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Behavioral Skills Training to Teach Correct Heading Skills to Youth Soccer Players

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by

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ABSTRACT

Recently, concerns regarding sport-related concussions have increased within the research literature, the media, and popular culture. It is unknown to what degree purposefully striking the ball with one's head (i.e. heading) contributes to concussions within youth soccer. There is currently limited research on an effective teaching method to improve heading technique. Due to the numerous applications of Behavioral Skills Training (BST) to teach a wide variety of behaviors, the purpose of the current study was to evaluate the effectiveness of BST to teach correct heading techniques to youth soccer players. A task analysis was produced to score each header. Results indicated that BST increased the percentage of correct steps for each player. Based on social validity questionnaires administered to players and the coach, BST was rated as an acceptable form of training. After the final training session, experienced coaches evaluated video recordings of baseline and training sessions for each player and rated each player as having improved from baseline to training.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

CHAPTER I - INTRODUCTION

A concussion is a head injury that is often identified by several immediate symptoms including a brief loss of consciousness, light-headedness, blurred vision headaches, and nausea, as well as delayed signs, such as sleep irregularities, fatigue, and lethargy (Delaney & Frankovich, 2005). According to McCrory et al. (2013), and the Centers for Disease Control and Prevention (2003), a concussion is considered a form of traumatic brain injury. Over the last several years, there has been an increased focus on sports-related concussions, particularly in regard to younger athletes (Guskiewicz & McLeod, 2011; Rivara & Graham, 2014). Currently, little data exist to accurately estimate the incidence of concussions across a variety of youth sports. Many concussions go unreported, resulting in a possible underestimate of sports-related concussions (National Research Council, & Committee on Sports-Related Concussions in Youth, 2014). It is estimated 1.6 million to 3.8 million sports-related traumatic brain injuries (TBIs) occur each year; although this estimate may still be low due to the amount of injuries that remain unrecognized or unreported (Langlois, Rutland-Brown & Wald, 2006).

Concussions occur in all sports, with the highest incidents reported in football, hockey, rugby, soccer, and basketball (Harmon et al., 2013). Gessel et al. (2007) investigated the estimated epidemiology of concussions in a nationally representative sample of high school athletes. Based on this estimate, the majority of concussions resulted from participation in football (40.5%), followed by girls' soccer (21.5%), and boys' soccer (15.4%). Physiological differences between adolescent athletes and adult athletes (i.e. fitness levels, head-to-body ratio, neck muscles, weight and mass) allow for

more susceptibility/exposure to concussions (Buzzini & Guskiewicz, 2006). Boden, Kirkendall, and Garett (1998) suggest that the majority of concussions are due to "player to player contact especially head to head contact" (p.316). Concerns over concussions in soccer developed later than other sports, such as football, with soccer not considered a "high-risk sport" for concussions until research uncovered a significant increase in risk of concussion while playing (Delaney et al., 2001).

Barnes et al. (1998) surveyed soccer participants (n = 137) at the 1993 United States Olympic Festival men's and women's soccer competition. Over half of the men and over one-third of the women reported a history of multiple concussions. Fuller, Junge, and Dvorak (2005), examined head injuries from six years of Federation International Football Association (FIFA) competition of 1,633 recorded injuries; 237 were to the head and 11 to the neck. Of the 248 head and neck injuries, 194 (78.2%) were sustained by men and 54 (21.8%) were sustained by women. The higher the level and the more competitive the play, the more likely concussions are to occur (Kirkendall, Jordan, & Garrett, 2001).

Covassin, Swanik, and Sachs (2003) conducted a study over the course of a sport season. Certified athletic trainers recorded weekly injuries from the first day of preseason practice to the final post-season game. Results concluded that male soccer players sustained a greater number of concussions than either male basketball players and baseball players. Female soccer players had a greater number of concussions than individual sports including female lacrosse players, female basketball players, female gymnasts, and female softball players (Covassin et al., 2003).

As stated earlier, it is currently unknown the degree to which heading contributes to the overall rate of soccer-related concussions. It is also noteworthy that, regardless of the contribution of headers to the frequency of concussions, not all head injuries in soccer can be attributed to heading. Falling to the ground, head-to-head contact between opposing players, and other impacts to the head could contribute to the frequency of concussions in soccer. However, in 2014, a group of parents from Northern California filed a class-action lawsuit against the American Youth Soccer Organization (AYSO), Federation International de Football Association (FIFA), and U.S. Soccer. The plaintiffs, in a 131-page complaint, addressed each of the organizations' negligence toward adopting proper guidelines for concussion management. In response to the lawsuit on August 20, 2016, U.S. Soccer issued new rules for heading in youth soccer to help prevent future concussions and head injuries. U.S. Youth Soccer Policy. Rule 305, states:

> "All players age 10 and younger shall not head the ball directly from the air in any match or competition, nor shall these players practice heading the ball in any organized team setting. Players age 11 and 12 shall be permitted to head the ball in any match or competition. These players may practice heading the ball in an organized team practice or skill session, but coaches must monitor this practice so not one player is heading the ball more than 25 time per week, regardless of setting. Players age 13 or older shall be permitted to head the ball in any match or competition and these players may practice heading the ball in an organized team practice or skill session." (p.7)

The fourth consideration in the Class Action Complaint that addresses why youth soccer players are more vulnerable discusses poor technique by stating "heading is less risky

when kids use their head and neck correctly; the reality is that few do" (p. 33). The result of the rule change by FIFA and U.S. soccer, however, may decrease the amount of time children are exposed to appropriate instruction on proper heading technique. The limitation of proper technique practice with executing headers could potentially lead to higher incidents of header-related injures due to poor and improper use of the head and neck. As such, this policy may pose risk for increasing the future overall frequency of concussions over time.

There are many steps involved in executing a safe and effective header. Proper heading technique should be taught by a qualified individual (Delaney & Frankovich, 2005). Players must focus on body positioning along with where they should make contact with the ball that will decrease impact. Studies discuss many preventative measures such as lightweight balls and head gear (Barnes et al., 1998; Delaney & Frankovich, 2005). Although preventative measures are discussed, there is currently limited research on an effective teaching method to improve heading technique. Given the lasting consequences of repeated head injuries, including concussions, learning to execute movements that purposefully use the head is vital in maximizing player safety, both in short and long term playing history. As with many sports, little quality research exists in the identification of effective methods to teach a variety of simple to complex skills.

Research has demonstrated the potential of applying behavior principles into sports in several ways (Allison & Ayllon, 1980; Luiselli, Woods, & Reed, 2011). Further behavior analytic research should be conducted to assess effectiveness, accessibility, and satisfaction in sports performance interventions (Luiselli, Woods, & Reed, 2011). Almost

40 years ago, Allison and Ayllon (1980) asserted that “exploratory research in the area of the application of behavioral procedures to sport and physical education has been scarce” (p. 313). Although the application of behavioral procedures to sports has increased over the decades, the specific use of behavioral procedures to improve soccer skills remains limited.

Sports Intervention and General Behavioral Procedures

Brobst and Ward (2002) examined behavioral sport interventions by implementing a package of public posting, goal setting, and verbal feedback on the skills of three high school soccer players during practice scrimmages. Public posting refers to a method that makes data on performance viewable to the public and often includes an oral feedback component. Goal setting provides specific criterion that is used as a performance standard. Public posting, goal setting, and verbal feedback were implemented sequentially across three behaviors. First, occasions in which a player receives the ball and dribbles for at least 5 seconds without losing possession to another player were labeled as movement with the ball. Second, player movement to an open space to receive the ball that is kicked or thrown to them to resume play during restarts (i.e., throw ins, corner kicks) was labeled as movement during restarts. Third, player movement to a supporting position after passing the ball was labeled as movement after the player passed the ball. Results indicated that the interventions were effective in improving performances during scrimmages but produced limited generalization to game settings. Brobst and Ward (2002) reported that the greatest strength of the procedure was

providing players objective measures of their performances, thus allowing them to modify behaviors.

Ziegler (1994) examined the effects of an attentional shift training program on the performance skills during soccer drills with collegiate soccer players. Attentional shifting is comprised of the direction of attention, the "breadth" of focus, and the ability of the individual to shift their focus of attention. Participants were selected based on freshman or sophomore status at the University, coach's rating, individual interviews, and low scores on Martens' (1998) test of attentional shift. Martens' (1998) test of attention shift is comprised of 12 sport-related situations that asks participants to rate their attentional shift effectiveness. For the study, subjects were then rated on their ability to hit targets during four soccer drills. Points were scored based on each drill, when participants executed all passes for that drill with a one-touch pass and when the ball was kicked to the correct receiver holding the designated target. Targets were cards that displayed a geometric shape, color, letter, or number. Drill 1 required the player to receive the ball from the experimenter and execute a one-touch pass to the person holding the designated target. Drill 2 was similar other than the targets were mixed (i.e., each target displayed different numbers, letters, colors, or shapes). Drills 3 and 4 were similar, but the complexity of the targets increased which included the name of a color appeared on a card but written in a different color (i.e., the word *red* written in blue lettering). Each athlete received three attempts for each of the four drills.

A progression of activities for training included two phases: an information phase and an application phase. The information phase consisted of a lecture of attentional shifting skills which included controlled practice of attentional shifting via concentration

grids and attentional drills in the office. The application phase consisted of practicing attentional shift skills while executing soccer drills. The intervention was individually conducted in two sessions with each of the four athletes. Results indicated that attentional shift training program can improve athletes' performance during soccer drills, such as those conducted within the study, that require multiple attention shifts.

Other types of behavioral interventions have included systematic verbal instructions and feedback, positive and negative reinforcement, positive practice, and time out in three different sports: football, gymnastics, and tennis (Allison, & Ayllon, 1980). Boyer et al. (2009) implemented the use of video modeling and feedback to improve the execution of gymnastic routines in four female competitive gymnasts. Hume and Crossman (1992) evaluated the effectiveness of using music contingent on certain practice behaviors in competitive swimmers. Stokes et al. (2010) include descriptive feedback with and without video feedback and teaching with acoustical guidance as an intervention to improve blocking skills in high school football athletes. One of the more researched methods used to teach a variety of simple and complex behaviors involves Behavioral Skills Training (BST), but surprisingly little research has specifically applied BST to the teaching of sports-related skills.

Behavioral Skills Training and Sports Intervention

According to Himle and Miltenberger (2004) BST is comprised of instruction, modeling, rehearsal, and praise or corrective feedback, and has been applied across multiple areas. Johnson et al. (2005) examined the effectiveness of individual BST to train 13 preschool children in abduction prevention skills. BST has been used to teach

children safety skills to use when or if they find a gun (Himle and Miltenberger, 2004). Stocco, Thompson, Hart, and Soriano (2017), evaluated the effectiveness of BST to improve interview skills of college students. Across the literature, BST has been demonstrated to be an effective method for teaching a variety of skills.

The initial step of BST includes instruction which consists of providing written and/or verbal information regarding the steps of a skill to the participant. For example, Himle and Miltenberger (2004) discussed the danger of firearms to children during the instruction component. Johnson et al. (2005) discussed with children the types of lures used by an abductor and the appropriate safety skills to use when presented with a lure. Instruction allowed the researcher to clarify and provide a description of the skill. For the most part, instruction has rarely been evaluated alone, and is often delivered with other components of BST, such as modeling. A unique exception to this was offered by Sterling-Turner, Watson, and Moore (2002), in which teachers received written and spoken instruction on a behavioral intervention protocol to be used in their classes. This instruction alone was insufficient in the acquisition of accurate implementation of the behaviors outlined in the protocols. Moore and Fisher (2007) also evaluated an instruction-only condition in the training of clinic staff in the correct implementation of functional analysis methodology. They used written protocol and lecture with PowerPoint™, followed by a written exam in which each participant earned scores of 100%. Despite their ability to pass the exam, however, no participant was able to achieve acceptable rates of accuracy in the implementation of functional analysis conditions following only instruction.

Secondly, modeling allows the researcher to specifically show how the skill should be performed. For example, Himle and Miltenberger (2004) modeled appropriate firearm safety by approaching a disabled firearm and said, “do not touch” (p. 4). Johnson et al. (2005) demonstrated appropriate responses in the context of different abduction lures. Models can involve other people acting out the targeted behavior live in front of the participants or may involve showing the trainee videos of models. Moore and Fisher (2007) found that video models that contain exemplars of all potential therapist behavior were sufficient to produce mastery performance of functional analysis conditions.

Rehearsal, also called role play, refers to allowing practice of the skill until the trainee achieves mastery. Himle and Miltenberger (2004) provided participants opportunities to practice correct responding when approaching a firearm. Johnson et al. (2005) allowed each participant to rehearse the safety skills in different scenarios. Smith, Parker, Traubman, and Ivar (1992) found that training packages that included rehearsal produced superior behavioral acquisition to similar programs that omitted rehearsal. Sterling-Turner et al. (2002) found that rehearsal with feedback was sufficient to produce improved performance for teachers implementing complex behavioral protocols.

Feedback involves providing positive praise for correct responses or corrective feedback for incorrect responses. Himle and Miltenberger (2004) delivered praise each time the participant correctly executed firearm safety. If the participant did not engage in the correct response, the trainer corrected the error, modeled the appropriate response and the participant would continue to rehearse the correct response. Johnson et al. (2005) provided praise for correct responses and further instruction was issued to correct errors. The participant would then rehearse the skills until the skills were demonstrated

correctly. According to Miltenberger (2008), feedback should be delivered as immediately as possible. Although much of the earlier research on BST utilized post-session feedback, more recent studies have included in-situ, or "in-the-moment" feedback.

Research Employing BST to Skill Acquisition in Sports

Research implementing BST to improve skill acquisition in sports is limited. Tai (2016) was the first study to evaluate BST in a sports setting. BST was used to teach safer tackling techniques among six youth football players. First, the researcher instructed the participant on each step of the task analysis. After instruction, the researcher modeled each step with a tackle dummy to provide a visual example for the participant to see what each step should look like. The participant rehearsed the steps in the task analysis using the tackle dummy, after each rehearsal tackle the researcher provided feedback describing which steps the participant performed correctly and incorrectly. Data were collected during a two-month long season using video recording. Intervention consisted of three to four trials during practice in which each participant demonstrated his tackling skill. Data were recorded based on a 10-step task analysis. BST was used to teach each step of the correct and safer tackle as listed in the 10-step task analysis. Training sessions ended after the participant demonstrated tackling at 100% accuracy per the task analysis. Based on review of the results an increase in safer tackling skills along with a decrease in the amount of unsafe tackles was demonstrated as well as generalized to game settings.

In a recent application of BST with other behavioral methods, Moore and Quintero (in press) conducted a comparison of forward and backward chaining to teach

adults Olympic weightlifting techniques. A concurrent multiple baseline across participants with embedded adapted alternating treatment design features was used to assess the effects of forward and backward chaining to improve technique for the clean and the snatch.

Following baseline, behavioral skills training with video and verbal in-situ performance feedback was used to teach both lifts. For Phase I each lift was randomly assigned to either forward or backward chaining. During Phase II, if one lift was mastered and the other was not, the teaching technique (forward or backward chaining) was applied to the non-mastered lift. After performance for both lifts reached mastery, participants returned for two additional follow-up sessions to assess maintenance of accurate technique.

Results indicated all participants showed improved skill acquisition under forward chaining. In Phase I, participants showed improvement over baseline across both lifts that were taught using forward chaining. During Phase II, when forward chaining was applied to unmastered lifts, percent of correct steps and weight lifted increased across all four participants. Accuracy and continued improvements in weight lifted were observed across follow-up sessions. Though this study employed BST in training, the main investigation related to comparing forward and backward chaining.

Summary and Purpose

Although multiple studies have applied behavioral principles to enhance performance in multiple sports, more research is needed in soccer that addresses safety and appropriate techniques for game play. Furthermore, given the aggressive use of the

head and neck as a part of competitive play, more research is needed to evaluate the potential of behavioral procedures for teaching heading skills to youth players. There are no current studies examining the effectiveness of BST and soccer skill acquisition. Due to the lack of research on teaching heading techniques in youth soccer and the proven efficacy of BST for teaching skills, the purpose of this study was to evaluate the effectiveness of BST to teach skill acquisition of heading technique to youth soccer players. Specifically, this study evaluated the following questions:

1. Will Behavioral Skills Training lead to the performance of correct technique in youth soccer players?
2. Will correct technique maintain after discontinuation of BST sessions?
3. Will these procedures be considered acceptable to coaches and players?
4. Will experienced coaches rate an improvement of heading skill from baseline and training?

CHAPTER II – METHOD

Participants

Three 12-year old female soccer players were recruited from a local middle school soccer team. Victoria played recreational soccer since she was 5 years old. Mary played recreational soccer since she was 9 and Lacey played recreational soccer since she was 8. For all players, this was their second year playing for the middle school soccer team. Players did not play soccer at the competitive (i.e., DIII, also called "club" or "select") level. Players served as participants based on their expressed interest in improving their heading technique and parent consent (Appendix B). Criterion for players to participate was a score of 64% or lower (i.e., 5 or more incorrect, incomplete, or unperformed steps) based on the 14-item task analysis. Prior to baseline, the researcher distributed and reviewed with each participant the minor assent form prior to baseline (Appendix C).

Participants also included experienced coaches that have coached at the collegiate, high school, and competitive (DIII) level to rate video footage following training. Coaches were selected to participate based on expressed interest.

Materials and Setting

In order to minimize the risk of head injury, a size four eight-inch foam training ball was employed throughout the study. Sport cones were used to indicate the five-yard distance needed between player and researcher during each trial. An iPad was utilized through each phase to video record each trial for scoring purposes. All sessions were video recorded using the Hudl Technique application. Hudl is a free recording application that allows the user to record any technique to review in slow motion. The application

also allows for side-by-side video comparisons. Researchers recorded sessions to visually analyze the slow-motion video to accurately score each trial to quickly assess performance. Trainings for this study were conducted at the team's practice field located on campus during regular practice days and times.

Dependent Variable

The main dependent variable for this study was the percent of correct steps performed based on a 14-step task analysis of correct heading technique (Appendix A). The percent of correct steps performed was calculated by dividing the number of correctly implemented steps by the total task analysis steps, and then multiplying by 100%. The task analysis was developed by observing headers and breaking down each step of the header into 14 components. The task analysis was also reviewed by a sample of expert coaches at the collegiate, high school, and competitive (DIII) level. Their feedback helped guide the creation of the task analysis. The researcher met with coaches in-person as well as electronically distributing the task analysis for feedback. The primary researcher asked coaches to provide feedback if steps needed to be worded differently, if there were steps missing, or if steps needed to be added. Coaches provided feedback for steps 1, 9, 11, and 13 specifically.

Coaches suggested that for step 1 eye contact must be maintained up until physical contact is made with the ball not just initial eye contact. This would allow the player to keep the ball in their field of vision and move their body and position accordingly. Suggestion for step 9 was to include that a player's arms are used for balance and support. For step 11, the suggestion was to include making contact with the

ball at the highest point. A coach suggested, for step 13, to include the hips and back as to provide more support through the entire movement.

Measurement and Interobserver Agreement

A second observer was trained on each component of the task analysis to identify all the steps that are executed correctly and all the steps that are missed in the task analysis. Training the observer consisted of watching sample videos. Sample videos included correct headers and incorrect headers. A criterion of 90% agreement with the primary investigator for each video was met in order to consider an observer trained. IOA was collected by dividing the number of agreements on the steps of task analysis by the number of steps in the task analysis and multiplying by 100% to calculate a percent of agreement.

For Victoria IOA was collected for 100% of baseline sessions, 100% of training sessions, and 50% of follow-up sessions. Baseline IOA ranged from 92% to 100% and an average of 98%. IOA for training sessions ranged from 85% to 100% and an average of 98%. For follow-up sessions IOA ranged from 92% to 100% and an average of 96%. IOA was collected for 57% of baseline sessions, 100% of training sessions and 50% of follow-up sessions for Mary. Baseline IOA ranged from 92% to 100% and an average of 94%. IOA for training sessions ranged from 85% to 100% and an average of 95%. IOA range and average for follow-up sessions were 100%. For Lacey IOA was collected for 50% of baseline sessions, 100% of training sessions, and 50% of follow-up sessions. IOA range and average for baseline sessions were 100%. IOA for training sessions ranged from 85% to 100% with an average of 95%. IOA ranged from 92% to 100% with an average of 96% for follow-up sessions.

Experimental Design and Procedures

A multiple baseline across participants design was used to evaluate the implementation of BST to improve heading technique. Training sessions lasted between 30-60 minutes.

Baseline

Data collection for heading drills was conducted during practice sessions prior to intervention. Players participated in a heading drill with the researcher. A size four eight-inch foam ball was used during the heading drill. The heading drill consisted of the player standing five yards away from the researcher. The researcher tossed the ball to the player, and the player executed a header. The researcher set up trials for each participant to demonstrate heading skills as they typically would engage in a header. No feedback was given for correct or incorrect headers. Each player engaged in the heading drill and each baseline session was recorded for scoring purposes.

Behavioral Skills Training

Behavioral Skills Training was used to teach each step of the 14-step task analysis. Training was implemented by the primary researcher. Instruction was provided initially during the BST phase. The researcher began training by providing the player verbal instruction (Appendix E) on each step of the task analysis by reading and reviewing each step of the task analysis in detail with each player. Each step of the task analysis was modeled by the researcher for the player to observe. Players would then rehearse the steps with the foam soccer ball. Rehearsal time varied across participants depending on how they performed, although rehearsal time did not exceed 12 minutes for each participant. After each demonstrated header, the researcher provided descriptive

praise of correct steps, and explained which errors were made, along with describing what the alternative, correct response should be. The training session ended once the participant demonstrated heading skills with 100% accuracy based on the task analysis. After training, the players executed headers using the same heading drill described in baseline.

Follow-Up

Follow-up sessions were conducted for each participant. Follow-up trials simulated training trials to assess the maintenance of accurate technique based off the 14-step task analysis.

Social Validity

At the final training, participants were provided with a 5-point Likert scale survey (refer to Appendix F) adapted from Tai (2016) to evaluate how players and coaches rate the effectiveness of training.

Experienced Coaches Ratings

After the final training, video recordings from the first session of baseline and the last training session were evaluated by experienced coaches (i.e. collegiate, high school, and competitive (DIII) level). Coaches were not provided with the utilized task analysis. Coaches were provided with a 5-point Likert scale survey (refer to Appendix G) to evaluate how players executed headers during baseline as compared to headers in the final training session. The provided Likert-scale summarized the task analysis into 4 major components. The 4 major components were selected by the expert coaches during the initial review of the task analysis. Each experienced coach was provided with a pre-training video as well as a post-training video for each participant. Experienced coaches

were randomly assigned video recordings and were not aware which video represented pre-training or post-training. Coaches observed the same 2 videos for each player.

Safety Protocol

There are no expectations that the training protocol would lead to an increase in injury exposure. Despite this, a safety protocol was implemented, that included a symptom checklist (Appendix H) following each session (Piland, 2017). After the consent form was signed by either a parent or guardian, the researcher verbally reviewed each item on the symptom checklist with the participants prior to the first session of baseline. Researcher stated that if any participant begins to feel any symptoms related to the symptom checklist during or after each session they should immediately report to the researcher. If symptoms emerge mid-session; participants were to report to the researcher and the session would end. If participants reported symptoms either during or after sessions, the researcher reviewed the checklist more thoroughly with the participant. Any symptoms reported under these set conditions would warrant a referral to the closest medical center. Throughout this study none of the participants reported experiencing symptoms.

CHAPTER III - RESULTS

Figure 1 depicts data for percentage of correct steps through all phases for all participants. Each participant demonstrated an overall increase of percentage for correct steps from baseline to training. Victoria (top panel) engaged in an average of 53.3% of correct task analysis steps during baseline (range = 42-64%). During the BST training phase, she improved her correctly implemented steps to an average of 98% across all sessions (range = 92-100%). Victoria demonstrated correct implementation an average of 98% during the follow-up sessions, demonstrating maintenance of the trained skill (range = 92-100%).

Mary (middle panel) engaged in the correct task analysis steps, on average, 36% of the time across all baseline sessions (range = 28-42%). Her performance improved to an average correct execution on 91.2% of the steps across all sessions (range = 71-100%). Once training was terminated, Mary returned to perform follow-up trials. Mary averaged correct performance on 100% of the header steps across all trials, demonstrating maintenance of the acquired skill.

Lacey (bottom panel) averaged 25.2% correctly implemented steps across all sessions during baseline (range = 14-35%). Her performance improved to an average of 95.4% correct steps across all sessions (range = 92-100%). Lacey averaged 100% of the steps implemented correctly during follow-up, demonstrating the acquired behavior maintained in the absence of continued training.

Table 1 depicts the social validity surveys that were administered to players and coach. These data suggest that behavioral skills training was considered to improve heading technique as well as a recommended form of training. Every participant strongly

agreed that BST as a form of training improved their heading skills, that they head the ball more safely, and they enjoyed behavioral skills training as the form of training. All of the participants strongly agreed that they felt more confident in their heading skills following training. 2 of the participants strongly agreed that it is important to learn safe heading technique, while 1 participant agreed that it is important to learn safe heading technique. 2 of the participants agreed they would recommend this training to other players, while 1 of the participants strongly agreed they would recommend this form of training.

Experienced coaches were provided video records of the first session of baseline and last training session for each participant. Baseline videos and training videos were randomly assigned to experienced coaches for rating. Coaches were provided a 5-point Likert Scale that summarizes key points of a header to rate each video. An average of experienced coach ratings for each participant are summarized in Table 2. Victoria exhibited an average rating of 3.7 during baseline for question 1 and slightly improved eye contact to a rating of 4.2 during training. Concerning athletic stance, Victoria improved from a rating of 1.5 to a rating of 3.2 from baseline to training according to coaches. Victoria also improved from a rating average of 2 to 4.2 from training to baseline in regard to making contact with the ball with the forehead. Victoria improved her follow through from baseline to training from a rating of 2.7 to 4.5. According to experienced coaches, Victoria exhibited an improvement in overall heading technique from a 2.2 rating to a 3.7 rating.

Mary improved from a rating of 3 to 4 rating for making eye contact with the ball. According to coaches Mary improved from a 1.5 average rating to an average rating of

3.5 for her athletic stance. Mary's follow-through improved from an average rating of 2.2 to an average rating of 4 according to coaches. Mary improved making contact with the ball using her forehead with an average rating of 1.7 in baseline to an average rating of 3.2 in training. Mary's overall heading technique improved from an average rating of 1.7 during baseline to an average rating of 3.5 after training.

For eye contact, Lacy received an average rating of 3 for baseline and 4.2 for training. Lacey's athletic stance improved from 2.5 to 3.7. Lacy improved making contact with the ball using her forehead with a rating of 3.5 to 4 from baseline to training. Lacey's follow-through improved from a 2.2 to 3.5 and her overall heading technique improved from a 2.5 to 5.

CHAPTER IV – DISCUSSION

Soccer is a sport that utilizes a unique feature of using a player's head to direct and control the ball during play. It is currently unknown the degree to which heading contributes to soccer-related concussions. Delaney and Frankovich (2005) discuss the importance of proper heading technique and that heading should be taught in a supervised and controlled setting. This study suggests that behavioral skills training is an effective training method for teaching a specific soccer-related skill. Specifically, research questions included:

1. Will Behavioral Skills Training lead to the performance of correct technique in youth soccer players?
2. Will correct technique maintain after BST implementation?
3. Will these procedures be considered acceptable to players?
4. Will experienced coaches rate an improvement of heading skill from baseline and training?

The results of this study provide an affirmative answer to Question 1, by showing an overall increase in the percentage of correct steps for executing a correct header based on the 14-step task analysis after behavioral skills training was utilized. Victoria exhibited somewhat variable responding through baseline, but scores increased and remained stable following training. Mary and Lacey exhibited low averages of responding during baseline, but scores increased and remained at 100% for the remainder of training.

Question 2 was confirmed based on data collection. During follow-up correct technique was maintained across all participants. Follow-up trials simulated training trials. Victoria's responding improved after the initial trial and remained at 100% of correct steps throughout follow-up. Mary and Lacey remained at 100% of correct steps during follow-up. These data strongly suggest that the BST led to strong acquisition of the trained behavior, resulting in a lasting and firm maintenance of those behaviors over time.

Luiselli, Woods, & Reed (2011) mention that future research should evaluate acceptability and satisfaction with sports performance intervention and procedures. The distributed social validity surveys provide an answer to Question 3. Players expressed acceptability for behavioral skills training as a form of training. Behavioral skills training was feasible to implement during normal practice times.

Question 4 was addressed utilizing a 5-point Likert scale, because external experienced coaches review baseline videos and training videos provided insight to coaching expertise. An evaluation of ratings from pre to post training for each player demonstrates that there are improvements from baseline to training. Some improvements are more subtle than others but experienced coaches expressed overall improvements for each player. Coaches' previous experiences may have influenced overall expectations of a correct header.

The current study extends a small literature base in which BST has been used to train specific skills used in various sports. This is the first study to examine the use of BST to train correct heading technique in soccer. The results of this study are consistent with previous studies that have utilized BST to improve new skills. Utilizing behavioral

skills training to train young players may allow for players to be exposed to appropriate instruction on proper heading technique.

As these results are preliminary findings, there are limitations that future studies should consider. Limitations of this study may include only examining female participants. Future research should investigate male participants and their skill acquisition for heading. The most significant limitation is that this study did not examine the generalization of training into game play. Players many not be provided the opportunity to head a ball during a game and the number of remaining games for the season was limited throughout this study. Future research should examine the generalization from training into game play as well as, generalization to a soccer ball as compared to the utilized foam ball.

This foundational study expands the use of behavioral principles in sports, more specifically it is the first study to examine BST to improve heading technique in soccer. Luiselli, Woods, and Reed (2011) review numerous forms of interventions such as goal setting, modeling, and feedback that have been implemented in different sports. Luiselli, Woods, & Reed (2011) also suggests that "other intervention methods appear to be promising but require further evaluation" (p. 1001). This study explores a common behavioral method of training but is implemented in an area of soccer that has not been previously examined from a behavioral perspective. This study expands the use of behavioral principles in sports, answering the call of Allison and Ayllon (1980) which emphasized the shortage of applying behavioral procedures to sports.

Table 1 – *Player Acceptability*

Participant Questions	**Average Rating**
1. This training improved my heading skills	5
2. It is important to learn safe heading technique	4.6
3. I feel I head a soccer ball more safely	4
4. I enjoyed this style of training	4.6
5. I am more confident in my heading skill	5
6. I would recommend this training to other players	4.3

Table 2 – *Experienced Coaches Ratings*

Average Expert Ratings						
		Q1	Q2	Q3	Q4	Q5
Victoria	Baseline	3.7	1.5	2	2.7	2.2
	Training	4.2	3.2	4.2	4.5	3.7
Mary	Baseline	3	1.5	2.2	1.7	1.7
	Training	4	3.5	4	3.2	3.5
Lacey	Baseline	3	2.5	3.5	2.2	2.5
	Training	4.2	3.7	4	3.5	5.2

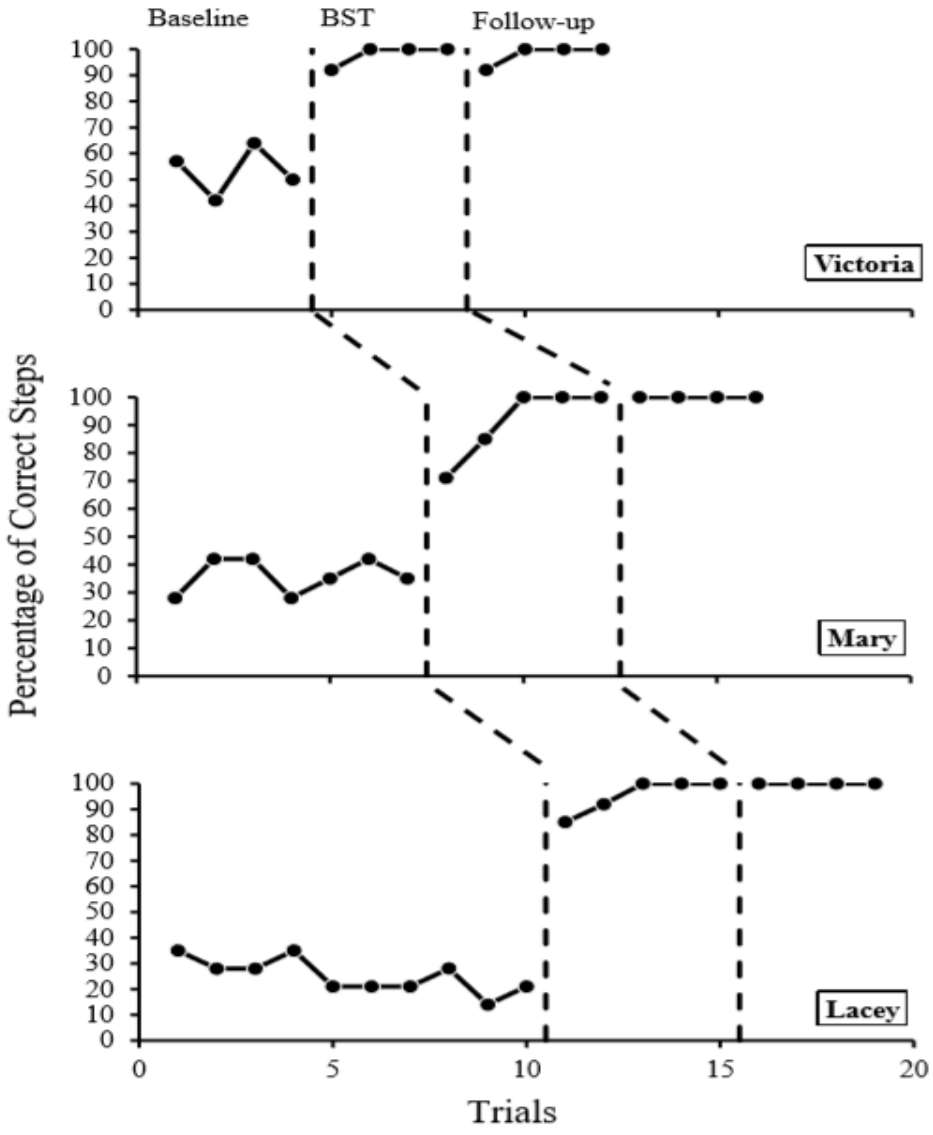

Figure 1. Percentage of correct steps for Victoria (top panel), Mary (middle panel), and Lacey (bottom panel) across baseline, training, and follow-up phases.

APPENDIX A – IRB Approval Letter

THE UNIVERSITY OF
SOUTHERN MISSISSIPPI

INSTITUTIONAL REVIEW BOARD
118 College Drive #5147 | Hattiesburg, MS 39406-0001
Phone: 601.266.5997 | Fax: 601.266.4377 | www.usm.edu/research/institutional.review.board

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.
  Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 17101708
PROJECT TITLE: Behavioral Skills Training to Teach Safe Heading Skills to Youth Soccer Players
PROJECT TYPE: Master's Thesis
RESEARCHER(S): Laura Quintero
COLLEGE/DIVISION: College of Education and Psychology
DEPARTMENT: Psychology
FUNDING AGENCY/SPONSOR: N/A
IRB COMMITTEE ACTION: Expedited Review Approval
PERIOD OF APPROVAL: 11/13/2017 to 11/12/2018
Lawrence A. Hosman, Ph.D.
Institutional Review Board

APPENDIX B – Parent Consent Form

ORI | Office of Research Integrity

INSTITUTIONAL REVIEW BOARD

PARENTAL CONSENT FORM

PARENTAL CONSENT PROCEDURES
This document must be completed by the Principal Investigator and signed by the parent or guardian of each potential research participant. • The Project Information and Research Description sections of this form should be completed by the Principal Investigator before submitting this form for IRB approval. • Signed copies of the long form consent should be provided to a parent or guardian of every participant. Last Edited May 22nd, 2014

Today's date:		
PROJECT INFORMATION		
Project Title: Evaluating Behavioral Skills Training to Teach Headers to Youth Soccer Players		
Principal Investigator: Laura M. Quintero	Phone:601-519-9460	Email: laura.quintero@usm.edu
College: Education and Psychology	Department: Psychology	
RESEARCH DESCRIPTION		

1. **Purpose**:
   The purpose of this study is to evaluate the effectiveness of Behavioral Skills Training to teach correct and safe heading techniques to youth soccer players.

2. **Description of Study:**

   Behavioral skills training is comprised of instruction, modeling, rehearsal, and praise or corrective feedback.

Baseline: During baseline, a size 4 eight-inch foam ball will be used during the heading drill. The heading drill will consist of the player standing 5 yards away from the researcher. The researcher will toss the ball to the player. The researcher will set up trials for each participate to demonstrate heading skills as they typically would engage in a header. No feedback will be given for correct or incorrect header.

Behavioral Skills Training: Behavioral Skills Training will be used to teach each step of the 14-step task analysis. Training will be implemented by the primary researcher. The researcher will begin by giving the player verbal instruction on each step of the task analysis. Each step from the task analysis will then be modeled by the researcher for the player to observe. Once the researcher has modeled each step, players will rehearse the steps from the task analysis with the foam soccer ball. After the participant demonstrates heading the foam ball, the researcher will provide verbal descriptive feedback describing which steps were done correctly and which steps could be improved.

Follow-up: Two follow up sessions will be conducted two weeks post-training. Follow up trials will simulate training trials to assess the maintenance of accurate technique based off the 14-step task analysis. If a player regresses during the follow up sessions; 2 more sessions of training will be conducted along with additional follow up sessions.

3. **Benefits:**

The major benefit of this study is the evaluation of a training procedure that will improve a player's ability to effectively head a soccer ball as a possible preventative measure for injury.

4. **Risks:**

There are no expectations that our protocol would lead to an increase in injury exposure. In order to minimize the risk of head injury, a size 4 eight-inch foam training ball will be employed throughout the study. We've implemented a safety protocol that will include a symptom checklist following each session. After the consent form is signed by either a parent or guardian, the researcher will verbally review each item on the symptom checklist with the participants prior to the first session of baseline. Researcher will state that if any participant begins to feel any symptoms related to the symptom checklist during or after each session they should immediately report to the researcher. If symptoms emerge mid-session; participant is to report to the researcher and the session will end. If participants report symptoms either during or after sessions, the researcher will review the checklist more thoroughly with the participant. Any symptoms reported under these set conditions would warrant a referral to the closest medical center.

5. **Confidentiality:**

The baseline and treatment sessions will be videotaped for data collection. However, the videos will not be used in publications or conference presentations without specific additional written consent. Videos will be stored on a secure laptop. All raw data will be stored in a locked office only accessible to members of the reseracher team. Confidentiality will be assured.

6. **Participant's Assurance:**

This project has been reviewed by the Institutional Review Board, which ensures that research projects involving human subjects follow federal regulations.

Any questions or concerns about rights as a research participant should be directed to the Manager of the IRB at 601-266-5997.Participation in this project is completely voluntary, and participants may withdraw from this study at any time without penalty, prejudice, or loss of benefits.

Any questions about the research should be directed to the Principal Investigator using the contact information provided in Project Information Section above.

PARENTAL CONSENT INFORMATION	
Participant's Name:	Participant's Age:
Parent or Guardian's Name:	
Person Soliciting Parental Consent:	

AGREEMENT TO ALLOW PARTICIPATION IN RESEARCH

Consent is hereby given to participate in this research project. All procedures and/or investigations to be followed and their purpose, including any experimental procedures, were explained. Information was given about all benefits, risks, inconveniences, or discomforts that might be expected.

The opportunity to ask questions regarding the research and procedures was given. Participation in the project is completely voluntary, and participants may withdraw at any time without penalty, prejudice, or loss of benefits. All personal information is strictly confidential, and no names will be disclosed. Any new information that develops during the project will be provided if that information may affect the willingness to continue participation in the project.

Questions concerning the research, at any time during or after the project, should be directed to the Principal Investigator with the contact information provided above. This project and this consent form have been reviewed by the Institutional Review Board, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research participant should be directed to the Chair of the Institutional Review Board, The University of Southern Mississippi, 118 College Drive #5116, Hattiesburg, MS 39406-0001, 601-266-5997.

Include the following information only if applicable. Otherwise delete this entire paragraph before submitting for IRB approval: The University of Southern Mississippi has no mechanism to provide compensation for participants who may incur injuries as a result of participation in research projects. However, efforts will be made to make available the facilities and professional skills at the University. Participants may incur charges as a result of treatment related to research injuries. Information regarding treatment or the absence of treatment has been given above.

_____
_____
Parent or Guardian of Research Participant **Person Explaining the Study**

_____
_____
Date **Date**

APPENDIX C – Minor Assent Form

ORI | Office of Research Integrity

INSTITUTIONAL REVIEW BOARD

MINOR ASSENT FORM

MINOR ASSENT PROCEDURES

This document must be completed by the Principle Investigator and signed by each assenting minor.

- The Project Information and Research Description sections of this form should be completed by the Principal Investigator before submitting this form for IRB approval.
- Parental consent must be obtained before soliciting the assent of any minor participating in the study.
- Signed copies of the IRB approved assent form should be provided to a parent or guardian of every assenting minor.

Last Edited May 22nd, 2014

Today's date:		
PROJECT INFORMATION		
Project Title: Behavioral Skills Training to Teach Safe Heading Skills to Youth Soccer Players		
Principal Investigator: Laura Quintero	Phone: 601-519-9460	Email: laura.quintero@usm.edu
College: Education and Psychology	Department: Psychology	

RESEARCH DESCRIPTION

1. **Why am I being asked to participate?**

   The purpose of this is to teach correct heading skills. It may help you have better body positioning when you head a ball.

2. **What will I have to do?**

   Either before or after normal practice time you will have the chance to have one-on-one training to improve your heading skills. You will be asked to head a ball like you normally would and then we'll move into training to help improve those skills.

3. **What do I get if I agree to participate?**

   You will learn a key component in soccer and you will improve your skills.

4. **Can anything bad happen if I participate?**

   We will be using a foam ball for practice. For safety reasons we will go over a checklist of items with a parent present that can help you be aware of any discomfort if you should feel any.

5. **Who will get to see information about me?**

   Each training will be video recorded but no one will have access other than the team leader. Any other information will be kept confidential in a locked filing cabinet.

6. **What if I do not want to participate?**

Participation is not required, however it may be beneficial for training purposes.

7. **Who may I contact if I have other questions or concerns about my participation?**

This project has been approved by the Institutional Review Board. Its job is to protect research participants. Questions or concerns about your participation should be directed to the Manager of the IRB at 601-266-5997.

ASSENT TO PARTICIPATE IN RESEARCH

Participant's Name:	Participant's Age:
Person Soliciting Assent:	

Check one of the following (to be completed by the person soliciting assent):

☐ In my opinion this minor is able to provide informed assent (proceed to Agreement to Participate).
☐ In my opinion this minor is unable to provide informed assent for the following reason(s) (do not proceed):

AGREEMENT TO PARTICIPATE

I agree to participate in this research project. The project has been fully explained to me and I was given the chance to ask any questions I have about it. I understand that I can stop participating at any time.

Research Participant	**Person Soliciting Assent**
Date	**Date**

APPENDIX D – Task Analysis Criteria for Correct Heading

	Steps	**Description**	**Correct?**
1	Eyes on ball	Maintain eye contact with ball up until physical contact is made with the player and ball	
2	Lead with non-dominant foot	Take one step back with dominant foot	
3	Athletic stance	Feet should be shoulder width apart; feet pointed straight; head up	
4	Keep body weight on balls of feet	Body weight is evenly distributed by keeping heels off the ground and weight is supported by metatarsal heads of feet	
5	Slight bend at knees	Both knees should be slightly bent	
6	Non-dominant shoulder facing ball	The shoulder in line with non-dominant foot should facing toward the direction in which the ball is coming from	
7	Non-dominant hip facing ball	The hip in line with non-dominant foot should be facing toward the direction in which the ball is coming from	
8	Push weight onto back foot	Push body weight onto back foot; lower heel to the ground	
9	Keep elbows bent	Keep elbows bent at ribs; use arms as support and balance	
10	Back extension	Upper body leans back from the hips	
11	Jump	Make contact with the ball at the highest point	
12	Connect with ball	Make contact with the ball using forehead	
13	Use upper body	Push hips, back, and neck forward and through	
14	Land on both feet	Player lands with both feet firmly on the ground	

APPENDIX E – Verbal Instruction of BST Script

"Let's go through each step. First, keep your eyes on the ball. Second, you want to put your non-dominant foot in front; step back with your dominant foot. For the athletic stance, keep your feet shoulder width apart with your feet pointed forward and your head up towards the ball. Once you're in the athletic stance, be sure to stay on your toes. Keep your heels off the ground and keep your knees bent. Now make sure that your shoulders and hips are facing the ball. So, if your left foot is forward your left hip and left shoulder should be facing the ball. Also, keep your elbows tucked into your ribs so you can use your arms for support and balance. When you're getting ready to jump push your weight onto your back foot and lean back from your hips. You'll want to jump to meet the ball at its highest point. Hit the ball with your forehead and push your hips and back forward and through the ball. Be sure to land on both feet."

APPENDIX F – Player Acceptability Scale

Participant Question:	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
	1	2	3	4	5
1. This training improved my heading skills					
2. It is important to learn safe heading technique					
3. I feel I head a soccer ball more safely					
4. I enjoyed this style of training					
5. I am more confident in my heading skill					

APPENDIX G – Experienced Coaches Rating Scale

Coach Question:	Strong disagree	Disagree	Neutral	Agree	Strongly Agree
	1	2	3	4	5
1. Does player maintain eye contact?					
2. Does player maintain an athletic stance?					
3. Does player make contact with the ball using the forehead?					
4. Does player follow through? (i.e. push hips, back, and neck forward and through?)					
5. Does player overall exhibit correct heading technique?					

APPENDIX H – Symptom Checklist

C.A.R.E. Plan: HIS-sideline

Name_____
Time of Injury: _____ Time of Completion: _____

Symptom Checklist: *Circle **"YES"** if you are experiencing the symptom right now. Circle **"NO"** if you are not experiencing the symptom.*

1. Do you have a **headache**?	YES / NO
2. Are you **nauseous**?	YES / NO
3. Are you having any **difficulty balancing**?	YES / NO
4. Are you feeling **fatigued**?	YES / NO
5. Are you feeling **drowsy**?	YES / NO
6. Are you having **difficulty concentrating**?	YES / NO
7. Do you feel like you are **"in a fog"**?	YES / NO
8. Are you feeling **"slowed down"**?	YES / NO
9. Are your eyes **sensitive to light?**	YES / NO
10. Do you feel **sad**?	YES / NO
11. Have you **vomited** recently?	YES / NO
12. Are your ears **sensitive to noise**?	YES / NO
13. Are you feeling **nervous**?	YES / NO
14. Are you having **difficulty remembering** things?	YES / NO
15. Are you feeling **numbness** anywhere on your body?	YES / NO
16. Are you experiencing **tingling** sensations anywhere on your body?	YES / NO
17. Are you feeling **dizzy**?	YES / NO
18. Do you have any **neck pain**?	YES / NO
19. Are you **irritable**?	YES / NO
20. Are you feeling **depressed**?	YES / NO
21. Is your **vision blurry**?	YES / NO

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