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The Effects of Feedback Statements versus Coaching Questions on Athlete Performance

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The Effects of Feedback Statements versus Coaching Questions on Athlete Performance

by

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Abstract

The Effects of Feedback Statements versus Coaching Questions on Athlete Performance

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Coaching is a term used frequently in behavioral and non-behavioral literature, yet often with a lack of clarity on form and function. One component of coaching is feedback, which is the most common intervention in Organizational Behavior Management (OBM) and has shown to be an effective treatment when implemented correctly. However, the use of questions rather than statements to improve performance has not yet been evaluated in the coaching system. The current investigation used a coaching system to separately compare the effectiveness of both interactions (feedback statements and coaching questions) to contribute to the coaching literature. Five Mixed Martial Arts (MMA) fighters participated in the study and received coaching questions and feedback statements in a randomized order. An alternating treatments design was used to evaluate the effects of the intervention on athlete performance.

Keywords: coaching, feedback, sports, Mixed Martial Arts, coaching questions

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Dedication

I am dedicating this thesis to my mother, Zeli Pereira Machado, whom saw potential in me, left her home country and family to give me a chance to get an education. My mother sacrificed everything for me, and always believed in me even when I didn't believe in myself. Through all of the hardships of being undocumented immigrants in a foreign country, you never lost sight of your dreams for me, you never gave up, and you never let me forget where we came from. Your strength and perseverance have been my true inspiration, because you broke through all barriers with honesty and kindness. Now I have the honor of making you proud, and it is all thanks to your hard work and sacrifices. Everything was worth it. "Go from your country, your people and your father's household to the land I will show you." Genesis, 12:1.

Estou dedicando esse tese para minha mãe, Zeli Pereira Machado, quem viu potencial em mim, deixou seu país natal e família para me dar uma chance de obter uma educação. Minha mãe sacrificou tudo por mim, e sempre acreditou em mim mesmo quando eu não acreditava em mim mesma. Através de todas as dificuldades de ser imigrantes indocumentados em um país estrangeiro, você nunca perdeu de vista seus sonhos para mim, você nunca desistiu, e você nunca me deixou esquecer de onde viemos. Sua força e perseverança têm sido minha verdadeira inspiração, porque você rompeu todas as barreiras com honestidade e bondade. Agora eu tenho

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Chapter 1
Introduction

If performance is important enough to be built, then, regardless of industry and area of application, it should be built to last. One suggested approach to build performance is to use coaching techniques, particularly *behavioral* coaching techniques to improve performance and aid in the generalization of skills learned in training (Seniuk, Witts, Williams, & Ghezzi, 2013; Tilka & Johnson, 2018). However, there is variability across multiple fields regarding the definition of coaching. According to the Oxford Advanced Learner's Dictionary (2011), coaching is defined as "the process of training somebody to play a sport, to do a job better or to improve a skill" (p. 1). Senuik et al. (2013) conducted a review of the term coaching and its uses in sports, Organizational Behavior Management (OBM), and in research. In sports, the term coaching has been used as a type of intervention to train athletes. In the behavior-analytic literature regarding sports, behavioral coaching has been defined as an intervention package that includes instruction, evaluating the response, feedback, modeling, and imitation. The review of the sports coaching literature by Seniuk and colleagues (2013) found that behavioral

coaching was an effective strategy to teach skills; however, there is a need to develop a behavioral coaching definition to identify what the process entails and how it should be implemented in sports settings.

The variability in the definition and application of coaching has been seen in the field of behavior analysis for years. For instance, Brown (2001) started using the word "coach/coaching" in the 1980s to describe the daily activities of effective supervisors and as a metaphor for the behavior of effective leaders. In addition, Brown (2001) used the term as a training strategy for supervisors and managers, also describing the positive role the word "coaching" had to break the barrier between behavior analysis and the business community. In a study conducted by Gravina and Austin (2018), the authors described coaching as a follow-up condition that takes place following intervention to promote generalization. The coaching condition in the Gravina and Austin study consisted of a monthly meeting to report on performance-improvement updates and to obtain feedback on the intervention. Tilka and Johnson (2018) defined coaching as "an individualized approach consisting of prompting, modeling, and differential evaluative feedback regarding job performance that is provided on an ongoing and frequent basis to employees" (p. 50-51). In the behavioral consulting field, the term coaching has been defined as a method for managing employees within a company (Seniuk et al., 2013). This inconsistency in definitions of coaching poses an issue for researchers and practitioners in behavior analysis, producing problems with the replication of

coaching research as well as with implementation in applied settings. Although there is no distinct definition of behavioral coaching, it is crucial to differentiate between coaching procedures and other interventions (e.g., training, feedback) in order to advance the science.

Coaching

Coaching as a behavior-analytic intervention has been implemented in a variety of settings, including a sales department of a window company (Tilka & Johnson, 2018), a mathematics classroom (Averill et al., 2016), and a human service setting (Gravina & Austin, 2018). Behavioral coaching has been widely applied in sports such as football, gymnastics, and tennis (Allison & Ayllon, 1980; Komaki & Barnett, 1977), as well as ballet and track (Fitterling & Ayllon, 1983). Behavioral coaching was shown to improve beginning athletes' performance immediately, and in some cases, improvement was as much as 10 times higher when compared with other coaching techniques (Martin & Hrycaiko, 1983). In addition, it has been widely accepted that traditional coaching has opportunity for improvement (Donahue, Gills & King, 1980). Although these studies found that behavioral coaching was more effective than traditional coaching, they used the term behavioral coaching as a training or teaching technique, similarly to a Behavioral Skills Training (BST) intervention, including prompting, feedback, modeling, and imitation.

Komaki and Barnett (1977) were the first researchers to apply and use the term “behavioral coaching” in sports. Winning, as a main approach to sports, has gained criticism by researchers, since it does not focus on the desired, pinpointed behaviors required to reach the terminal goals. Instead, a focus on individual athletes’ improvement has been suggested as an alternative approach. Considering the difficulty in sports for assessing performance and implementing contingent reinforcement, the authors recommended a behavioral approach to emphasize both the desired outcome (winning) and improved athlete performance. The authors suggested that the behavioral coaching approach to sports may aid in learning the basics of the sport through provision of contingent performance consequences by the coach, in addition to athletes focusing on improvement regardless of the game outcome. Komaki and Barnett (1977), implemented an intervention including a checklist, feedback, and recognition contingent on correct execution of a play. The coach chose three plays, which were each broken down into five stages. The purpose of the study was to improve the execution of the five plays. Players were presented with a description and modeling of the play and were given feedback during practice contingent on correct execution of the play. During baseline, 100% accurate execution of a play was seen in 2 out of 84 total play attempts and, during intervention, perfect execution of plays was seen in 22 out of 89 total play attempts. This application of coaching including description, feedback, and modeling is

consistent with other applications of coaching in sports, which are comparable to components of BST.

Although coaching has been used in a number of applied settings, it is still not a commonly studied technique in the behavioral research literature (Seniuk et al., 2013). In OBM Consulting, however, companies such as Aubrey Daniels International (ADI) and Alula commonly use the term in practice. For instance, ADI uses the term coaching, particularly Coaching for Rapid Change®, which includes brief interactions called "touchpoints" where the coach asks questions regarding performance to influence employees and institutionalize ideal performance (Laipple, 2012).

This gap between practice application of coaching and the lack of empirical literature poses an issue for the behavioral field due to variations in the definition and application of coaching. There is inconsistency in the behavior-analytic literature on the usage of behavioral coaching in sports and in OBM, where some studies use the term to describe an intervention package, while others use the term to describe supervisory guidance or teaching. The importance of consistency in the usage of coaching will be essential to the advancement of the procedure. Coaching has been suggested to aid in the generalization of skills acquired during training; however, there is a need for applied behavioral coaching research to identify the components that allow it to be effective.

Seniuk, et al. (2013), suggested using the effective behavioral coaching characteristics developed by Martin and Hrycaiko (1983) in order to identify whether procedures used in an intervention should be considered behavioral coaching examples or non-examples. Martin and Hrycaiko (1983) suggested that effective behavioral coaching should be applied consistently with the seven dimensions of Applied Behavior Analysis (ABA) to aid in enhancing and maintenance of athletic skills. The seven dimensions of ABA developed by Baer, Wolf, and Risley (1968) state that behavioral interventions should deal with problems of social significance (applied), focus on measurable behavior (behavioral), demonstrate experimental control (analytic), allow for replication (technological), are derived from basic principles of ABA (conceptually systematic), produce results that are socially significant (effective), and that results are transferable to novel settings (generality).

Martin and Hrycaiko (1983) developed six characteristics for effective behavioral coaching, particular to sports, derived from the seven dimensions of ABA. The first dimension focuses on athletic performance measurement as the primary source for assessing the effectiveness of a coaching procedure. This characteristic states that the measurement of athlete performance should be detailed, specific, and frequent. Before beginning a behavioral intervention (applied in any target and setting) it is necessary to develop a list of behaviors to target, linked to metrics of value to the individual and the organization (Martin &

Hrycaiko, 1983). Broad initial behaviors need to be specified and measured with precision to allow the individual to focus on improvement (Champathes, 2006). Once the list of target behaviors has been created, it is essential to conduct an assessment and use the results obtained as the basis for effective coaching. The authors recommend that coaches develop a detailed checklist with components of the target behavior to measure athlete improvement (Martin & Hrycaiko, 1983).

The second dimension of effective behavioral coaching is the differentiation between skill acquisition and maintenance, considering that well-designed procedures achieve both. Although coaching and teaching are often confused, they are different processes. Even when supervisors teach individuals what to do and what not to do, individuals may continue to perform differently (Champathes, 2006). During a training phase, coaches provide instruction while athletes are developing a new skill. Then, once the skill is in the athlete's repertoire, coaches typically assume that it is the athlete's responsibility to maintain, execute, and transfer the skill to practice consistently (Martin & Hrycaiko, 1983). When an athlete learns a new skill, it takes some time before that individual accesses naturally-occurring reinforcers in their environment; therefore, coaching can be used to bridge the gap between skill-acquisition and institutionalization where external reinforcers (e.g., progress) take the place of extrinsic reinforcers (e.g., praise). When the individual presents results of their performance, the coach is able to deliver feedback, which then allows the individual to alter his or her behavior

(Martin & Hrycaiko, 1983). This process repeats until the individual achieves the desired results, which indicates the reciprocity of the coach-coachee relationship (Champathes, 2006).

The third characteristic of effective behavioral coaching states that procedures should have a focus on performance improvement on an individual level, avoiding comparisons between athletes; therefore, athlete's performance should be compared to their own prior performance. The fourth dimension of effective behavioral coaching notes that interventions should be specifically described to allow for replication, consistent with the first characteristic. Moreover, interventions should be based on procedures that have shown to be effective experimentally. This is because behavioral coaching is based on the science of behavior, which is not founded on subjective accounts (past experiences) on what works and what does not work. In order to scientifically demonstrate the effectiveness of a procedure, it is crucial to measure performance before and during the intervention, while also ensuring experimental control. Preparation of a coaching procedure consists of collecting data on the coachees' performance through direct observations. Level of competency is important in determining if individuals need to be coached or if an error was an isolated occurrence. Data collected during this phase can be used as evidence when explaining the need for coaching to the individual (Champathes, 2006). In order to avoid mentalistic

explanations of athlete behavior, it is important to get coaches committed to using data-based procedures which can be replicated (Martin & Hrycaiko, 1983).

These first four characteristics of effective behavioral coaching offered by Martin and Hrycaiko (1983) focus on the behavior of the athlete. The fifth dimension emphasizes the behavior of the coach. Both the coach's behavior and athlete performance should be improved during the coaching process. Videotaped sessions can be used to assess the coach's performance and aid improvements in behavior. The authors mention that when athletes watch their behavior on video it is common that they exhibit surprise or unawareness of the behaviors they have engaged in (e.g., "Did I really do that?"). In the same manner, coaches have had similar reactions when watching their own behavior on video. The authors suggested that coaches monitor their own behavior or allow others to assess their performance using a checklist, in order to improve behaviors that have been identified as effective coaching.

The final characteristic of effective behavioral coaching refers to the social validity of the procedures used. This dimension states that, just like other interventions in behavior analysis, behavioral coaching should target behaviors that are of importance to the coachee or to society. Moreover, procedures should be accepted by the client even when other procedures are presented which might yield similar results. Finally, it states that consumers of behavioral coaching ought to be satisfied with the results produced from the intervention. If people are going to

continue the use of an intervention, the individuals involved in these procedures need to see the value. It is important to assess the social validity of behavioral coaching goals, procedures, and results. This can be accomplished through questioning of individuals involved at the respective setting and giving them the opportunity to voice their opinions regarding the procedures as well as satisfaction of results (Martin & Hrycaiko, 1983).

Professionals have been using coaching for many years before coaching became a common term in the behavioral literature in the early 1990s, in and outside of sports (e.g., life coaching, executive coaching). Behavioral science research can be essential to the further development of the field of coaching (Grant, 2005). Martin and Hrycaiko (1983) suggested that collaboration between coaches and behavioral professionals on the development of behavioral coaching research will produce significant benefits for the performance of athletes. Although coaching is present in the behavioral literature, there is significant variability regarding the definition of coaching. As a result, this procedure has been implemented inconsistently (Seniuk et al., 2013).

Coaching and Training

Effective behavioral coaching consists of measurement of performance compared to previous performance, differentiation between skill acquisition and maintenance, usage of experimentally valid procedures, includes the behavior of

the coach, and is socially valid. Multiple sports studies found that behavioral coaching was more effective than traditional coaching; however, these studies used the term "behavioral coaching" as a training procedure, similar to a Behavioral Skills Training (BST) intervention. According to LaBrot et al. (2016), BST is a method for skill acquisition which includes instructions, modeling, rehearsal, and feedback delivered by someone with superior knowledge to someone with less expertise regarding the skill. Although BST is commonly used as a training method and has been implemented with numerous different populations (Labrot et al., 2016), it should not be confused with coaching. BST is a training procedure, which is an antecedent that comes before the behavior to get it started, focusing on skill acquisition and competency. Coaching on the other hand is a consequence intervention that focuses on maintenance and generalization of a previously acquired skill (Tilka & Johnson, 2018).

It is not possible to coach a behavior that does not exist; thus, the skill must be acquired through training. Training procedures have value as an essential antecedent process that, once completed, can produce mastery and/or fluency of a skill allowing for the application of coaching for transfer and maintenance of novel skills. Therefore, coaching takes place when the target skill is already in the individual's repertoire. This is consistent with the second dimension of effective behavioral coaching regarding the differentiation between training and coaching, considering well-designed procedures include both processes (Martin & Hrycaiko,

1983). Thus, training and coaching should not be confused with one another. They should be viewed as compliments of each other, where coaching procedures are dependent on prior skill acquisition and training procedures are dependent on coaching for transfer and maintenance of skills. Consequently, training has a clear end, usually when a mastery or fluency criterion are met with a focus on maintenance, while coaching is an ongoing procedure that continues beyond the intervention to aid in institutionalization. Maintenance of results occurs when the intervention has ended and the effects of the intervention continue over time. On the other hand, institutionalization occurs when the intervention (e.g., coaching) continues beyond the intervention phase (Sigurdsson & Austin, 2006; Weatherly, 2019).

Although training may lead to increased knowledge, the behavior of a trainee might not always generalize to other settings (Tilka & Johnson, 2018). Coaching has been suggested to improve long-term maintenance of skills acquired in training (Tilka & Johnson, 2018). Coaching, at its core, is about promoting and maintaining both organizational and human change (Grant, 2005). Moreover, it is important to set up an environment in which performance changes are supported to avoid negative results (Slowiak & Lakowske, 2017). When an environment has been set up appropriately to support performance and individuals have shown competency through training, coaching can then be used as a support system to continue improving performance and maintaining skills previously acquired.

Coaching and Feedback

It is necessary to understand the difference between the coaching system and the coaching interaction in order to understand the area of intervention analysis. The coaching system involves identifying, assessing, and directly observing the target behavior, in addition to manipulating various aspects of an organizational systems (e.g., providing direct changes to the environment). On the other hand, the coaching interaction consists of specific and brief interactions, including prompting and feedback delivery by the coach to the coachee (Weatherly, 2019). Thus, feedback is a critical part of the coaching interaction similar to prompting; however, neither processes describe the entire interaction. Feedback is the most common intervention applied in the field of Organizational Behavior Management (OBM) and has shown to be an effective procedure when implemented appropriately (Weatherly & Malott, 2008). Balcazar, Hopkins, and Suarez (1985) evaluated 126 articles in which performance feedback was applied in the behavioral literature. The authors stated that feedback can function as a discriminative stimulus, where it occasions the availability of reinforcement, and can function as conditioned reinforcement when it provides a consequence for performance. However, feedback only functions as a reinforcer if it is linked to reinforcing consequences and, when delivered contingent on performance, increases performance. Results of the Weatherly and Malott (2008) literature

review suggest that feedback should be accurate, quantitative, and frequent and can have significant benefits when delivered by someone in a supervisory position.

Feedback has received substantial attention in the behavior-analytic literature regarding sports. In a review of sports studies in the behavioral literature, Seniuk et al., (2013) found 13 articles implementing feedback as part of the intervention. For instance, in a study by Quinn, Miltenberger, and Fogel (2015), two dance teachers provided immediate feedback to four dancers contingent on desired behavior. Immediate feedback was delivered in the form of a clicker, known as TAGteach. This study evaluated the effects of TAGteach as a conditioned reinforcer to strengthen three dance moves. Results indicated that, as a conditioned reinforcer, TAGteach was successful in improving the dance moves of three of the participants; however, for one of the participants, TAGteach alone did not improve performance. Therefore, a token system was added to the TAGteach intervention which increased the target behaviors.

Henley and DiGennaro Reed (2015) defined specific feedback as "feedback that explicitly referenced information about observable behavior relevant to task performance." (p. 325) and found it to be more effective than general feedback. Balcazar et al., (1985) identified six characteristics of feedback, the first of which is feedback source, which refers to the tool used for feedback delivery (supervisor, automated, peer, etc.). The second characteristic identified was feedback privacy (public or private). Third, was feedback participants, which referred to the

individual(s) who were receiving feedback. The fourth characteristic identified was feedback content, which referred to the form of feedback used (group comparison, individual, etc.). Fifth was feedback mechanism, also known as the means used to deliver feedback (verbal, graphed, written, etc.). The final characteristic was feedback frequency which states how often the feedback was delivered. Results of this review showed that feedback alone was the most frequently used application of feedback and this trend is continuing according to a more recent feedback literature review conducted by Alvero et al. (2001). Although feedback alone is the most common application, it does not produce the most consistent effects. The combination of antecedent interventions with feedback resulted in the most consistent effects, moreover, using other interventions in combination with feedback produced much higher consistency effects than feedback alone (Alvero et al., 2001). These reviews of feedback applications in behavior analysis concluded that feedback alone does not change behavior as much as feedback combined with other interventions.

The distinction between the coaching system and the coaching interaction is important for the current investigation. For the purposes of this study, coaching interactions will be defined as brief and frequent interactions regarding specific performance, in the form of a question or feedback statement delivered by the coach to the coachee. The coaching system will be defined as the ongoing and frequent use of coaching interactions by the coach to shape and maintain desired

performance (Weatherly, 2019). Components of effective coaching have been identified as reciprocity, relationships, reflection on reality, and questioning (Averill, Drake, Anderson & Anthony, 2016). The effectiveness of coaching is largely influenced by the relationship between the coach and the coachee. The source of the coaching relationship is built on coaching interactions, although there is a lack of research regarding the interaction that takes place during the coaching process (Ianiro et al., 2014).

Purpose of Current Investigation

The use of questions as a basis of the coaching interaction can promote reflection, reciprocity, and relationships (Averill, Drake, Anderson & Anthony, 2016). Senge et al., (1999) suggested that effective coaching is developed through questions rather than answers. According to Rock (2006), when questions are developed well and have a purpose the individual being coached will realize that they already possess the skills necessary for success. In addition, well established questions are crucial to the development of the ongoing progress of coaching (Averill et al., 2016). Ladyshewsky and Varey (2005) suggested interactions should continue as non-evaluative and as equal partners throughout the coaching relationship. The purpose of the current study will be to extend the literature on the coaching system and interaction and to separately identify the effectiveness of feedback statements and coaching questions, as delivered by a coach, on athlete

performance. The aim is to use procedures that are conceptually systematic to allow for clarification regarding the definition and process that takes place during the coaching process and to permit subsequent replication.

Chapter 2
Method

Participants and Setting

The current study recruited six Mixed Martial Arts (MMA) athletes to serve as participants. All participants were Caucasian, three participants were male (Peter, Joe, and Dave), while the other three participants were female (Jackie, Natasha, and Ally). Participants' ages ranged from 10 years old to 25 years old. Peter and Joe were both 11 years old, Jackie was 13 years old, Natasha was 17, Ally was 25, and Dave was 17 years old. Natasha withdrew from the study because she stopped attending after session 5, therefore, only five participants attended enough sessions to be included in the study. The principal investigator requested informed consent or parental consent from all participants (Appendix I). The study took place in an MMA gym located in southeastern Florida. In order to control for carry-over effects, participants were randomly assigned to 1 of 2 groups, using Microsoft Excel. Peter and Jackie were in group 1, and Joe, Ally, and Dave were assigned to group 2. The study was implemented simultaneously across these separate groups. There was one coach responsible for delivering coaching interactions for both groups and this individual was responsible for implementing the intervention to the athletes. Each session lasted approximately 30 min.

Materials

The materials for this investigation were used for data collection (see Appendix A), procedural integrity (see Appendix B), and to aid in differentiation. The materials for recording consisted of one camcorder to film participants on the left side of the gym, an additional camcorder hooked up to a microphone to record coaching interactions, a GoPro camera to record participants on the right side of the gym, and a secure drive to upload videos. Construction cones (six small and two large) were used to separate the gym (see Appendix H) and wood sticks with Velcro (2) were used to hold up color-coded condition signs. Job aids were created for each condition (see Appendix E, F, and G) and data sheets were created for data collection (see Appendix A).

Dependent Variable

The dependent variable was athlete performance, specifically *rear foot pivot*, which was operationally defined as feet apart with a wide stance, the lead foot pointed forward and flat on the ground, the rear foot pointed in or forward, at least at a 45-degree angle, and with the ball of the foot touching the ground (Krukauskas, 2016, p. 11). Performance was scored as correct or incorrect for every fighting opportunity, which has been identified as during a right-cross strike and while slipping or dodging a punch. The coach trained the principal investigator to

identify these opportunities (right-cross and slipping a punch) and to detect correct versus incorrect rear foot pivots. The principal investigator then trained the additional data collector. During these opportunities the data collector recorded whether the participant had the correct foot placement using a data sheet (see Appendix A). Data were calculated by dividing the number opportunities with correct rear foot pivots by the total number of opportunities during each session.

Independent Variable

The independent variables for the current study included the use of different types of coaching interactions involving coaching questions or coaching statements delivered by the coach. All versions of coaching interactions involved either a positive or constructive component (e.g., question, feedback statement) that referenced current performance relative to accurate rear foot pivot. The coach was trained on the correct delivery of each phase of the independent variable. In addition, color-coded job aids were created by the principal investigator in collaboration with the coach, for Coaching Interaction A (see Appendix E), Coaching Interaction B (see Appendix F), and Coaching Interaction C (see Appendix G). These job aids included examples and components of each coaching interaction. Data collectors scored the correct delivery of Coaching Interaction A,

B, and C by the coach for 43% of sessions and recorded how many coaching interactions were involved with each session for each participant (see Appendix B).

Coaching Interaction A

Coaching Interaction A (CIA) involved the use of specific feedback statements without the use of coaching questions. Specific positive feedback statements were defined as information delivered by the coach, directed to the coachee, regarding accurate rear foot pivot performance (e.g., "Good foot pivot"). A specific corrective feedback statement is similarly defined but also included an additional statement regarding optimal performance (e.g., "You didn't do the foot pivot." "Show me where your back foot should be.")

Coaching Interactions B and C

These two types of coaching interactions (Coaching Interaction B and Coaching Interaction C) involved the use of coaching questions. Coaching Interaction B (CIB) asked the performer what he or she should be doing in relation to rear foot pivot, without discussing the benefit of that behavior. Correct performance resulted in a positive coaching interaction. The positive coaching interaction included questions asked by the coach, directed to the coachee, about current performance relevant to accurate rear foot pivot (e.g., "Where is your foot located?"). This coaching interaction was also followed by a brief statement affirming the correct response to the coaching question (e.g., "Good"). Incorrect

performance resulted in the use of constructive coaching. A constructive coaching interaction included questions asked by the coach, directed to the coachee, about current performance related to rear foot pivot (e.g., “Where is your foot located?”), in addition to asking about optimal performance related to rear foot pivot (“Where is it supposed to be?”). This coaching interaction was also followed by a brief affirmation of the correct response.

Coaching Interaction C (CIC) involved asking the performer what he or she should be doing in relation to rear foot pivot, in addition, the coach asked an additional question that linked current performance with the benefit of that behavior (e.g., “Why do you pivot your back foot?”). A positive coaching interaction used two questions asked by the coach, directed to the coachee. The first question was related to accurate rear foot pivot performance while the second question linked performance to a consequence (e.g., “Did you pivot on that last strike?” “How did that help?”). A constructive coaching interaction added an additional question about optimal performance and the benefit of correcting the behavior (e.g., “Did you pivot?” “Can you show me a correct pivot?” “Why do you pivot your back foot?”). Both positive and constructive coaching interactions included brief statement affirming the correct response to each of the coaching questions.

Interobserver Agreement (IOA)

Interobserver agreement (IOA) was collected for the dependent variable by a second observer, who gathered data independently across 38% of all sessions (see Appendix D). Each session had a duration of 30 min. Trial-by-trial IOA was used, noting the number of trials with agreement of the dependent variable (foot pivot performance) divided by total number of trials and multiplied by 100. The overall mean IOA across all participants was 91% (range: 82% to 100%). For Peter, the average IOA was 91% (range: 82% to 94%), participants 2's mean IOA was 88% (range: 82% to 94%), Jackie's average was 92% (range: 86% to 100%), Ally's mean IOA was 92% (range: 90% to 94%), and Dave's IOA had an average of 90% (range: 84% to 96%).

Experimental Design

An alternating treatments design with an initial baseline probe was used to evaluate the effects of the intervention on athlete performance. An alternating treatments design was chosen because it allows for comparison between multiple treatments in a short period of time, allowing the researchers to identify the most effective coaching interaction out of Coaching Interactions A, B, and C (Cooper, Heron & Heward, 2014). A baseline probe was used because the athletes only practiced once per week, thus requiring a study that spanned multiple months, and

the coach noted that participant attrition and absences are likely. Participant attrition is a commonly cited concern with extended baseline conditions, thereby ruling out an extended initial baseline or a multiple baseline design. The coach was already providing feedback and other behavioral coaching techniques to athletes during pre-intervention baseline conditions making a reversal difficult. The intent of the experimental design was to isolate and implement specific variations of coaching statements and coaching questions.

Procedures

Baseline

During this probe, researchers reviewed the footage and recorded athlete foot pivot performance using a data sheet (see Appendix A). There was no manipulation of variables during this phase.

Intervention

Participants in group 1 and 2 were separated by small cones placed in the middle of the gym (Appendix H). To facilitate differentiation between the coaching conditions, two additional regular sized cones were placed at the end of the strip of cones and used to hold up color-coded signs with the name of the conditions clearly printed. These signs also served as a prompt to the coach to ensure he knew the type of coaching interaction to deliver to each group. Job-aids were created by the

principal investigator in collaboration with the coach and were used by the coach to familiarize himself with the conditions before the start of each practice (Appendices E, F, and, G). Prior to the beginning of each condition, participants in group 1 were instructed to practice on the left side of the gym and participants in group 2 were instructed to stay on the right side of the cones for the entirety of practice. Athletes who were not participants in the study were allowed to practice on either side of the gym. After participants were separated into their groups, the coach announced the condition to each group separately, e.g., "On the right side I will be asking you questions, and on the left side I will be giving you feedback." Mid-way through data collection (about 15 min), the principal investigator changed the signs to reflect the changed conditions for both groups and the coach announced the new conditions to each group.

The coach wore a microphone during all sessions and a video camera with a microphone receiver was used to record all coaching interactions. The principal investigator followed the coach around with this camera during every session to monitor the delivery of the coaching interactions and to prompt the coach if he deviated from the current coaching condition for a given group. Two additional cameras were used to record the athletes' performance. One camera recorded participants in group 1 while the second camera recorded participants in group 2. The principal investigator and trained research assistant reviewed the videos and collected data on the dependent variable and independent variables for all sessions.

Data were taken across all phases of the study including on the dependent variable (see Appendix A), on IOA (see Appendix D), and on the use of the independent variable and procedural integrity (see Appendix B).

Phases of the Independent Variable

There were three phases of the independent variable (Coaching Interaction A, B, and C), which alternated twice during a session, where the first condition was delivered for the first half of practice, and the second condition was implemented during the second half of practice (approximately 15 min for each condition). All athletes received all coaching interactions; however, the order in which these coaching phases were implemented was randomly assigned using Microsoft Excel. The order of conditions for group 1 was: CIB, CIA, and CIC, and group 2's was: CIC, CIB, and CIA, both groups' sequence alternated in order. Coaching Interaction A used specific positive or corrective feedback statements and Coaching Interaction B included the use of positive or corrective coaching questions. Coaching Interaction C included the use of positive or corrective coaching questions, tied to natural contingencies.

Coaching Interaction A

This coaching condition involved the use of coaching statements rather than questions. During a coaching session, the coach rotated through all athletes

(participants and non-participants) and provided specific positive or specific constructive feedback statements to the applicable participating athlete. An example of a positive feedback statement is “Good foot pivot on that strike”. An example of a constructive feedback statement is “You’re only half pivoting, make sure you fully pivot.”

Coaching Interaction B

This coaching interaction involved the coach asking a positive or corrective question contingent on correct or incorrect responding (e.g., “Did you pivot on that last slip?”).

Coaching Interaction C

This condition of the independent variable consisted of the coach asking a positive or corrective question, which was linked to the value of their performance (e.g., “Why do we pivot the back foot?”).

Procedural Integrity

Formal procedural integrity was gathered for the independent variable also using trial-by-trial IOA for 43% of all sessions. Procedural integrity was calculated by noting the number of interactions with correct coaching interactions divided by the total number of interactions and multiplied by 100 (see Appendix B). The

average independent variable IOA was 89% (range: 72% to 100%). Procedural integrity was informally monitored by the primary investigator for 100% of all sessions, in the form of in-the-moment prompting if the coach made a mistake while delivering coaching conditions. It is important to note that this coach is a BCBA and needed minimal prompting (1-2 instances per session).

Chapter 3
Results

The purpose of this study was to evaluate the effects of feedback statements and coaching questions on the proper rear foot pivot of five MMA athletes. This study included three independent variables: Coaching Interaction A (CIA) consisted of specific feedback, Coaching Interaction B (CIB) involved asking questions, and Coaching Interaction C (CIC) consisted of asking questions and including a question linked to the value of the behavior. The dependent variable for this study was the performance of a rear foot pivot for each individual athlete. This investigation had a total of 13 sessions and five participants. Peter and Dave attended all practices (participated in 13/13 sessions), Joe and Jackie were absent during sessions 6, 7, 12, and 13 (attended 9/13 sessions), and Ally was absent for sessions 4, 5, 10, and 11 (participated in 9/13 sessions). Prior to the start of the study, the coach identified Joe, Ally, and Dave as high performers, whereas Peter and Jackie were identified as lower performers. This was confirmed during baseline.

Social validity data were collected in the form of an anonymous survey from 3 out of 5 participants (see Appendix C). These participants reported that they had been practicing MMA for 1.5 years, 5 years, and 11 years. Participants reported that this research was either very helpful (1 participant) or extremely helpful (2

participants), to their overall performance in MMA. All participants stated that the most helpful condition was CIC, and that the least helpful condition was CIA. Two out of three participants noted that their foot pivots had improved a lot since the start of the research and 1 noted that it had somewhat improved, however, all agreed that foot pivots are extremely important in MMA. Two out of three participants reported that knowing which type of coaching interactions produce the greatest athlete performance, as extremely valuable and 1 reported that it was neutral.

Figure 1 displays Peter's data. This participant was identified as a low-performer, as evidenced by the baseline level of 24%, which was the lowest compared to the other participants. Peter participated in all data collection sessions. This participant correctly performed the rear foot pivot for an average of 23% (range: 12.5% to 36%) of opportunities during CIA, which represents a 1% decrease from baseline. During condition CIB performance of the back foot pivot improved to a mean of 47% (range: 11.5% to 86%), and during CIC performance increased to an average of 51% (range: 28% to 65%), representing a mean performance increase from baseline of 27%. Therefore, for this participant, Coaching Interaction C was the most effective condition in improving the performance of the rear foot pivot.

Joe attended 9 out of the 13 sessions across the course of the study (see Figure 2). Due to absences, this participant only contacted conditions A and B for 2

sessions each. This participant was identified as a high-performer and had the highest baseline level compared to the other participants with rear foot pivots at 56%. Performance of the rear foot pivot improved from 56% in baseline to a mean of 70% (range: 52% to 88%) during CIA. Correct rear foot pivots decreased to an average of 51% (range: 32% to 70%) in condition CIB. Performance increased to a mean of 61% (range: 20% to 88%) during condition CIC. Percentage of correct rear foot pivots improved by a mean of 14% from baseline to condition CIA, making this condition the most effective for this participant.

Jackie was identified as a low-performer as evidenced by her baseline level of 28% (see Figure 3). Throughout the course of this investigation, Jackie was present for 9 out of the 13 total data collection sessions, resulting in this participant only contacting 2 sessions for conditions A and C. During condition A back foot pivot performance improved from 28% in baseline to an average of 87% (range: 80% to 93%), while correct pivoting during Condition B increased to a mean of 60% (range: 16% to 88%), and performance improved to an average of 70% (range: 66% to 73%) during CIC. The most effective condition for improving the performance of the back foot pivot for this participant was condition A, as pivoting improved by a mean change of 58%.

Ally's data can be seen in Figure 4. This participant attended 9 out of 13 sessions; therefore, she was only able to contact conditions A and C for 2 sessions each. Ally was identified as a high-performer, as demonstrated by the foot pivot

being correctly performed during 38% of baseline opportunities. During CIA conditions, correct performance increased to a mean of 64% (range: 36% to 92%), representing a mean improvement of 26% from baseline. Performance averaged at 45% in condition B (range: 0% to 78%), and during condition C performance had a mean of 45% (range: 29% to 61%). For this participant the most effective condition in increasing the performance of correct foot pivots was Condition A.

Figure 5 shows the data for Dave, who attended all practices during data collection. This participant was identified as a high-performer and correctly performed the back foot pivot during 48% of opportunities in baseline. Correct performance increased to a mean of 61% (range: 52% to 80%) during Condition A, while correct foot pivots increased to an average of 64% (range: 34% to 94%) in condition CIB, and during CIC performance improved to a mean of 66% (range: 32% to 80%). As evidenced by the data, foot pivot performance improved by a mean of 18% during condition CIC making this condition the most effective for this participant.

Baseline levels for all 5 participants had an average of 38% (range: 24% to 48%), CIA increased overall performance to a mean of 55% (range: 12.5% to 93%), representing an average improvement of 17% from baseline. Mean performance increased from 38% in baseline to 54% (range: 0% to 94%), during CIB, producing an average increase of 16% for this condition. CIC increased the

overall performance average to 59% (range: 20% to 88%), which represents a 21% increase from baseline levels.

Chapter 4
Discussion

This investigation was developed to evaluate the effects of three different types of coaching interactions: specific feedback (CIA), coaching questions (CIB) and coaching questions with a value component (CIC). Although feedback is the most common intervention in Organizational Behavior Management (Weatherly & Malott, 2008), the use of questions as part of the feedback and coaching process had not yet been empirically evaluated. The current study sought to evaluate and empirically compare specific feedback (CIA), basic coaching questions (CIB), and value questions (CIC) to improve the performance of the rear foot pivot of five participants practicing MMA. Based on data improvements from baseline to intervention, CIA was the most effective intervention for 3 out of 5 participants, while CIC was the most effective condition for 2 out of 5 participants. The purpose of this investigation was to separately evaluate components of coaching interactions in order to identify the most effective components and maximize performance. This research extends the current literature by comparing the use of coaching questions and feedback statements, which had not yet been empirically evaluated in the coaching and feedback literature. The value of this line of research is in finding empirical value to helping performers see the benefit of their own performance. As participants become better observers of their own behavior,

progress can be noticed by the individual, resulting in naturally occurring contingencies. According to the coach in the current study, the value of proper rear foot pivots is more powerful punches, more range in their strikes, and better dodging of punches. These improvements can potentially function as positive reinforcers, contingent on proper foot pivots, if the athletes can link these outcomes with their performance. This would mean that external reinforcers from the coach could be faded, while the natural reinforcement maintains proper performance.

The study involved minors, so the researchers worked to ensure all parental questions were answered and concerns were addressed. Parental concerns were brought to our attention before the start of session 8, with this concern consisting of their child being restricted to only 1 side of the gym and not being paired up with other athletes in the other group. The coach and primary researcher explained to the parent that they could withdraw their child from the study at any point (as stated in the consent forms), to which the parent responded that it was not needed but that they wish their child could pair up with other athletes. The coach then paired up the child with other athletes (non-participants) while keeping the participant in Group 1 and in the study. As for the concern that the child was limited to the same side of the gym for every practice, the researchers decided to switch the groups, so Group 1 and Group 2 were swapped in sides of the gym for the remainder of the data collection sessions. This simply changed the location of the groups, not the participants in the groups.

Limitations

One of the main challenges of this study, as in most applied research, was the need to limit the research's intrusiveness in the setting while still collecting meaningful data and ensuring experimental control. All the athletes were paying for MMA training, which requires the coach to teach multiple behaviors, not just the rear foot pivots. In addition, not all athletes were participants in the study; therefore, it was important to allow the coach to teach the class and keep his schedule for the practice as close as possible. For this reason, this study did not control for the difficulty of the drills delivered by the coach for each session and it is possible that some drills (sessions) were easier to perform the rear foot pivot than others. Drills that included slipping opportunities for the foot pivot (e.g., dodging a punch) appeared to be more difficult for the athletes than drills with right-strike opportunities. Since the researchers did not control the combinations instructed, some drills provided more opportunities for a dodge or right-strike (more than 50), while other drills provided for fewer opportunities (20-30).

Given that the number of opportunities varied across participants and sessions, the researchers scored either the first 50 opportunities for a pivot or the full 15 min of a session (whichever came first) as a representative sample of the performance for that session. Fifty opportunities typically included most of a given session; however, it is possible that performance data could have been different if all opportunities were scored. This is especially relevant if some of their coaching

interactions took place towards the end of the session, and the participant had already reached the 50 opportunities for the condition before the 15 min of footage was finished. Another limitation of the current study is that some opportunities were skipped when the camera angle could not capture the opportunity or if the camera could not get a clear visual of the foot pivot. This is an important note for applied research in sports, particularly gyms, because the athletes are constantly moving, and moving very quickly, making it difficult to capture multiple participants' performance. Two cameras were used to attempt to overcome this limitation (1 GoPro and 1 camcorder), capturing the performance of the athletes on both sides of the gym.

The number of coaching interactions delivered during a condition per participant was not controlled for, due again to the differences in drills across sessions, resulting in some participants having more coaching interactions than others. There were some instances where, as the number of coaching interactions increased, performance of the rear foot pivot also increased, regardless of condition (see Figures 6-10). For some participants this represented a clear pattern and the researchers thought there could be a correlation here.

The coach at the MMA gym used in this study made it clear that there is variability in attendance and how long a given athlete will continue at that particular gym. Six participants were initialing selected in an attempt to plan for absences and attrition. Natasha stopped attending practice after session 5 and was

dropped from the study. In order to be included in the study, participants had to be present for at least 9 sessions, therefore, we ended up with 5 participants. Joe, Jackie, and Ally missed 2 practices equaling 4 sessions of data, for this reason, these participants did not contact each treatment for at least 3 sessions. Consequently, we ended up with 2 participants which contacted each condition at least 3 times (Peter and Dave). Peter was not present on the day that baseline data were collected, therefore, baseline data for this participant represents a baseline probe of 2 min with the coach. All other participants' baseline data had a duration of 15 min and was collected while they were paired up with other athletes. Although Peter did not miss any scheduled practices, it is important to note that this participant has flat feet, making it more difficult to perform the rear foot pivot correctly, which could very well have contributed to the variability in the data for this participant.

Joe and Jackie were absent for sessions 6 and 7, the following week was a holiday and practice was not held, therefore, these participants went 2 weeks without practicing MMA between session number 7 and 8. In addition, session 8 and half of session 9 was a simulation rather than a drill, which are more difficult and fast paced. The coach explained that a simulation is more difficult than a drill because it mimics a real fight in which the athletes are fighting back and forth and moving around much more. A drill on the other hand, has a combination where the peer athlete is just blocking the punches and not fighting back. During a drill the

athletes are allowed to take their time with the combination to get it right and then gradually get faster in pace as the athletes get more comfortable with the combination. This gap in practice time, as well as the fighting simulation rather than a drill have been hypothesized to be the cause of the low performance data seen following session 7 for these participants. All athletes performed considerably lower during session 8 and 9 due to the simulation instruction. Jackie did not have a low performance during session 9 because her turn to fight was towards the end of the session when the coach had instructed the participants to move from simulation to drill. All other participants' data for session 9 were collected during the simulation.

Another limitation of this study was the data collection frequency and timeline. Practice was only held once per week, limiting data collection and delivery of the conditions. It would have been ideal to continue to collect data to even out participants' absences, but this was not possible for a variety of reasons. First, the coach alerted us before the start of session 10 that the class would be moved to a new location, in a new city after May 17th. Second, Joe and Jackie decided to stop attending practice after session 9 but agreed to come for one more practice. Third, the parents of Peter had parental concerns which were addressed but could not be completely resolved without dropping the participant or risking the integrity of the study.

Fourth, the conditions were becoming repetitive and participants appeared to be experiencing a level of satiation, especially with the value questions condition. The coach reported that the participants were expressing annoyance with this condition when responding to the questions. Answering multiple questions while practicing seemed aversive to the participants, because they were not supposed to stop the combinations during these interactions as to not waste valuable practice time. Lastly, before the start of the study, the first half of practice was used for drills and the other half was sparring (about 30 min), which the participants seemed to enjoy. When the study started, we needed at least 30 min of data (drills) and with warm-ups at the beginning of practice, this only left 5-10 min of sparring at the end. The coach had some complaints from the athletes before the start of session 10 about the limited time for sparring; to overcome this, the coach cut warm-up short and we only collected data for 25 min of drills, which left the athletes with about 20 min of sparring at the end. Therefore, we were not able to continue to evaluate the effects of the conditions on athlete performance, as continuing data collection was not feasible.

The current study also did not control for the levels of MMA performance across athletes. After randomly assigning participants to Groups 1 and 2, and collecting baseline data, it was apparent that participants in Group 2 had a higher baseline levels, averaging at 47% (range: 38% to 56%) while participants in Group 1 had a mean baseline levels at 26% (range: 24% to 28%). In order to control for

carry-over effects, the original 6 participants were randomly assigned to Group 1 or Group 2. Each group was randomly assigned the order of the alternating conditions so that participants in each group were receiving a different condition for each session and in a different order. Although the researchers attempted to control for carry-over effects, there could still be effects of previous conditions on current athlete performance. After the first treatment session participants were aware of the IV and possibly became better observers of their back foot pivots, which would have affected their performance for the following conditions. Participant reactivity was another limitation which could have impacted the results of this study, especially for the first few sessions, before participants became used to researchers and multiple cameras in the gym. Although sports settings are known for taping performance for later evaluation, this site did not have any recording systems in place at the start of this study.

The current study did not control for which peer athlete was paired with which participant for a given session. Pairing up the participants with the same athletes each week would give us more control but would not be feasible due to athletes' absences. This resulted in participants sometimes being paired with high-performers (which provided additional feedback and prompting), and sometimes being paired with low-performers (which provided little to no feedback and prompting). In addition, the coach that delivered all coaching interactions is an experienced behavior analyst, therefore, the coach was most likely already

providing good feedback and utilizing questioning before the start of the study. Although this is a strength for the site, it could be a limitation in our study because the coach was already delivering questioning and specific feedback to the athletes before the start of the study, possibly producing less robust results. The researchers controlled for this limitation by taking baseline data on the participants' performance, which were all below 60% (range: 24% to 56%). In addition, the purpose of this study was to isolate specific components of coaching interactions (which the coach might have already been engaging in), to identify the most effective coaching interaction.

Although the investigators took steps to ensure differentiation between the conditions, by announcing the conditions to the participants before the start of a session and using posted color-coded signs with the condition name, differentiation was minimal, as evidenced by each condition's results. Procedural integrity cannot be accounted for the issues in differentiation, as it was high for the 6 sessions in which it was evaluated: mean of 89% (with a range from 72% to 100%). This lack of differentiation between the conditions as shown in the results could be due to the conditions having similar effectiveness strength.

Future Research

Many of the limitations for the current study were due to constraints from the current applied setting. Future studies evaluating the effects of feedback and

coaching questions should consider a laboratory study to increase control. In a laboratory setting, the investigator has the opportunity to control for the number of opportunities to engage in the task, the difficulty of the task, and the number of coaching interactions delivered per participant per condition. In a more controlled setting, it would be possible to collect data more frequently with a different dependent variable that is easier and less time consuming to score. The main recommendation regarding the dependent variable, is to choose a target behavior that facilitates data collection, allowing the investigator to collect data on every opportunity, for the entire session. Another advantage of a controlled setting is that the participants would not be paying for the service at the applied site, which would allow for more control of the structure of the sessions.

This site practiced once per week, which limited data collection and stretched out the study timeline. Future research should collect data more frequently to reduce the study timeline, prevent participant dropout, and possibly result in less participant satiation. This investigation controlled and assessed feedback the coach delivered to the participants only regarding the rear foot pivot. Interactions regarding any other behavior could be delivered in any format (e.g., questioning, feedback, and modeling). It would be valuable to design a research study where every coaching interaction, regardless of behavior, within a condition was controlled. For instance, if a participant was in the CIA condition, every time the coach interacted with the participant, the coach would follow the specific

feedback structure. This would also solve the satiation experienced by the participants in this study, as the condition would be applied to all behaviors resulting in more varied coaching interactions. Regarding the coach which delivered the coaching interactions, future research should utilize a coach with less experience in behavior analysis and feedback in order to maximize the effects of the coaching conditions on the performance of the participants. In addition, it would be of value to train coaches on these conditions in order to improve their coaching interactions. Procedural integrity was high for this study which was believed to be due to the coach's experience in ABA; thus, it would be interesting to conduct this study with coaches outside of the field and see how difficult it is to get this level of procedural integrity.

Conclusion

The purpose of this study was to identify the most effective components of a coaching interaction to maximize athlete performance. Results of this study showed that CIA was the most effective coaching interaction for 3 out of 5 participants. CIC was the most effective intervention for 2 out of 5 participants, and CIB was the least effective coaching interaction, as it did not produce the most improvement for any of the participants. Feedback as part of an intervention has received considerable attention in sports. In a literature review of sports studies in the behavior-analytic literature, Senuik et al., (2013), identified 13 investigations

including feedback as part of their treatment. Questioning on the other hand had not yet been investigated as part of the coaching interaction, therefore, this investigation extended the literature by comparing and evaluating feedback versus questions.

According to Martin and Hrycaiko (1983), when an athlete state results of their performance during a coaching interaction, it allows the coach to give feedback, which enables the individual to change their behavior. For behavior that is novel, not occurring frequently, or well enough, it takes some time for the athlete to access naturally-occurring consequences. Coaching has been suggested to aid in transfer and maintenance of previously acquired skills (Tilka & Johnson, 2018). Therefore, initial athlete progress is resulted from the coaching interactions delivered by the coach, but as the athlete notices improvement in their behavior, they access naturally-occurring contingencies, which maintain behavior.

References

Allison, M. G., & Ayllon, T. (1980). Behavioral coaching in the development of skills in football, gymnastics, and tennis. *Journal of Applied Behavior Analysis, 13,* 297-314.

Averill, R., Drake, M., Anderson, D., & Anthony, G. (2016). The use of questions within in-the-moment coaching in initial mathematics teacher education: Enhancing participation, reflection, and co-construction in rehearsals of practice. *Asia-Pacific Journal of Teacher Education,44*(5), 486-503. doi:10.1080/1359866x.2016.1169503

Alvero, A. M., Bucklin, B. R. & Austin, J. (2001). An objective review of the effectiveness and essential characteristics of performance feedback in Organizational settings (1985-1998). *Journal of Organizational Behavior Management, 21,* 1, 3-29.

Baer, D. M., Wolf, M. M., & Risley, T. R. (1968). Some current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis, 1*, 91-97.

Balcazar, F., Hopkins, B. L., & Suarez, Y. (1985). A Critical, Objective Review of Performance Feedback. *Journal of Organizational Behavior Management,7*(3-4), 65-89. doi:10.1300/j075v07n03_05

Brown, P., L. (2001). Communicating the benefits of the behavioral approach to the business community. *Journal of Organizational Behavior Management,* 20:3-4, 59-72.

Champates, M. R., (2006). Coaching for performance improvement: the "COACH" model. *Development and Learning in Organizations: An International Journal, 20*:2, 17-18.

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). *Applied behavior analysis* (2nd ed.). Upper Saddle River, NJ: Pearson Education.

Donahue, J. A., Gillis, H. & Kind, K. (1980). Behavior modification in sport and physical education: a review. *Journal of Sport psychology, 2,* 311-328.

Fitterling, J. M., & Ayllon, T. (1983). Behavioral coaching in classical ballet: enhancing skill development. *Behavioral Modification, 7,* 345-368.

Grant, A. M. (2005). What is Evidence-Based Executive, Workplace and Life Coaching? *Evidence-Based Coaching* (pp. 1-12). Australian Academic Press.

Gravina, N., Austin, J. (2018) An evaluation of the Consultant Workshop Model in a human service setting. *Journal of Organizational Behavior Management, 38*, 2-3, 244-257.

Gravina, N., King, A. H. & Hodges, A. C. (n.d.) *Consulting in OBM.* Unpublished manuscript.

Henley, A. J. & DiGennaro Reed, F. D. (2015) Should you order the feedback sandwich? Efficacy of feedback sequence and training. *Journal of Organizational Behavior Management, 35,* 3-4, 321-335.

Ianiro, P. M., Lehmann-Willenbrock, N., & Kauffeld, S. (2014). Coaches and clients in action: A sequential analysis of interpersonal coach and client behavior. *Journal of Business and Psychology,30*(3), 435-456. doi:10.1007/s10869-014-9374-5

Komaki, J., & Barnett, T. (1977). A behavioral approach to coaching football: Improving the play execution of the offensive backfield on a youth football team. *Journal of Applied Behavioral Analysis,* 10(4), 657-664.

Krukauskas, F. K. (2016). Using Auditory Feedback to Improve Striking for Mixed Martial Artists. *Graduate Theses and Dissertations.* Retrieved from https://scholarcommons.usf.edu/etd/6529.

LaBrot, Z. C., Radley, K. C., Dart, E., Moore, J., & Cavell, H. J. (2018). A component analysis of behavioral skills training for effective instruction delivery, *Journal of Family Psychotherapy,* 29:2, 122-141, doi:10.1080/08975353.2017.1368813

Ladyshewsky, R. K., & Varey (2005) Peer Coaching: A Practical Model to Support Constructivist Learning Methods in the Development of Managerial Competency. *Evidence-Based Coaching* (pp. 171-182). Australian Academic Press.

Laipple, J. (2012). Path to rapid change. Rapid Change: *Immediate Action for the Impatient Leader* (61-101). Atlanta: Performance Management Publications.

Martin. G., & Hrycaiko, D. (1983). Effective behavioral coaching: What's it all about? *Journal of Sport and Exercise Psychology, 5,* 8-20.

Oxford Advanced Learner's Dictionary. (2011). *Sport.* Retrieved from https://www.oxfordlearnersdictionaries.com/definition/english/coaching?q=coaching

Quinn, M. J., Miltenberger, R. G., & Fogel, V. A. (2015). Using Tagteach to improve the proficiency of dance movements. *Journal of Applied Behavior Analysis,48*(1), 11-24. doi:10.1002/jaba.191

Rock, D. R. (2006). Quiet leadership: help people think better- Don't tell them what to do. *Reference and Research Book News, 22*, 2.

Senge, P., Kleiner, A., Roberts, C., Ross, R., Roth, G., & Smith, B. (1999). *The dance of change: the challenges to sustaining momentum in learning organizations.* New York: Doubleday/Currency.

Seniuk, H., A., Witts, B. N., Williams, L., Ghezzi, P. M. (2013). On terms behavioral coaching. *The Behavior Analyst, 36*(1), 167-172.

Sigurdsson, O. S. & Austin, J. (2006). Institutionalization and response maintenance in organizational behavior management. *Journal of Organizational Behavior Management, 26(*4), 41-77.

Slowiak, J. M., & Lakowske, A. M. (2017). The influence of feedback statement sequence and goals on task performance. *Behavior Analysis: Research and Practice,17*(4), 357-380. doi:10.1037/bar0000084

Tilka, R., & Johnson, D. A. (2018). Coaching as a packaged intervention for telemarketing personnel. *Journal of Organizational Behavior Management, 38*(1), 49-72. doi:10.1080/01608061.2017.1325821

Weatherly, N. L. (2019). A Behavioral safety model for clinical settings: Coaching for institutionalization. *Perspectives on Behavior Science, 41*(1), 1-13. doi:10.1007/s40614-019-00195-1

Weatherly, N. L., & Malott, R. W. (2008). An analysis of organizational behavior management research in terms of the three-contingency model of performance management. *Journal of Organizational Behavior Management,28*(4), 260-285. doi:10.1080/01608060802454643

Whiting, S. W., Miller, J. M., Hensel, A. M., Doxon, M. R., Szekely, S. (2014). Increasing the accuracy of EpiPen administration with a brief behavioral skills training package in a school for autism. *Journal of Organizational Behavior Management, 34*(4), 265-278, doi: 10.1080/01608061.2014.973632

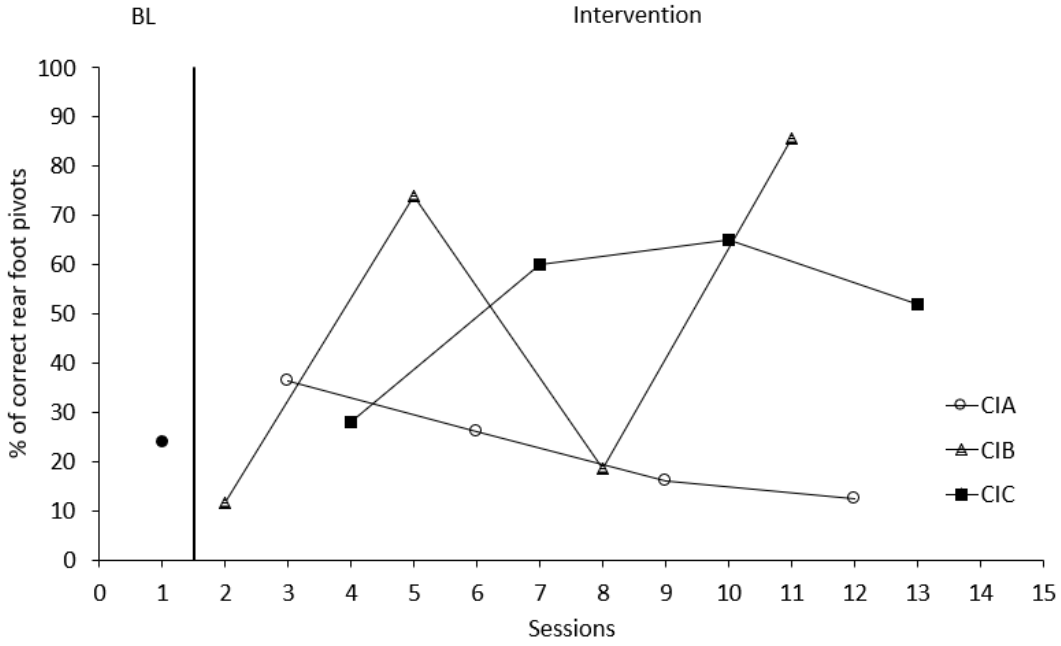


Figure 1. Peter's results

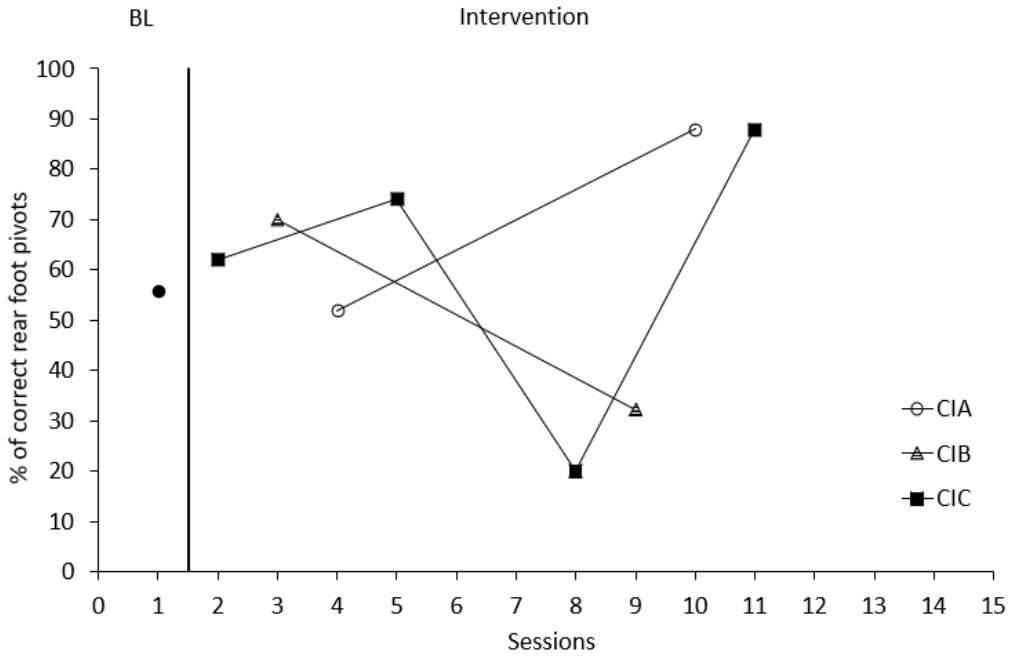


Figure 2. Joe ’s results

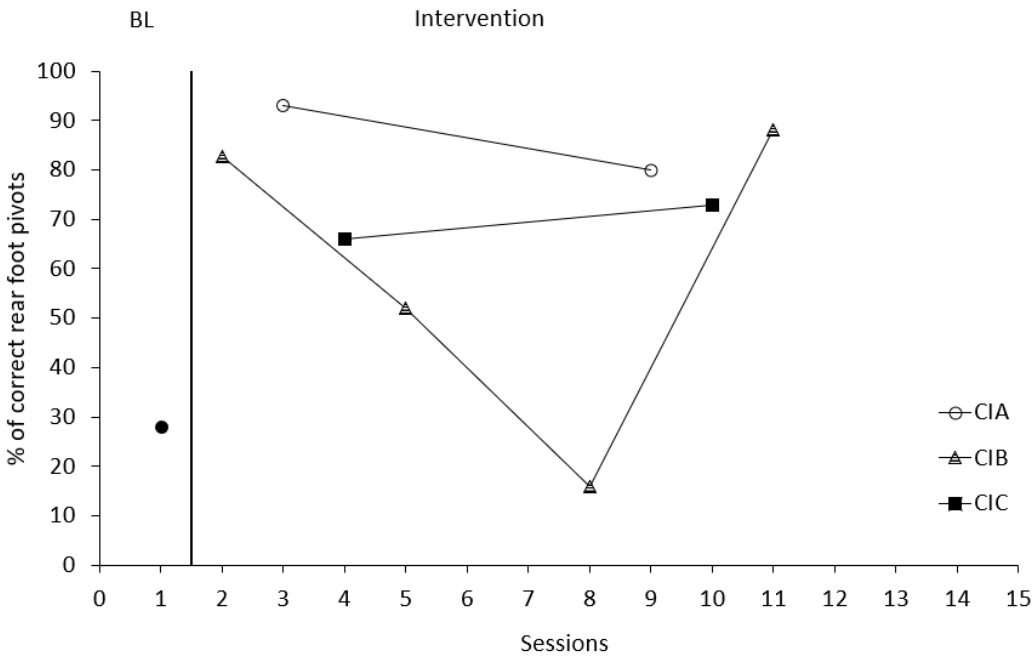


Figure 3. Jackie's results

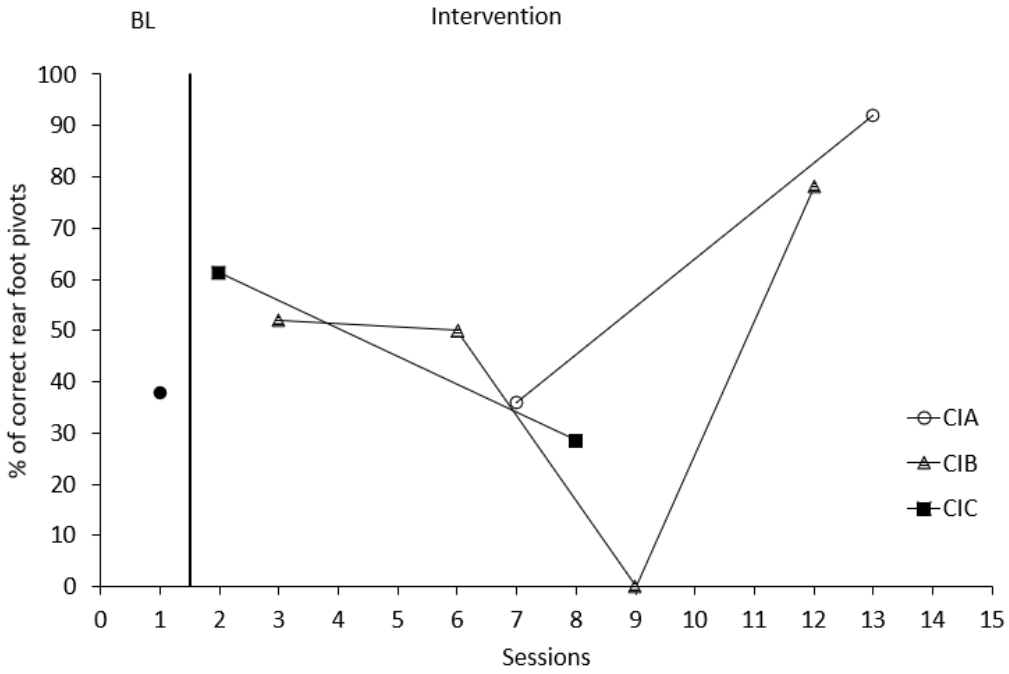


Figure 4. Ally's results

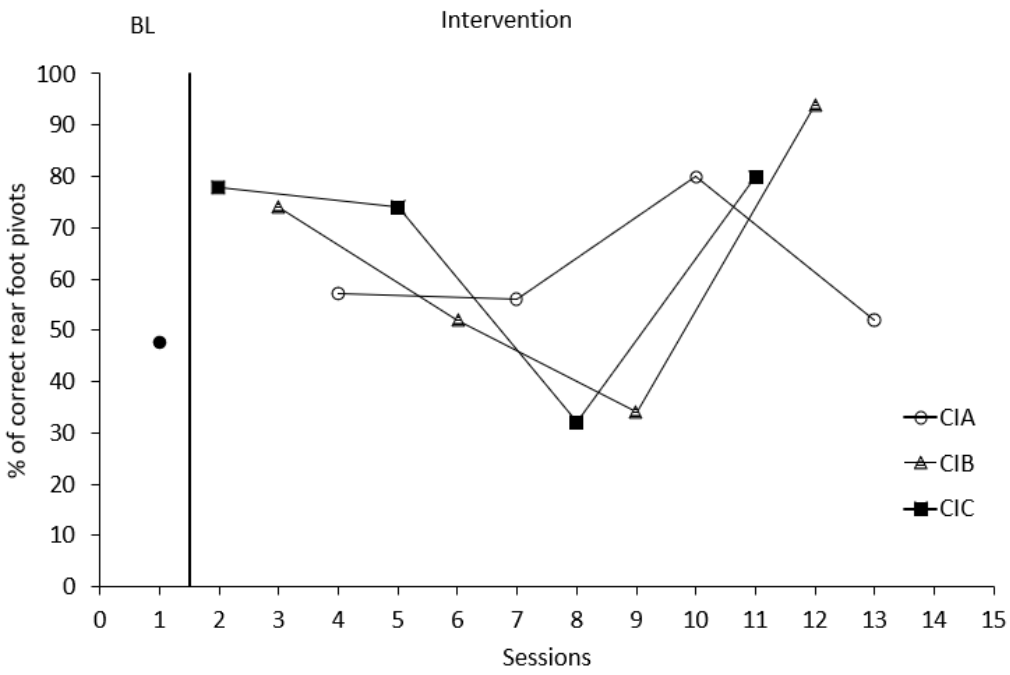


Figure 5. Dave's results

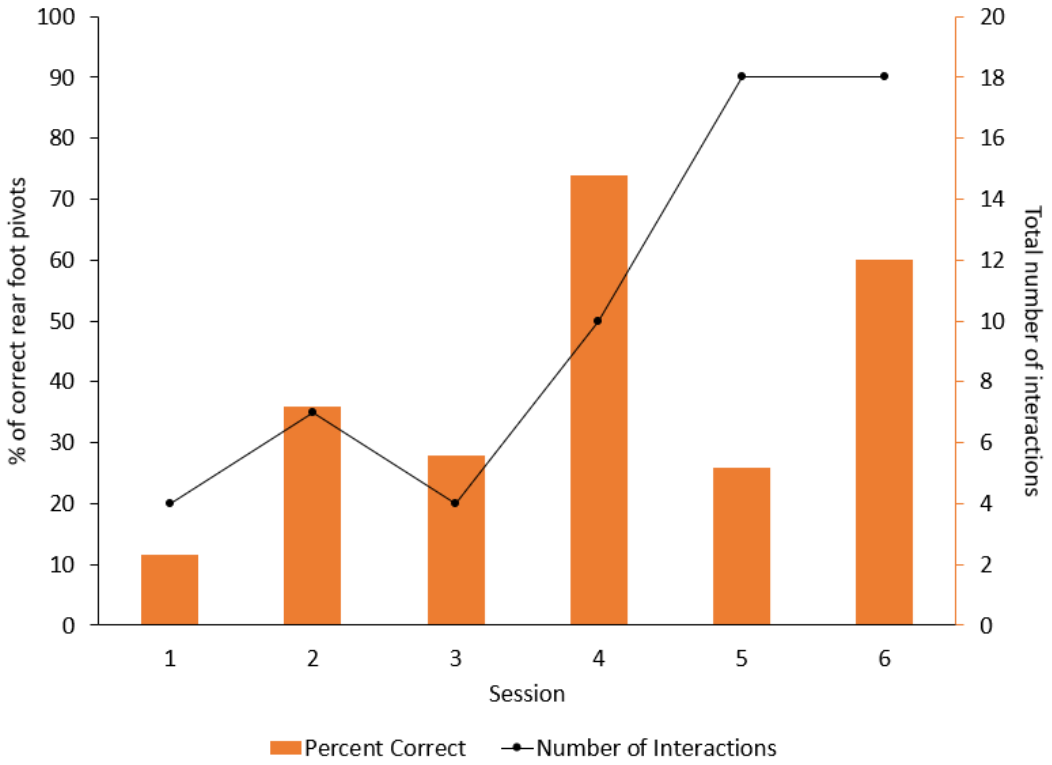


Figure 6. Peter's performance and coaching interactions graph

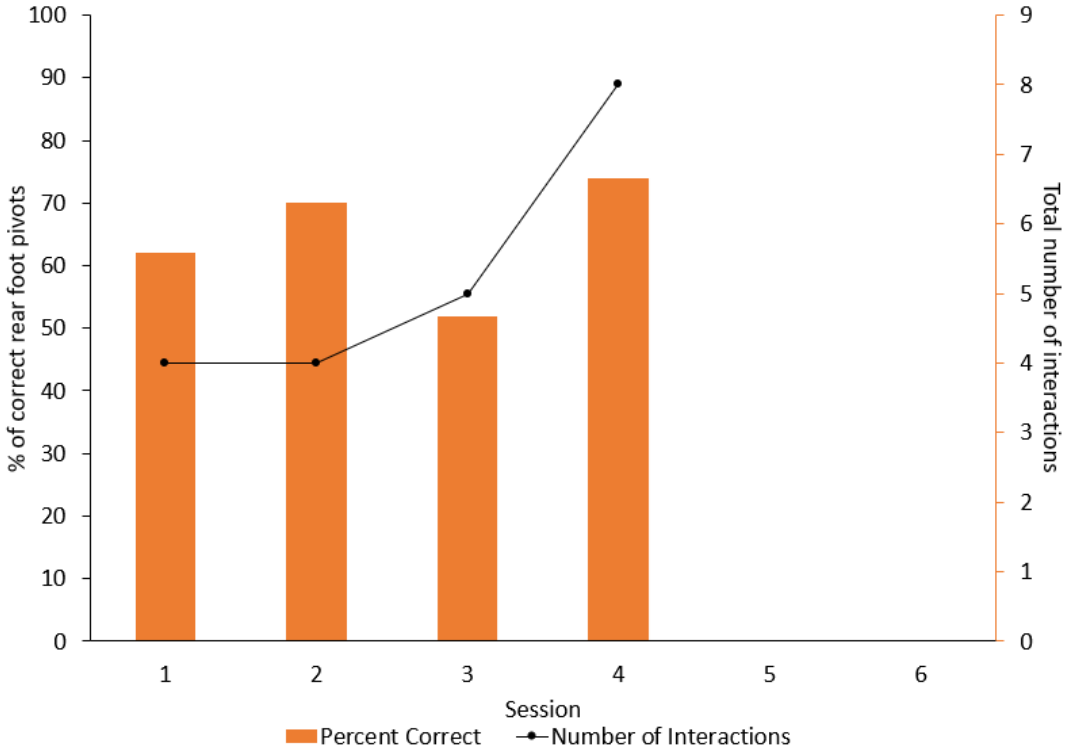


Figure 7. Joe ’s performance and coaching interactions graph

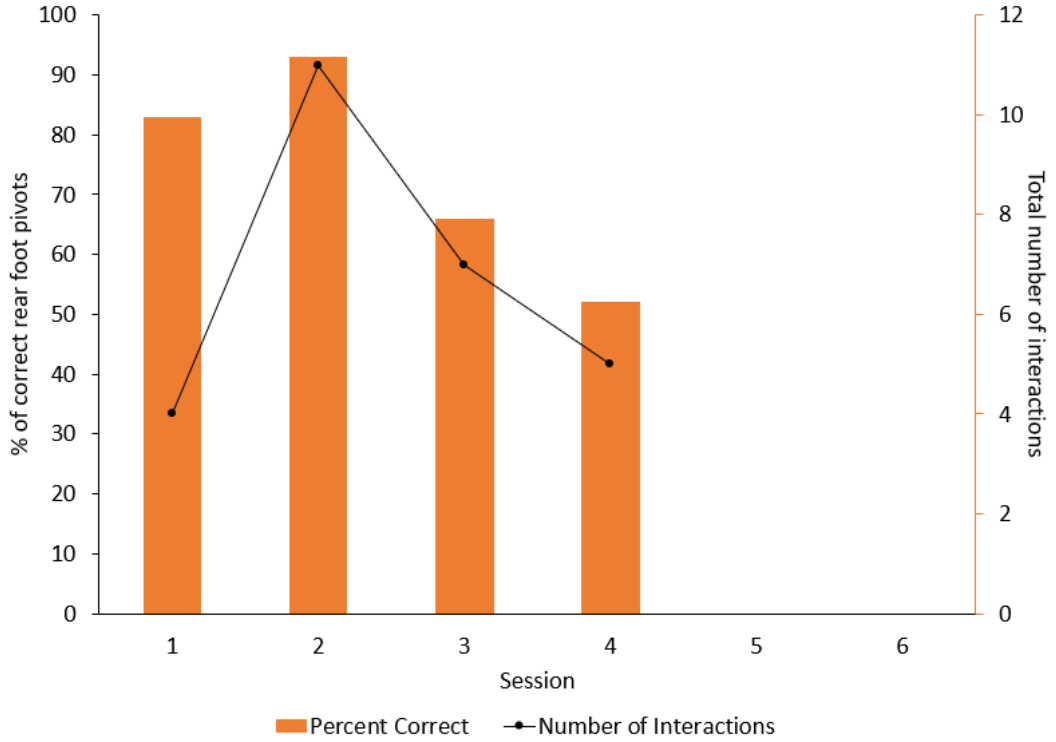


Figure 8. Jackie's performance and coaching interactions graph

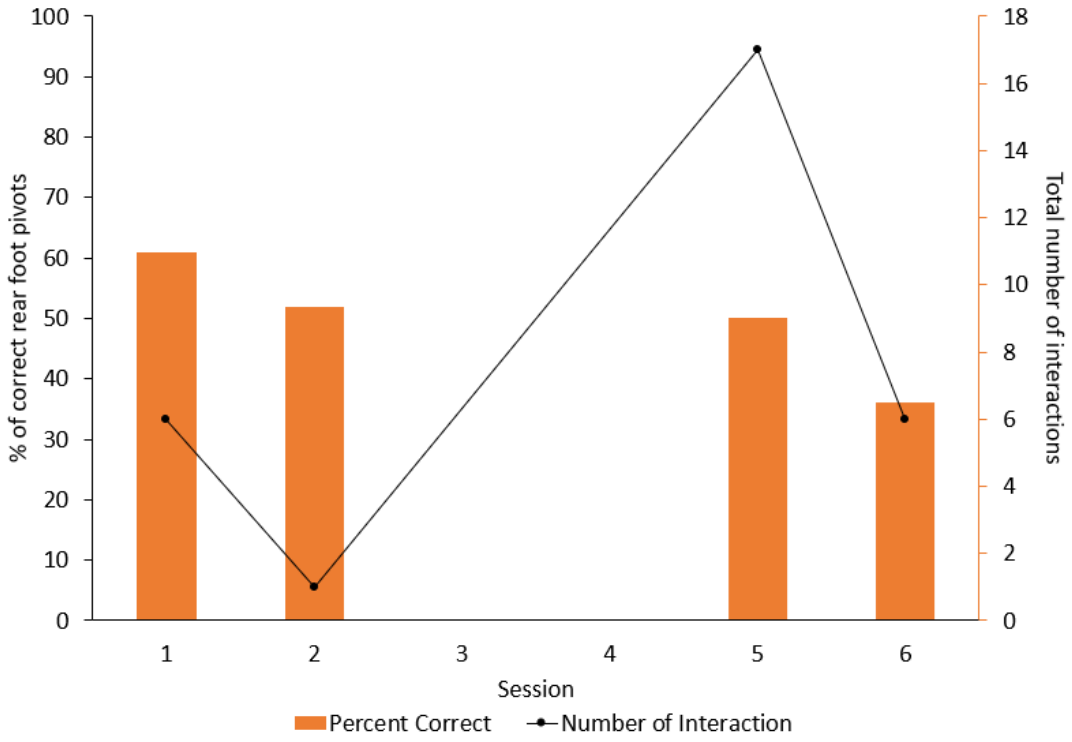


Figure 9. Ally's performance and coaching interactions graph

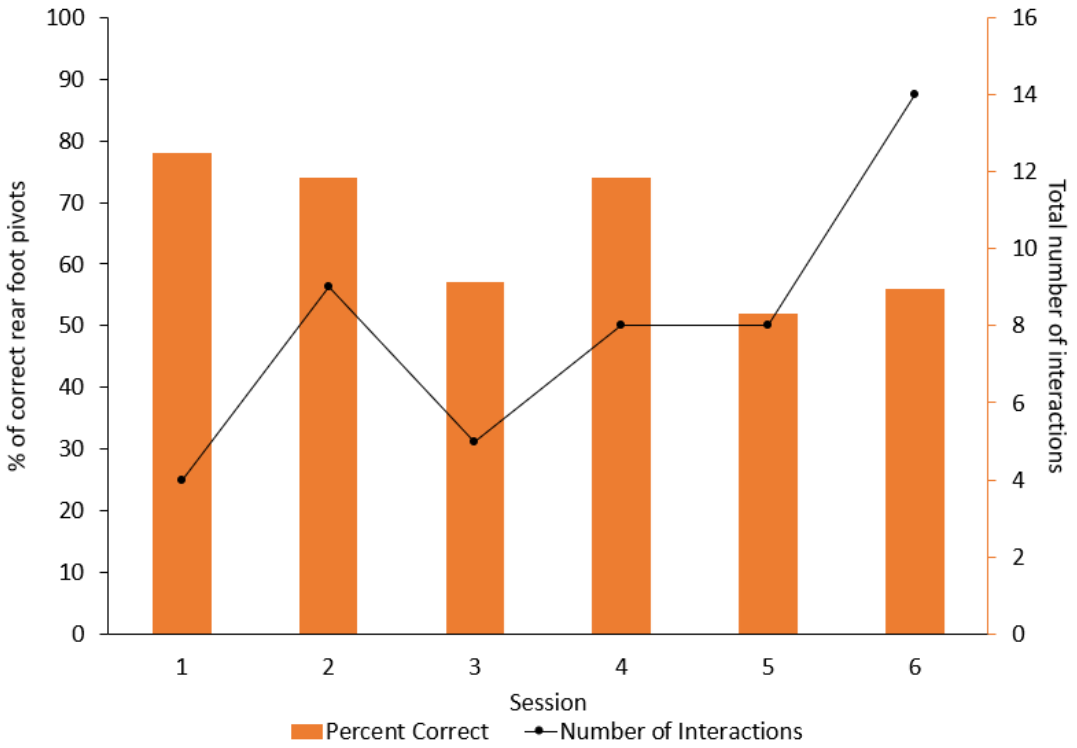


Figure 10. Dave's performance and coaching interactions graph

Appendix A

Participant #: ____ Group #: ____ Data collector initials: _____ Video name: _____ Condition: _____							
Opp. (right cross/ dodging)	Time	Feet are apart	Lead foot is pointed forward or slightly toed in	Back foot is pointed forward or toed in	Only the ball of the back foot is on the ground- if off ground count as incorrect	Back foot is at least at a 45 degree angle	Correct or incorrect X or ✔
1	:	+ / -	+ / -	+ / -	+ / -	+ / -	
2	:	+ / -	+ / -	+ / -	+ / -	+ / -	
3	:	+ / -	+ / -	+ / -	+ / -	+ / -	
4	:	+ / -	+ / -	+ / -	+ / -	+ / -	
5	:	+ / -	+ / -	+ / -	+ / -	+ / -	
6	:	+ / -	+ / -	+ / -	+ / -	+ / -	
7	:	+ / -	+ / -	+ / -	+ / -	+ / -	
8	:	+ / -	+ / -	+ / -	+ / -	+ / -	
9	:	+ / -	+ / -	+ / -	+ / -	+ / -	
10	:	+ / -	+ / -	+ / -	+ / -	+ / -	
Total # correct/ Total # of opportunities							%

Appendix B

Procedural Integrity- CIA		Date:	Group #:		
Interaction #	Participant #	Participant pivot +/- (correct or incorrect)	Specific performance feedback +/-	Ideal pivot feedback for (incorrect pivots only) +/-	Correct or incorrect interaction ✔/X
1		+ / -	+ / -	+ / -	✔/X
2		+ / -	+ / -	+ / -	✔/X
3		+ / -	+ / -	+ / -	✔/X
4		+ / -	+ / -	+ / -	✔/X
5		+ / -	+ / -	+ / -	✔/X
6		+ / -	+ / -	+ / -	✔/X
7		+ / -	+ / -	+ / -	✔/X
8		+ / -	+ / -	+ / -	✔/X
9		+ / -	+ / -	+ / -	✔/X
10		+ / -	+ / -	+ / -	✔/X
11		+ / -	+ / -	+ / -	✔/X
12		+ / -	+ / -	+ / -	✔/X
13		+ / -	+ / -	+ / -	✔/X
14		+ / -	+ / -	+ / -	✔/X
15		+ / -	+ / -	+ / -	✔/X
% of correct coaching interactions		Total # correct/ Total # of opportunities			%

Procedural Integrity- CIB				Date:	Group #:		
Interaction #	Participant #	Participant pivot +/- (correct or incorrect)	Question about current foot pivot +/-	Brief affirmation	Question about ideal performance (incorrect pivots only)	Brief affirmation (incorrect pivots only)	Correct or incorrect interaction ✔/X
1		+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
2		+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
3		+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
4		+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
5		+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
6		+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
7		+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
8		+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
9		+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
10		+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
11		+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
12		+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
13		+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
14		+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
15		+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
% of correct coaching interactions			Total # correct/ Total # of opportunities				%

Procedural Integrity- CIC					Date:		Group #:		
Interaction #	Participant #	Participant pivot +/- (correct or incorrect)	Question about current foot pivot +/-	Brief affirmation	Question about ideal performance (incorrect pivots only)	Brief affirmation (incorrect pivots only)	Question about benefit	Brief affirmation	Correct or incorrect interaction ✔/X
1		+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
2		+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
3		+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
4		+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
5		+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
6		+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
7		+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
8		+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
9		+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
10		+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
11		+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
12		+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
13		+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
14		+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
15		+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	✔/X
% of correct coaching interactions			Total # correct/ Total # of opportunities						%

Appendix C

Survey: Research on Coaching Interactions

1. How long have you been practicing MMA?

2. Do you feel this research was helpful to your overall performance in MMA?

1-not helpful at all. 5-extremely helpful. (please circle one)

1 2 3 4 5

3. Which coaching condition did you find the **most** helpful? (please circle one)

Coaching Condition A - Feedback "Good pivot"
Coaching Condition B - Questions "Did you pivot?"
Coaching Condition C - Value Questions "Did you pivot?" "Why do you pivot?"

4. Which coaching condition did you find the **least** helpful? (please circle one)

Coaching Condition A – Feedback Statements
Coaching Condition B - Questions
Coaching Condition C - Value Questions

5. Do you feel that, overall, your foot pivots have improved since the start of this research?

1-no improvement. 5-improved a lot. (please circle one)

1 2 3 4 5

6. Do you feel that foot pivots are important in MMA?

1-not important at all. 5-extremely important. (please circle one)

1 2 3 4 5

7. Do you think there is value in knowing what type of coaching produces the greatest athlete performance?

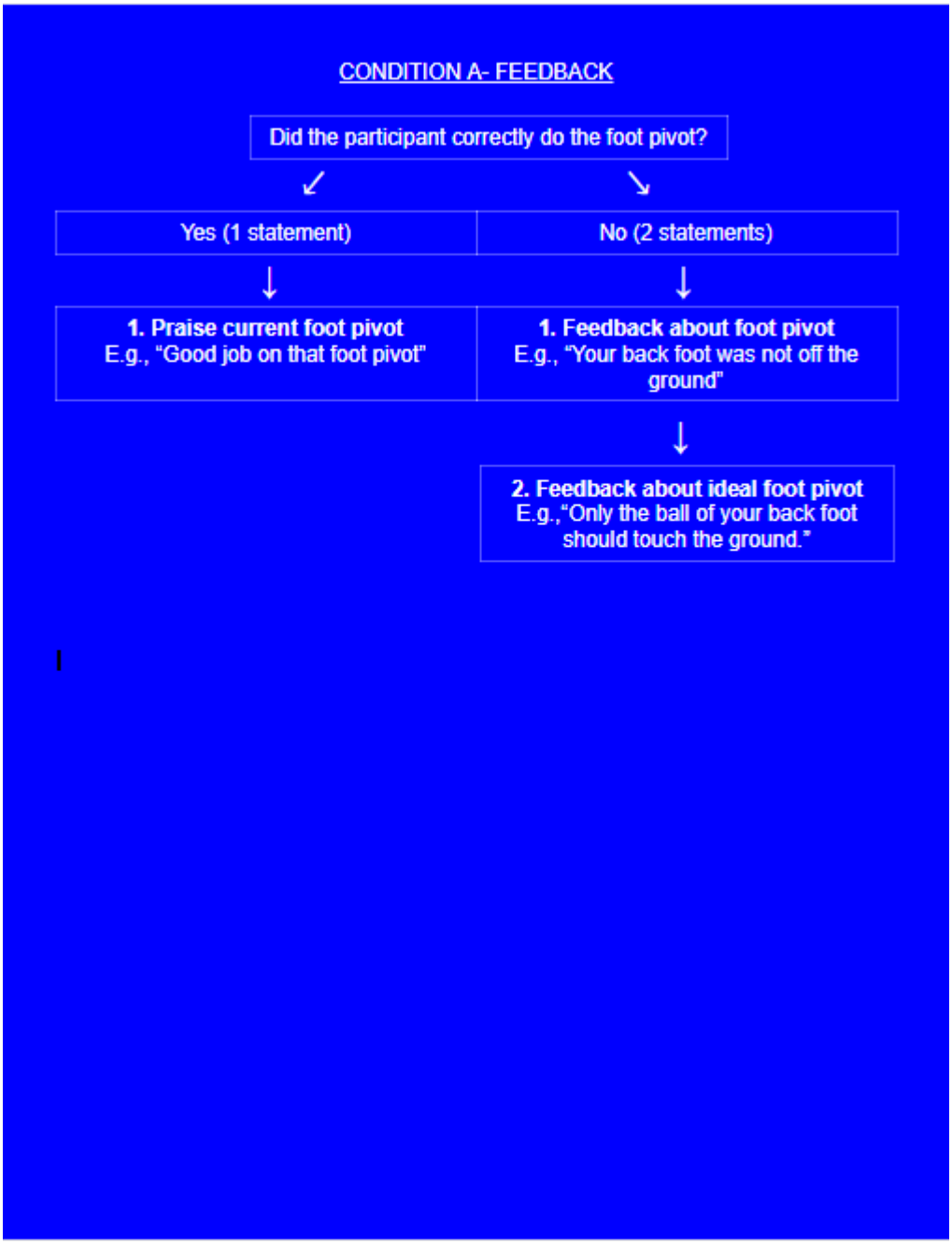
1-not valuable at all. 5-extremely valuable. (please circle one)

1 2 3 4 5

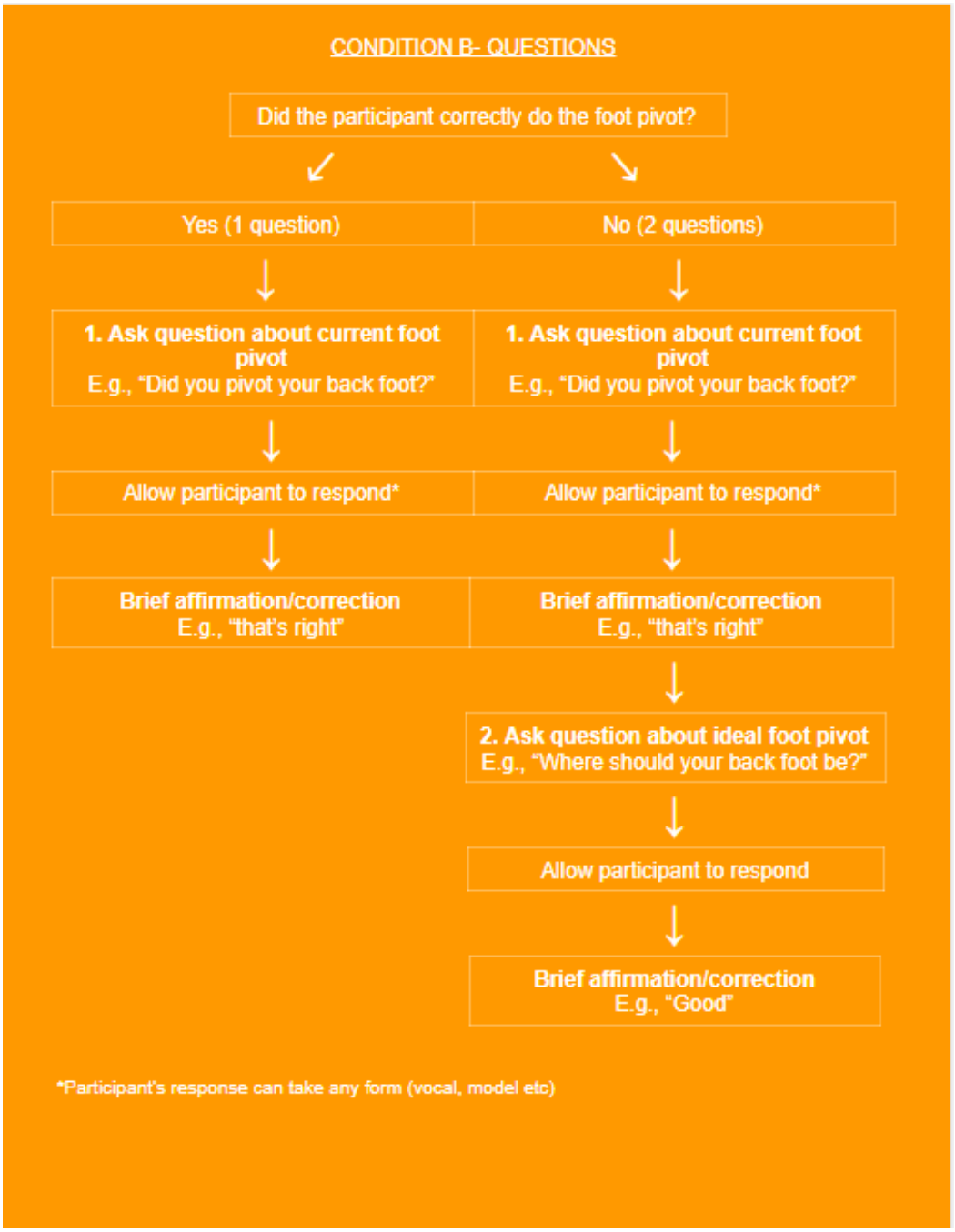
Appendix D

Date: _____ Participant: _____ Phase: _____ Video name:_____					
Opportunity (Right cross, slipping)	*Time*	*Observer 1 score (correct or incorrect opportunity)*	*Observer 2 score (correct or incorrect opportunity)*	*Agreement-1 Disagreement-0*	*Total # of trials with agreements/ total number of trials*
1	:	+/-	+/-		
2	:	+/-	+/-		
3	:	+/-	+/-		
4	:	+/-	+/-		
5	:	+/-	+/-		
6	:	+/-	+/-		
7	:	+/-	+/-		
8	:	+/-	+/-		
9	:	+/-	+/-		
10	:	+/-	+/-		%

Appendix E


CONDITION A- FEEDBACK
Did the participant correctly do the foot pivot?
Yes (1 statement)
No (2 statements)
1. Praise current foot pivot
E.g., "Good job on that foot pivot"
1. Feedback about foot pivot
E.g., "Your back foot was not off the ground"
2. Feedback about ideal foot pivot
E.g.,"Only the ball of your back foot should touch the ground."

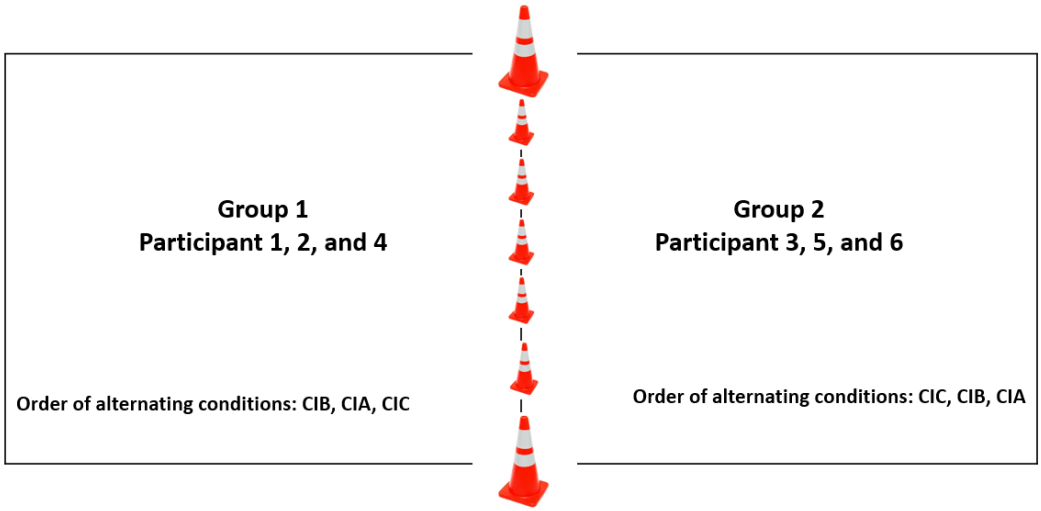
Appendix F


CONDITION B- QUESTIONS
Did the participant correctly do the foot pivot?
Yes (1 question)
No (2 questions)
1. Ask question about current foot pivot
E.g., "Did you pivot your back foot?"
1. Ask question about current foot pivot
E.g., "Did you pivot your back foot?"
Allow participant to respond*
Allow participant to respond*
Brief affirmation/correction
E.g., "that's right"
Brief affirmation/correction
E.g., "that's right"
2. Ask question about ideal foot pivot
E.g., "Where should your back foot be?"
Allow participant to respond
Brief affirmation/correction
E.g., "Good"
*Participant's response can take any form (vocal, model etc)

Appendix G


CONDITION C- VALUE QUESTION
Did the participant correctly do the foot pivot?
Yes (2 questions)
No (3 questions)
1. Ask question about correct foot pivot
E.g., "Where is your back foot?"
1. Ask question about incorrect foot pivot
E.g., "Where is your back foot?"
Allow participant to respond*
Allow participant to respond*
Brief affirmation/correction
E.g., "that's right"
Brief affirmation/correction
E.g., "Actually, you didn't pivot your back foot"
2. Ask question about the benefit of the foot pivot
E.g., "How did it help your strike?"
2. Ask question about ideal foot pivot
E.g., "Where should your back foot be?"
Allow participant to respond*
Allow participant to respond*
Brief affirmation/correction
E.g., "Very good"
Brief affirmation/correction
E.g., "that's right"
3. Ask question about the benefit of the foot pivot
E.g., "How does that help your dodging?"
Allow participant to respond*
Brief affirmation/correction
E.g., "Good"
*Participant's response can take any form (vocal, model etc)

Appendix H


Group 1
Participant 1, 2, and 4
Order of alternating conditions: CIB, CIA, CIC
Group 2
Participant 3, 5, and 6
Order of alternating conditions: CIC, CIB, CIA

Appendix I

Informed Consent

Please read this consent document carefully before you decide to participate in this study. The researcher will answer any questions before you sign this form.

Study Title: The effects of feedback statements versus coaching questions on athlete performance

Purpose of the Study: The purpose of the study is to improve athlete performance of rear foot pivot during right-strike and while dodging a punch. The coach will be using questions and feedback statements to improve performance of the foot pivot. Participants will be referred by the coach to participate in this study.

Procedures: No extra time will be required for participation, only attendance to the regularly scheduled weekly practices. The coach will train athletes on an as-needed basis on the correct performance of the rear foot pivot. Following as-needed training, the coach will practice with each athlete and deliver feedback in the form of a question or statement about rear foot pivot.

Potential Risks of Participating: There are no risks of participating, other than the usual risks involved in practicing Mixed Martial Arts.

Potential Benefits of Participating: Participants will benefit from participating in the study in that their rear foot pivot will be improved which in turn will enhance their right-strike, balance, and slipping a punch. In addition, this study will benefit the sports coaching literature and help coaches by identifying the most effective coaching interaction (question or statement) to improve athlete performance.

Compensation: N/A

Confidentiality: Confidentiality will be maintained by using participant initials. Identifying characteristics will not be written on any data sheets, graphs, or reports. The video recordings will be kept in a password-protected folder on the principal investigator's computer and transferred to a secure server. All video and data files will be maintained on a secure server, with paper data stored in a locked file.

Video/audio recording: It would be difficult to record live every instance of rear foot pivot as correct or incorrect, as MMA is a fast-paced activity. Therefore, cameras will be placed in the gym for data collection purposes. All video recordings will be reviewed and recorded at a later time. Video recordings will be accessed by the principal investigator, co-investigator, and trained research assistants and no other person will have access to these. Recordings will be stored by using Florida Institute of Technology's secure network. Once all data have been analyzed and recorded, all video recordings will be destroyed by deleting them from Florida Tech's network and any applicable video camera. Video recordings will be deleted in August of 2019.

Voluntary participation:
Your participation in this study is completely voluntary. There is no penalty for not participating. You may also refuse to answer any of the questions we ask you.

Right to withdraw from the study:
You have the right to withdraw from the study at any time without consequence.

Whom to contact if you have questions about the study:
Nicholas Weatherly, Ph.D., BCBA-D, LBA (CT, KY)
INTERIM HEAD OF SCHOOL & ASSOCIATE PROFESSOR
SCHOOL OF BEHAVIOR ANALYSIS
Email: nweatherly@fit.edu
321.674.7054

Florida Institute of Technology
High Tech with a Human Touch™

Whom to contact about your rights as a research participant in the study:

Dr. Lisa Steelman, IRB Chairperson
150 West University Blvd.
Melbourne, FL 32901
Email: lsteelma@fit.edu Phone: 321.674.8104

Agreement:

I have read the procedure described above. I voluntarily agree to participate in the procedure, and I have received a copy of this description.

Participant: _____ Date: _____

Principal Investigator: Date: