foot as it makes contact with the ball and you push it forward toward that place where you will make your first cut. The ball is rolling over the grass, crushing the small flat blades as it moves over them.

The air is breezing past your (shirt/jersey/top) as you approach the lines of low, bright orange disc cones. Slowing down slightly as you reach the first cone, the ball is directly in front of you at your feet and you're ready to make your first cut. Feel your cleat as it cuts through the grass and plants firmly in the dirt underneath. Using your other leg, you stretch your foot towards the ball. As you make contact with the ball, you hear the soft pop and feel the ball resting against your cleat and push it to the left, past the cone. You take a look up to see the next cone ahead. You are in the perfect position, pushing the ball forward towards the outside of the next cone. Again, you spot the place just outside of the cone where you will plant your foot and cut back the other direction.

Focusing all of your attention on this place, you slow your legs down and drop your right shoulder as you round this second cone. The cones are like hot lava that you are drawn to. You cut as closely as you can to each small, orange disc without touching it. Feel your body as it heats up beginning in your chest and spreading to your arms and legs. Using the perfect amount of force, you again push the ball forward. You are dribbling the ball quickly, keeping the ball directly in front of you and in complete control. Once again, you look up and spot the small patch of grass on the outside of the next disc cone where you will dig your cleat into the grass and explode back to the left towards the next cone.

You relax your body as the process is starting to just feel like a rhythm. Step, Step, Step, Cut, Push... Step, Step, Step, Cut, Push... You aren't trying to go faster anymore. You have reached the fastest pace at which you can keep control of the ball. Moving through the maze

feels almost automatic now. You have complete control of the ball like it's on a string attached to your foot. Sweat is beginning to drip down your (forehead/face/cheek/head) and you feel it cooling your arms. As quickly as you notice the sweat, you let the thought go. Nothing can distract you from moving through the orange disc cones as quickly and accurately as possible.

You plant your foot as round the last cone. Your legs are beginning to feel heavy but then, looking up, you see only a few feet of grass between yourself and the finish line ahead. You've almost made it! Excitement creeps in to your mind and you use it for one last push of energy. Opening up your stride with each step, you feel your cleats dig deep into the dirt and you press firmly, accelerating forward faster and faster. Your arms cut through the air, driving you forward as you speed up with each passing second. You are in complete control of the ball. You push it ahead and quickly close the gap. You're breathing hard at this point and you can hear each breath as you inhale fresh, clean, oxygen and then let it out.

As you cross the finish line, you hear someone say "stop" and you exhale again, clearing your lungs. You walk over to your ball and begin slowly dribbling it back to the starting line as you deliberately try to catch your breath. Controlling your breathing, you feel a sense of joy as you think back over your last attempt and ready yourself for your next turn.

