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Using Video-Based Feedback and Self-Monitoring to Improve Athletic Coaching Interactions

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by

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Abstract

Title: Using Video-Based Feedback and Self-Monitoring to Improve Athletic Coaching Interactions

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The present study examined if video-based feedback combined with self-monitoring will improve the quality of specific feedback statements delivered by coaches. The study involved four collegiate softball coaches. The primary dependent variable was the quality of coaching interactions delivered by the coaches as measured by items completed from a checklist of feedback characteristics. The coaching interaction was defined as any feedback statement that is referencing behavior relevant to task performance. The secondary dependent variable was the athlete's performance. The independent variable was video feedback combined with self-monitoring. The results showed an improvement in all four participant's coaching interactions. The group mean baseline levels for coaching interaction accuracy were between 39% - 59% which improved to 55% - 72% after treatment was introduced. The coaches individual improvement ranged

from 3.5%-15.4%. The current study found that using video-based feedback and self-monitoring was effective in improving coaching interactions.

Keywords: Performance Feedback, Video feedback, Athlete performance, Self-Monitoring, Softball, Coaches, Coaching Interactions

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Dedication

This thesis is dedicated to my parents, William and Sheri Nagel. I never would have made it to where I am today without your support. Thank you for always being there for me and for all your guidance throughout the years. This thesis is also dedicated to my grandpa, Bruce Johnson, who taught me that hard work and a good sense of humor is how you get to where you want to be in life.

Chapter 1
Introduction

Applied behavior analysis (ABA) is a universal science of behavior, meant to be a mainstream force relevant for most, if not all, behavioral concerns. If the field of behavior analysis wants to expand and become mainstream, we do not have to compromise any of our principles. We can simply integrate into a field that has already developed mainstream status (Normand & Kohn, 2013). A large market that has undeniably established mainstream exposure is organized sports. The U.S. Bureau of Labor Statistics reported that approximately 19.5% of men and women ages 15 and older participate in sports and exercise each day and 21.5 million children ages 6-17 participate in team sports (Woods, 2017). Of the 2,185 students surveyed by the U.S. Bureau of Labor Statistics, results showed that 75% of boys and 69% of girls ages 8-to-17 played organized sports (Woods, 2017). However, these numbers only display the number of *children* that participate in sports. There are numerous other levels in sports as well including athletes at the high school, collegiate, intramural, semi-professional, and professional levels.

Behavior analysis has already had some success integrating into this market by conducting research to show the effects of the interventions on sport performance. One study by Smith and Ward (2006) evaluated how behavioral interventions could improve football performance. The study used a reversal experimental design to show the effects of three conditions: (1) publicly posting performance, (2) goal setting, and (3) publicly posting performance combined with goal setting. The results indicated that all three conditions were effective in increasing the players performance in blocking and route-running behaviors. These results also generalized to games. In 2014, Schonwetter, Miltenberger, and Oliver found seven public high school swim team members self-monitoring combined with feedback was effective in increasing work output during practice with by 91%-98%. These studies are a great example of how applied behavior analysis interventions, when implemented by trained behavior analysts, can improve performance within athletics.

Institutionalization

In order for long-term success in improving performance in any area we need to get the internal workers, such as athletic coaches, to implement ABA principles first hand (Sigurdsson & Austin 2006). Temporary improvements cannot be considered evidence of effectiveness. The applied integrity of an intervention should be questioned if an effective intervention to increase athletic performance

fails immediately following the removal of the researcher. The value of applied behavior analysis does not come from just creating change, but from creating lasting change (Conard, Johnson, Morrison, & Ditzian 2016).

Behavior change that fosters long lasting effects can be separated into two categories: maintenance and institutionalization. Maintenance has been defined in various ways. Conard et al. (2016, p. 212) defined maintenance as a "type of durability across time in which the target behavior continues to occur after the intervention implemented by a consultant or researcher has been removed from the setting". Stokes and Baer (1977, p. 349) defined it as "generalization of behaviors acquired during training across time, persons, and settings". Malott and Suarez (2003, p. 442) defined maintenance as "continuing of performance after it was first established". Lastly, Boyce and Geller (2001) defined it as levels of responding established during intervention that are maintained after that intervention has been terminated. An emphasis on maintenance can imply that the goal is to remove an intervention, which is not always appropriate for certain types of interventions, including some of the most common interventions within Organizational Behavior Management (OBM) such as feedback, goal setting, and incentives (Conard, Johnson, Morrison, & Ditzian 2016; Fleming 2001). Quite often, if the target behavior is valued by an organization enough for intervention, then the tools used to create behavior change should be build and integrated to sustain even once the experimenters leave.

Institutionalization involves the partial or full continuation of an intervention by the organization after the consultant or researcher has been removed from the setting (Conard, Johnson, Morrison, & Ditzian 2016). One model that shows the importance of institutionalization of behavior principles in internal staff, such as managers, is the consultant workshop model. This model teaches managers to conduct their own performance improvement projects, potentially equipping them with the knowledge to continue improving performance after the consultation period is over and the ability to address other performance targets (Gravina & Austin 2018). Sigurdsson and Austin (2006) noted that giving implementation skills to managers ensures a higher chance for maintenance after the researchers are withdrawn. They also found that managers were more motivated to be trained in carrying out interventions, to be involved in data collection, and to deliver rewards and praise. Since managers are usually the ones that implement rules and control consequences within their environment, they might be more likely to buy into the intervention if they're involved in these solutions and processes.

Coaching for Institutionalization

In an athletic setting, the coach is equivalent to a manager. The athletic coach is responsible for implementing the team rules and controls the consequences within the environment (e.g., running sprints for mistakes). They are responsible for getting athlete results through the performance of their athletes, which is the

foundation of OBM. Therefore, training these athletic coaches to carry out the intervention after the researchers have been withdrawn can be advantageous in the continuation of behavior-change and results.

An athletic coach's main job is to train and coach athletes to play a specific sport; however, athletic coaches might not necessarily have received training in how to coach. They are often current or former athletes that have a great deal of knowledge about the sport. Their knowledge of the sport is supposed to be coupled with effective coaching techniques that can produce sustainable improvements in their athletes.

Komaki and Barnett (1977) explained the difference between traditional coaching and behavioral coaching. They mention that traditional coaching focuses on the eventual outcome of the game rather than player development and improvement. This allows for instances of desired skill execution to be overlooked because even when the players engage in the wrong behaviors it is ignored because a point was scored, or yardage was gained. Behavioral coaching, on the other hand, focuses solely on the players development and improvement and combines competitive and learning aspects together. The players progress is measured regardless of the outcome of the play or the game. Behavioral coaching also specifies desired behaviors and provides positive consequences for them. Traditional coaching often lacks frequent and contingent consequences. While a coach may target specific behaviors to change, it is often done by observation and

not systematically. Using a behavioral approach allows for the coach to combine the overall outcome of the game and individual's progress of the respective sport.

When it comes to coaching techniques, behavioral coaching has been found to be more effective than traditional coaching (Kelley & Miltenberger, 2016). Komaki and Barnett (1977) originally introduced the concept of behavioral coaching within athletics and found that behavioral coaching was superior to more traditional coaching methods that was restricted to verbal general descriptions of performance and feedback that focused primarily on incorrect responses. They used a checklist and frequent contingent reinforcement (e.g., feedback) for the accurate play execution for five football players. The results showed that behavioral interventions improved play execution by 54% - 82%. Behavioral specification and positive reinforcement of desired play execution is a viable approach to the coaching of football.

Effective coaching is made up of five characteristics as described by Martin and Hrycaiko (1983). First, there should be an emphasis on defining behavior problems that can be measured. Second, treatment procedures and techniques should be used to arrange an individual's environment in order to help individual function more fully. Third, the method and rationale should be described precisely. Fourth, coaching should be based on research. Lastly, behavioral coaching must also focus on the coach's behavior, not just the athlete's performance.

Coaching and Feedback

Given these components of effective coaching, Laipple (2012) states that feedback and coaching overlap. Performance feedback has been defined in a variety of ways. Prue and Fairbank (1981) define performance feedback as "information that is given to persons regarding the quantity or quality of their past performance". Sulzer-Azaroff and Mayer (1991) defined it as, information transmitted back to the responder following a particular performance. Daniels (1994) described it as, information about performance that allows an individual to adjust his or her performance. Lastly, Rummler and Brache in 1995 defined it as information that tells performers what and how well they are doing." (Alvero, Bucklin, & Austin 2001, p. 4-5). With all of these definitions, feedback plays an important role in improving a person's performance. Effective coaching consists of various forms of feedback that the coach gives about present or past performance to make a positive impact.

Weatherly and Malott (2008) found that feedback has been one of the most frequently used interventions, either alone or packaged with other components (e.g., training and goal setting) in the field of Organizational Behavior Management. It can be effective in increasing desired behaviors or decreasing undesired behaviors (Aljadeff-Abergel, Peterson, Wiskirchen, Hagen, & Cole 2017). For example, Rantz and Van Houten (2011) used feedback to improve completion of aircraft flight checklists from 38% to 100% in just a few trials.

Feedback in athletics is just as important. Within one athletic practice, a coach has numerous opportunities to give their athletes feedback on their performance. Many managers, or coaches, often overlook that inadequate feedback might result in poor performance (Daniels & Bailey, 2014). Daniels and Bailey state that when a person is described as unmotivated, lazy, or in need of more training, the problem can be traced, in large part, to lack of feedback. An athlete that is not given adequate feedback may not know what they need to change resulting in a plateaued performance level.

Daniels and Baily (2014) stated that for feedback to be effective it should follow certain characteristics. Feedback should include specific information and information on a performance the person controls, should be immediately following the performance, if not during, individualized, self-monitored when possible (if not self-monitored then delivered by the person in charge), focused on improvement, easily understood, graphed if possible, and used as an antecedent to reinforcement. Specific information means that the performer knows exactly what is expected of them and what behaviors they have to change in order to improve. Instead of a coach telling their athlete “good job” or “that wasn’t good enough, do it again”, the feedback should be specific to the behavior that needs to be improved or done accurately. For example, if an athlete missed giving a screen during an offensive possession, the coach could give that athlete feedback by saying “Mary you missed the screen on Nicole’s opponent before you ran to the baseline”. Feedback should

also be given on information that the person can control. The person should not only have the knowledge and skills to improve performance, but the performance should also be something they can do themselves. When a coach is expecting a hockey player to score a goal, they must take into account if the goalie's behavior is the reason the player missed. In terms of the timing of feedback, the sooner the feedback is provided the better. Hourly feedback allows for more opportunities for the performer to change their behavior. Feedback should also be individualized. When you give feedback to an individual about their own performance, it is most likely to be something that they can control, something they can understand, and self-monitored. If a coach gives feedback to their entire team, the players may not know who is causing the good or poor performance, what behaviors are needed to improve or continue, or who is in control of the improvement. Each position on a team sport have different responsibilities to the team's overall performance. One player might be in charge of rebounding the basketball while another player is in charge of bringing the call up the court. Therefore, the more individualized the feedback, the easier it is for each player to understand what is needed to improve.

It is also important to encourage the performer to self-monitor their performance (Daniels & Bailey 2014). The quicker the performer knows whether they are right or wrong the faster they will learn what to change. If they cannot self-monitor, the feedback given should be collected and delivered by the person in charge. The manager or coach that collects the data and gives feedback shows the

performers that these data are important for success, that the manager knows how they are doing, and they learn more about the data collected if they personally give the feedback rather than if they delegate it to someone else. Feedback should also consist of what the performer needs to improve rather than what they did wrong. It should include what behaviors will result in a solution rather than simply focusing on the behaviors that presented the problem. Instead of telling an athlete repeatedly what they are doing wrong (e.g., not rebounding correctly), a coach should tell the athlete what they need to do in the future in order to be successful (e.g., box out opponent before going for the ball) to improve performance. Feedback should also be easily understood to the performer. If the performer does not understand what is being asked of them, the likelihood they will make the correct changes to improve aren't likely. Graphing feedback is also an effective way to display visually to the performer how they are currently performing and how much they have improved since the last feedback instance (Smith & Ward 2006). Showing an athlete their batting percentage before and after correcting their stance can easily display to the athlete the importance of a correct batting stance. Lastly, feedback should be an antecedent for reinforcement. Feedback alone does not reliably change performance. The change resulting from feedback alone will likely be temporary if it's not followed up with reinforcement for the desired behavior (Daniels & Bailey 2014). A study by Loewy and Bailey (2007) separated feedback from goal setting and manager praise to evaluate the effects on customer greetings in a home

improvement store. Baseline showed that greetings were below expected levels. Feedback was introduced by posting feedback in the back of the store near the time clock. This intervention doubled the number of customer greetings in one store. This improvement only lasted two sessions before the level dropped down to baseline levels. Next, feedback was paired with goal setting and manager praise. The target levels increased and maintained until the end of the study. These results showed that feedback used as a discriminative stimulus (i.e., antecedent) to positive reinforcement is how feedback, particularly constructive feedback, becomes effective.

Antecedents alone get behavior started but behavior change comes from the consequences that follow the feedback. Take an example of a coach telling an athlete to keep their elbow up when shooting a free throw and the athlete subsequently making the shot. The antecedent (the coach instructing the athlete) got the behavior to occur, but the consequence is what impacts whether the athlete will continue to keep their elbow up. This increase in keeping their elbow up while shooting a free throw is not a result from the feedback alone but a result from the positive reinforcement of making the shot.

There are numerous types of feedback including video, verbal, and graphic forms of feedback. Many variations of feedback interventions have been used to improve performance within athletics. Examples include the use of video feedback and verbal feedback to increase horseback riding skills (Kelley & Miltenberger

2016), graphic feedback and goal setting to improve football skills (Smith & Ward 2006), and video modeling by experts and video feedback to enhance gymnastics skills (Boyer, Miltenberger, Batsche, & Fogel, 2009).

Video-Based Feedback

Video-based feedback "involves showing an athlete (or the performer of a particular skill) a video clip of his or her own performance of a particular skill" (Boyer, Miltenberger, Batsche, & Fogel 2009, p. 855). Keith (1967) stated that coaches could also use videotapes to evaluate their own performance. The use of video has been recommended for self-evaluation and used for eliminating poor behaviors and to provide corrective instruction for teachers and public speakers (Martin & Hrycaiko 1983). Martin and Hrycaiko (1983) reported that coaches who have replayed their own speech and behavior on film have stated that they were unaware of their own behaviors they exhibited (e.g., "Was that me? Did I really do that?"). The component of video-based feedback within an intervention adds visual feedback on a completed performance (Kelley & Miltenberger 2016). The video allows the individual to see their own performance in relation to what they view as the appropriate performance, giving them the information needed to adjust their performance moving forward. Video-based feedback has been evaluated across various areas including an elementary school (Thiemann and Goldstein 2001), an after school behavioral treatment program (Macpherson, Charlop, & Miltenberger

2014), a parent-training program (Phaneuf & McIntyre 2007), and public schools (Kern-Dunlap, Dunlap, Clarke, White, & Stewart 1992) and has shown a great deal of success in improving target performance.

There has been limited video-based feedback done within sports (Kelley & Miltenberger 2016). One study was conducted by Rikli and Smith (1980) who evaluated the effects of video-based feedback on improving tennis serves. They found that video-based feedback produced significantly higher levels of performance than those who did not receive video-based feedback in training. Within athletics it is extremely common to use film to re-watch games or practices. Coaches, especially on the collegiate level, have film sessions where they show past game or practice film to their athletes and point out various deficits within the player's performance. These sessions are typically filled with statements pointing out the athlete's wrong behavior and often do not give an individualized solution. Since film study is already incorporated within the athletic community, this provides an opportunity to use this video for self-monitoring and feedback related to coach performance as well as athletic performance.

Self-Monitoring

Video-based feedback is frequently used as an intervention with the addition of other components of feedback such as graphic and verbal feedback (Kelley & Miltenberger, 2016). Without it, it would be difficult for the feedback

receiver to know whether they are watching the correct performance or incorrect performance, which is one of the main purposes of feedback. Self-monitoring of the specific correct tasks being observed provides the opportunity for noting correct and incorrect performance. Self-monitoring has been used in athletics to show increases in performance. In 1991, Critchfield and Vargas used self-monitoring to record how many pool laps swimmers completed during practice. They found that completing the self-monitoring checklist at the end of every swim session, compared to every 5 or 10 laps within the swim session, was the most effective because the swimmers did not have the opportunity to engage in distracting behaviors such as talk with their peers' in-between laps. Polaha, Allen, and Studley (2004) examined the effects of self-monitoring to decrease the stroke count in swimmers. When self-monitoring was implemented, the swimmer's stroke count decreased. When self-monitoring was removed however, the swimmer's stroke count began to increase.

Self-monitoring has the potential to create a pairing of feedback with reinforcement of the desired behavior by allowing the individual to review their own performance and immediately receive positive, potentially reinforcing, feedback in the form of correct acknowledgments on self-monitoring forms. This allows for lasting behavior change as the individual is not reliant on someone else to know whether they are doing right or wrong and without needed someone else to

deliver the reinforcement. This is often done by having a participant complete a behavioral checklist as the self-monitoring mechanism (Rose & Ludwig, 2009).

Purpose of Current Investigation

Athletic teams are allotted a specific amount of field or gym time for practice each season. The goal is to maximize the time coaches spend coaching athletes and time spent improving their performance as a coach. For example, pulling a coach away from practice for immediate feedback on coaching performance can interrupt the allotted practice time and consequently decreases the overall time that the athlete has to engage in practicing their specific skills. This in turn may decrease the overall opportunities for the athletes to practice their skills. The purpose of the current study was to provide video-based feedback to athletic coaches on their own performance of giving specific feedback to their athletes while self-monitoring their individual performance. Feedback was given before each practice to combat the effects of interrupting practice time to give immediate feedback.

Chapter 2
Method

Participants and Setting

The participants were four softball coaches at a private university in south-eastern Florida. The principle investigator recruited the coaches by contacting local coaches in the area. To participate in a coaching study, coaches were required to allow video recording of their practices and to meet briefly before each practice to review performance. The setting was a collegiate softball field with sessions occurring during a previously scheduled summer camp for middle and high schoolers.

Materials

The materials for this study were relevant to recording the coaching interactions and for self-monitoring the coach's performance. The materials consisted of video recordings of each practice, a secure drive (i.e., Box) to store the recordings, camcorders, wireless microphones, and a datasheet comprising of specific components for self-monitoring the coach's feedback interactions (see Appendix A).

Dependent Variable

The main dependent variable for this study was the accuracy of specific feedback statements delivered to the athletes from the coaches. Henley and DiGennerao Reed (2015), defined specific feedback as "feedback that explicitly references information about observable behavior relevant to correct task performance" (p. 325). A positive feedback statement consisted of information regarding the athlete's current correct performance (e.g., "Good job pushing off your back foot during your swing"). Constructive feedback consisted of information regarding current incorrect athlete performance (e.g., "Widen your stance"). The dependent variable was the same for each coach; however, the type of feedback provided to each athlete varied from athlete-to-athlete based on athlete performance. In the present study, data were collected on 5 components of specific feedback. These components were chosen based on Daniels and Bailey (2014) characteristics of effective feedback and tailored to the athletic environment. The first component was if the coaching interaction specified a specific behavior (e.g., Good swing). The second component was the timing of feedback during the performance or immediately following (i.e., within 10 seconds of athlete's performance). The third component was if the coaching interaction was individualized, meaning that the coach was 1 on 1 with single athlete, called athlete's name, or that athlete was the only one who performed the specified skill.

The fourth component was if the coaching interaction compared the athlete's current behavior to previous performance, the correct behavior, or to past behavior (e.g., "Sheri your holding your bat with your hands separated. You need to keep your hands close.") This could also be counted correct by simply using a comparison word or statement (e.g., a comparative or superlative adjective – adjective + "er"/"est" – better, wider, faster).

Data were collected twice a day for four days during the softball camp's scheduled practice times across two weeks (i.e., total of 8 sessions). The accuracy of the specific feedback statements was calculated using a data sheet breaking down the different components of specific feedback for each coaching interaction (see Appendix A). Accuracy in the current study was defined as the coaching interaction containing all five components of the feedback definition. Accuracy was calculated using percent of correct components in each coaching interaction (i.e., number of correct components divided by the total number of components multiplied by 100).

Independent Variable

The independent variable introduced was video-based feedback combined with self-monitoring. Video-based feedback involved the coach reviewing a recording of their individual coaching interactions. These recordings consisted of footage from the preceding practice. If the coach did not perform during the

previous practice, the coach was shown interactions from the practice that they previously performed in. While reviewing their video performance, the coaches filled out a self-monitoring checklist (see Appendix A) to evaluate their performance of their coaching interactions involving feedback. These two components, self-monitoring and video-based feedback, were not separated out. The checklist was used to help ensure the coaches understood what was expected of them to provide effective feedback while they reviewed their coaching performance on the videos. During the video-feedback sessions, each instance where the coach provided a feedback statement that referenced behavior relevant to task performance (i.e., coaching interaction) the principle investigator paused the video to allow the coach to fill out the self-monitoring form. The principal investigator prepared the coaching interactions times prior to meeting with each coach.

Interobserver Agreement (IOA)

Main data collection was conducted by the principal investigator and a team of trained data collectors. Interobserver agreement (IOA) was taken on the dependent variable by a trained second observer, who collected data independently. IOA was collected for 30% of all recorded practices, and was calculated by dividing the total number of components with agreement for each coaching interaction by the total number of component opportunities and multiplying by 100. Percentage of agreement was 98.9% (range: 98% to 99%).

Experimental Design

The experimental design for the current study was a multiple baseline across participants. This design was chosen to show effects of the intervention on changing the accuracy of coaching interactions across multiple softball coaches. Due to the fact that the behavior change was skill acquisition, the intervention could not be completely withdrawn, ruling out a reversal design.

Procedures

Pilot Study

Prior to the start of the current study, the researchers did a pilot study in order to test the equipment, navigate the constraints of practice, and to see how much data was able to be collected during a short amount of time before the next practice. The pilot study involved a college softball team. Data was collected for 8 total sessions.

Baseline

During baseline, the principle investigator video-taped a minimum of 20 coaching interactions or up to thirty minutes of practice time. The recording began after all of the athletes and coaches were in the practice environment and engaging in the respective sport activities. The coaching interaction was any feedback statement that referenced behavior relevant to current task performance. An example of a coaching interaction would be if an athlete swung at a pitch and the

coach immediately said, “Widen your stance”. This constructive coaching interaction would be scored as specific, individualized (assuming the coach is one on one with the athlete), immediate, stated a correction, but no comparison, resulting in 80% accuracy for this interaction. A non-example of a coaching interaction would be if an athlete stood up at the plate and the coach prompted them to straighten their toes. This would be considered a prompt and not a feedback statement. Once at least 20 coaching interactions were recorded or up to thirty minutes of footage the principal investigator stopped recording practice. The coaches were not shown the video recordings during baseline as there were no manipulation of variables during this phase. The accuracy data were scored in a private location without the coaches present. The independent variable was introduced to the first coach when the individual coach’s data stabilized during baseline. The following coaches were introduced after they showed a stable trend and the previous coach was in treatment for at least 3 sessions.

Video-Based Feedback and Self-Monitoring

During treatment, the principle investigator video-taped a minimum of 20 coaching interactions or up to thirty minutes of practice time identical to baseline. The principle investigator met with the coach(es) individually, immediately preceding the start of practice to show them their recording (i.e., video-based feedback). During the first intervention session, the principle investigator reviewed

the self-monitoring checklist with the coach and explained the components of an accurate coaching interaction and what each component means while also providing practice examples to score together. Once all the participant's questions were answered and they demonstrated they could accurately score at least one interaction, the coaches scored their own performance from different video-feedback interactions. After this training, and for subsequent intervention sessions, the coaches observed their video footage. The principle investigator did not help the coaches fill out the self-monitoring checklist and simply paused the video after each coaching interaction for them to fill out the self-monitoring checklist independently.

Procedural Integrity

To ensure that the participants scored themselves efficiently on the self-monitoring checklist, researchers took IOA on the self-monitoring checklists. If the coach consistently failed (i.e., 2-3 consecutive sessions) to meet 80% or above accuracy on the self-monitoring checklist, the researchers would review the checklist and administer training until proficiency was met. Proficiency was defined as completing the self-monitoring checklist with 80% or above accuracy for at least three consecutive training sessions. The coaches averaged 93% - 96% (range 82% - 100%) accuracy on the self-monitoring checklists. The lowest IOA

that a coach received on the self-monitoring checklist was 83%. Therefore, none of the coaches required additional training.

Social Validity

A social validity survey was given to all of the participants of the current study (see Appendix B). The survey was anonymous, and the participants took the survey independently of each other and the researchers. Results are displayed in Figure 4.

Chapter 3
Results

The researchers visually analyzed the effects of video-based feedback combined with self-monitoring on the participant's coaching behavior. The present study assessed the accuracy of feedback statements and the percentage of positive versus constructive feedback statements. There is value in getting coaches to deliver effective feedback to athletes in order to maximize performance. Adequate feedback not only allows for the athletes to recognize what part of their performance needs improvement and allows them to make these changes, it also points out what part of their performance is correct so that they may maintain this performance in the future. If athletes do not receive adequate feedback, they might not recognize what parts of their performance needs improvement and what needs to be continued. This can result in their performance to plateau.

Participant 1's baseline probe showed 39% accuracy of coaching interactions. After treatment was introduced, the accuracy of Participant 1's coaching interactions increased to 55%, ranging from 30.5% - 73.2% (see Figure 1). On average, Participant 1's baseline coaching interactions were made up of 82% positive statements and 18% constructive statements. During treatment this participant had a mean of 85% positive statements and 15% constructive statements (see Figure 3).

Participant 2's baseline data showed an average of 53.7% accuracy (range 32.7% - 67.8%). Once treatment was introduced, the coaching interactions improved to a mean of 57.2% accuracy (see Figure 2). On average, Participant 2's coaching interactions were 71% positive statements and 29% constructive statements during baseline and 85% positive statements and 15% constructive statements during treatment (see Figure 3).

Participant 3 averaged 59% accuracy during baseline (range 37.7% - 72.6%) and after exposed to the video-based feedback and self-monitoring their performance increased to 71.9% accuracy (range 60.1% - 78.5%) (see Figure 2). On average, Participant 3's coaching interactions were 55% positive statements and 45% constructive statements during baseline and 53% positive statements and 47% constructive statements during treatment (see Figure 3).

Participant 4's average baseline performance was 47% accuracy (range 25% - 61%). After introducing the intervention their performance improved to an average of 57% (see Figure 2). On average, Participant 4's baseline coaching interactions were 77% positive statements ranging from 62% to 100% and 23% constructive statements ranging from 0% to 39%. During treatment, this participant's coaching interactions were 77% positive statements ranging from 50% to 94%, and 23% constructive statements ranging from 6% to 50% (see Figure 3).

Overall, the mean baseline performance across all four participants was, 49.8% (range: 39.1% - 59%). After introducing the intervention, coaching interaction performance increased to 60% accuracy (range: 55% - 71.9%).

Chapter 4
Discussion

The purpose of the current investigation was to evaluate the effects of video-based feedback and self-monitoring to improve coaching interactions between a coach and their athlete. Many coaches are not provided with any training prior to coaching and merely have a great deal of knowledge of the specified sport. Providing these athletic coaches with coaching techniques will allow for practice time to become more systematic and improved performance of their athletes. The current study found that using video-based feedback and self-monitoring was effective in improving coaching interactions.

Participant 1 had the biggest improvement out of the four participants from baseline performance to treatment with 15.4% improvement (see Figure 2). Participant 1, the head coach, was in treatment for the longest amount of sessions (i.e., 14 sessions) and was highly invested in the current study. This participant showed curiosity about how behavior analysis could benefit athletics by making statements such as, “I am excited to see what your thesis is about and how it can help athletics”.

Participant 3 had the second largest performance improvement by increasing their coaching interaction accuracy by 12.9%. This coach was the

second coach introduced into treatment and was exposed to treatment for 9 sessions. When asked to participate in the study, Participant 3 reported that the study would be helpful for her coaching skills as well as helpful for her future career (i.e., education). Based on conversation with the principal investigator, Participant 3 seemed to be the most receptive to the intervention and enthusiastic about changing her own behavior. Following the introduction of the intervention, there was only a 2% change in the type of coaching interactions Participant 3 was providing (i.e., positive or constructive). Positive coaching interactions decreased by 2% to a mean of 53% of total coaching interactions and constructive feedback increased by 2% to 47%.

Participant 4 had a stable increase during treatment starting at 32.7% accuracy and improving steadily to a mean of 81.1% accuracy (see Figure 2). When asked to participate in the study, Participant 4 mentioned that she does not talk to the athletes often. This participant showed signs of being shy and uncomfortable wearing the microphone. This participant made comments such as, “again?” and “are you almost done?”. Figure 1 shows that observing her own performance and self-monitoring improved her coaching interactions to a stable rate.

Participant 2 had the smallest performance improvement with 3.5% increase from baseline to treatment (see Figure 2). Due to time constraints, Participant 2 only had three treatment sessions. This short amount of time in treatment restricted

Participant 2 from fully benefitting from the intervention to see optimal improvements her performance. Figure 3 shows that Participant 2 consistently balanced positive coaching interactions with constructive coaching interactions. When treatment was introduced her coaching interactions became mostly positive (i.e., mean of 85%).

Figure 3 shows the percent of positive coaching interactions of each participant compared to their constructive coaching interactions. Participant 1 and 4's coaching interactions consisted primarily of positive coaching interactions (86% and 77% positive). After the intervention was introduced, Participant 1's coaching interactions became much more balanced between positive and constructive; however, these interactions quickly went back to being mostly positive coaching interactions. Despite coaching the same athletes, Participant 2 and 3's coaching interactions were much more variable. Participant 3's coaching interactions were consistently balanced between positive coaching interactions and constructive coaching interactions (i.e., 53% - 55% positive). Participant 2's coaching interactions were also balanced between positive and constructive during baseline (see Figure 3). After treatment was introduced however, this participant's percentage of positive coaching interactions increased from 71% to 85% of their coaching interactions.

The researchers anecdotally observed that the athletes preferred Participant 2 and Participant 3 out of the four coaches. When the athletes had a choice on which coach to go to for certain activities there would be a larger number that would gravitate towards these two coaches over the other two coaches. Figure 3 shows that these coaches were more variable with their constructive coaching interactions versus positive coaching interactions. This is likely due to their feedback being more tailored to the athlete's current behavior and allowing for more personalized attention from the coach. Participant 1 and 4 were often heard saying short and general feedback statements such as "good", "very good", "good job", or "nice". The athletes could have become satiated from hearing the same positive coaching interactions from these other two coaches.

When asked if the participants found this study overall helpful in improving their feedback interactions the average answer was 4.3 out of 5 (see Figure 4). Two participants agreed, one participant somewhat agreed, and the other participant was neutral. The participants reported that neither the filming nor the intervention sessions were invasive to practice time (see Figure 3). The participants also reported that they would be interested in continuing using video-based feedback and self-monitoring (i.e., average response 4.3).

The participants did not think that one tool, video-based feedback or self-monitoring, would have been helpful without the other tool. When asked if they

thought the video-based feedback would have been helpful without the self-monitoring datasheet the mean response was 1.8 out of 5 (Figure 3). Three participants somewhat disagreed and the fourth coach completely disagreed. Similarly, when asked if they thought the self-monitoring would have been helpful without the video-based feedback the coaches mean response was 1.3 out of 5 (see Figure 3). One participant somewhat disagreed, and the other three participants disagreed completely. These responses show that the participants preferred self-monitoring and video-based feedback when coupled together.

All the participants agreed that there is value in how you provide feedback to athletes and this feedback is important to their athlete's performance. One participant left the following comment on their survey: "I think that communication is very important in coaching and would like to learn more about effective ways to give feedback to athletes." When asked if the coaches felt that video-feedback and self-monitoring was effective in changing their feedback interaction performance, one participant agreed, two somewhat agreed, and one participant was neutral. Another participant commented, "the feedback made me very conscious about the type of feedback I am giving. Saying 'good' isn't enough you have to be more direct to get better results out of the athletes."

Limitations

Applied research in athletics comes with a number of barriers to overcome. Schedule demands, athlete absences, and coach attendance are just some of the constraints that must be navigated throughout the duration of a research study. The researchers worked to overcome many of these barriers including running a brief pilot of the intervention processes, working proactively with the coaches to coordinate the best ways to work the interventions within the flow of a given practice schedule, and using multiple data collectors to ensure all coaches were appropriately documented. However, the study was still restricted to the schedule of the camp. Thus, the main limitation of the current study was that data collection was reliant on the season's time constraints. The end of the athletic season caused the pilot study to end before data could be completed. Participant 1 and 2 were involved in the pilot study in which baseline data were collected. Participant 1 was introduced to treatment for one session before the athletic season ended, and data collection was terminated due to specific rules regarding practicing outside of the specified season. This caused the researchers to conduct a baseline probe for Participant 1 for the current study in the new context (i.e., summer camp) before proceeding with treatment sessions. The current study also relied on a strict summer camp schedule which hindered waiting for ideal stability before implementing treatment for Participant 2.

Weather conditions also hindered data collection. Softball is an outdoor sport; therefore, some data collection sessions were interrupted due to rain and thunderstorms. When the weather caused the camp to be held indoors, the athletic coaches were frequently playing games with the campers and had less opportunities to give feedback to the athletes. Indoor sessions also led to the athletes being in a smaller area which allowed for less coaches to lead bigger groups. It turned out that Participant 1 did not coach during the indoor sessions. Being outdoors also led to some technical issues. During data collection, the microphones lost their connection leading to audio issues. Some of the videos had inaudible footage which led to data collectors possibly missing coaching interactions.

Another limitation of the current study pertained to the feedback exchanges and how one feedback interaction was often interlocked with another subsequent feedback interaction. Athlete performance was very fast, often with multiple behaviors occurring within a minute. This meant a coach would often provide an athlete with proper detailed feedback, or prompt the athlete immediately preceding a performance; however, the coach would then provide brief follow up feedback for the subsequent performance that did not meet the full feedback criteria. For example, if a coach told the athlete to push off their back leg more when they swing, and the performance immediately following the athlete improved the coach would often times provide a brief feedback statement such as, “there you go”.

These are technically separate behaviors and separate feedback interactions; however, they are linked. Feedback was functioning as a consequence for the behavior it followed and an antecedent for the behavior it preceded. These types of interlocked feedback exchanges brought up questions as to whether how much specificity would be needed in the second feedback delivery in these interactions. meant that some instances of feedback.

Future Research

There are numerous areas of applied research that could prove valuable to the area of athletics and coaching. The field of behavior analysis can capitalize on what coaches are already doing and integrate our field into their tools seamlessly. Athletic teams are already providing their athletes with film sessions, so behavior-analytic solutions can help support these film sessions to run in a systematic way.

Coaches provide feedback to their athletes to improve athletic performance. These coaching interactions are not necessarily isolated exchanges, rather, each coaching interaction should interlock to continue to shape and improve performance. When coaches pinpoint a deficit and provide feedback on following performances, they may not need to give as specific of feedback but rather brief validation of their performance improvement. Future research could objectively

define and evaluate coaching interactions for different level performers and during specific situations (e.g., scrimmages, one on one lessons, etc.)

Conclusion

Overall, the current study showed that you can use a technology that is already commonly being used in athletics, such as video recordings, combined with behavior-analytic tools to improve coaching performance. There are numerous health and social benefits to individual and team athletics and behavior analysis offers solutions to maximize these athletic performances. Athletes need support from their coaches, but coaches need support as well. The field of behavior analysis has had a lot of success improving athletic performance and should strive to work with coaches and sport organizations to maximize performance at all levels of athletic systems.

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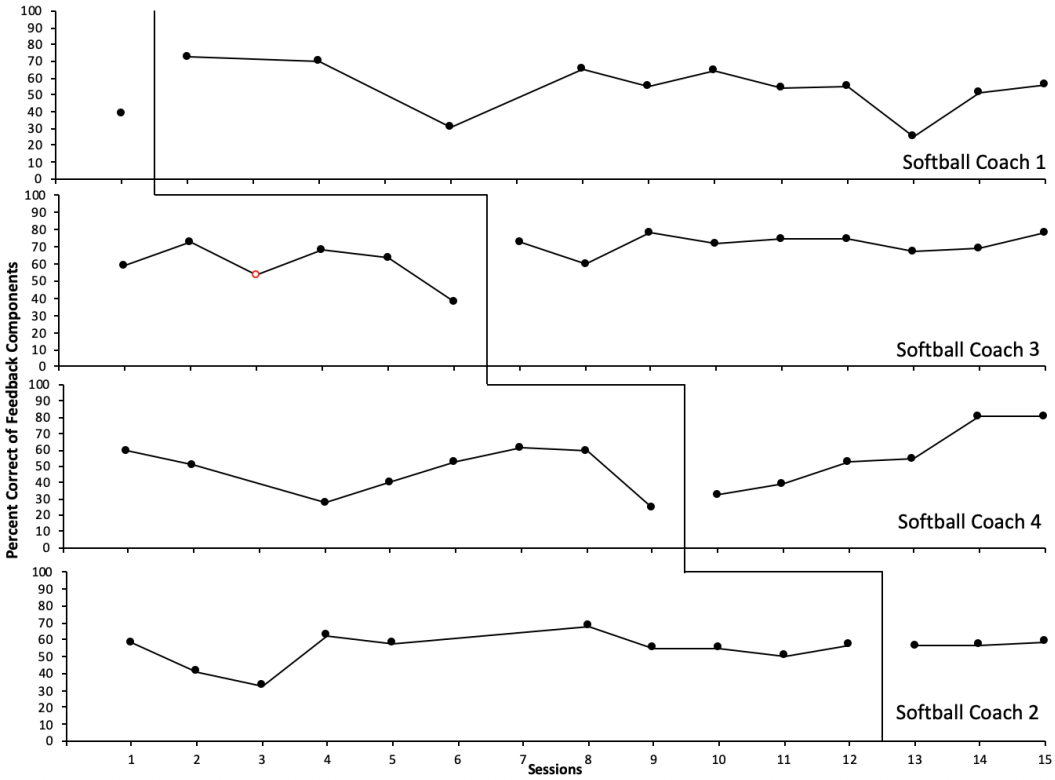

Figure 1. Accuracy of Coaching Interactions Graph

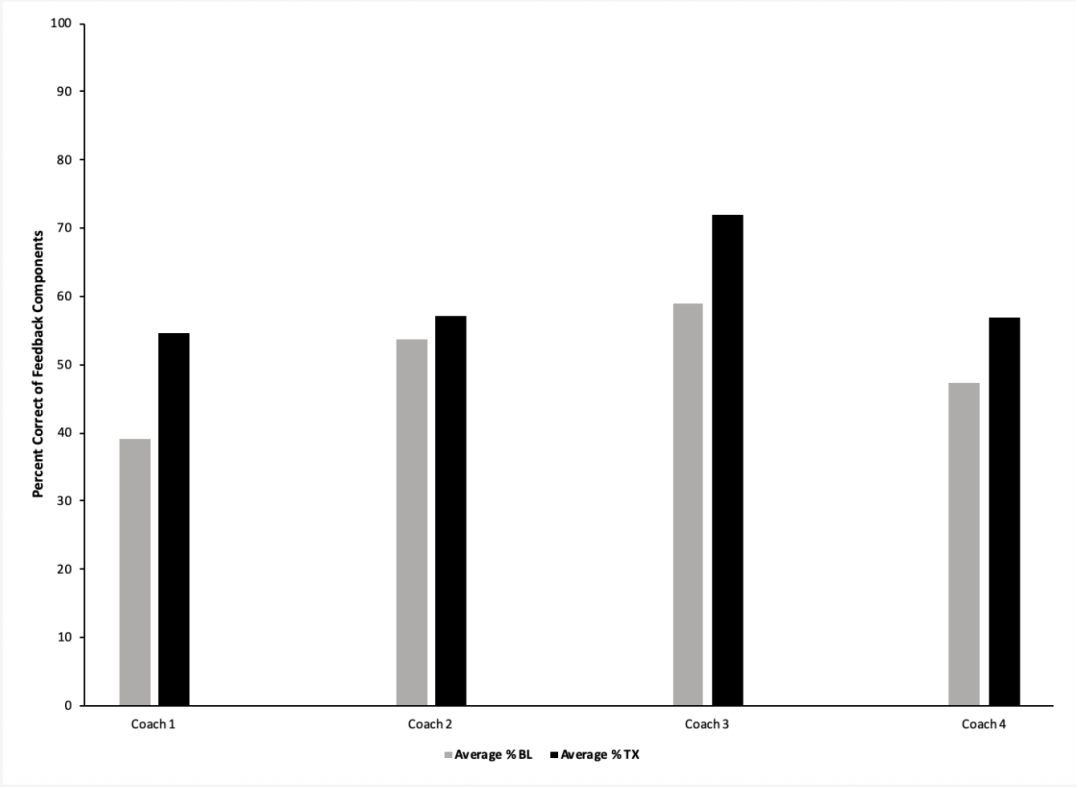

Figure 2. Mean Coaching Interaction Improvement from Baseline to Treatment.

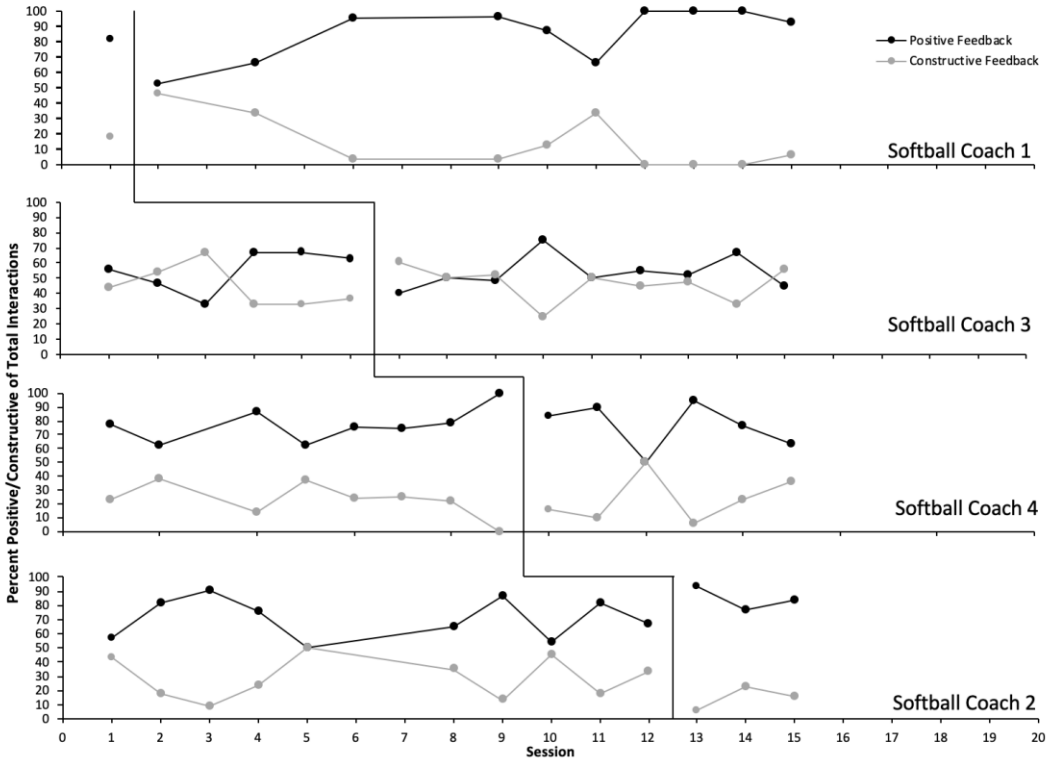

Figure 3. Percentage of Positive Coaching Interactions and Constructive Coaching Interactions.

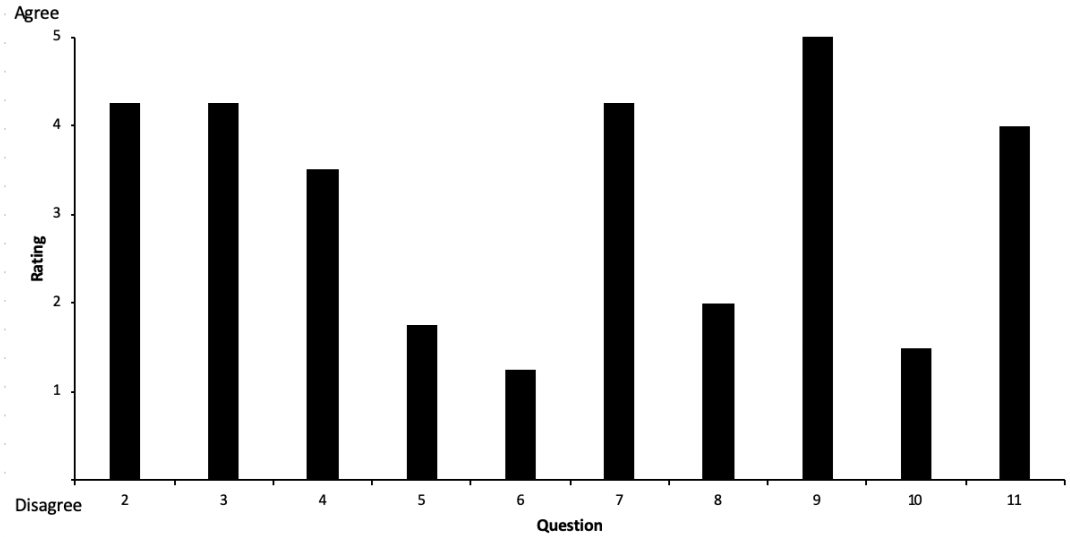

Figure 4. Mean Scores from Social Validity Survey.

Appendix A

Data Collector: ________________________ **D** **IOA**

Date: ____________ **Coach** (circle one): 1 2 3 4

Start Time:				**Stop Time:**	
Step	**Component Skill**	**Yes**	**No**	**N/A**	**Notes**
1	Specific Behavior				
2	During/Immediate				
3	Individualized				
4	Comparison				Video #:____
5	Stated Correction				+ -
		Total Yes:			/___x100 =

Start Time:				**Stop Time:**	
Step	**Component Skill**	**Yes**	**No**	**N/A**	**Notes**
1	Specific Behavior				
2	During/Immediate				
3	Individualized				
4	Comparison				Video #:____
5	Stated Correction				+ -
		Total Yes:			/___x100 =

Start Time:				**Stop Time:**	
Step	**Component Skill**	**Yes**	**No**	**N/A**	**Notes**
1	Specific Behavior				
2	During/Immediate				
3	Individualized				
4	Comparison				Video #:____
5	Stated Correction				+ -
		Total Yes:			/___x100 =

Start Time:				**Stop Time:**	
Step	**Component Skill**	**Yes**	**No**	**N/A**	**Notes**
1	Specific Behavior				
2	During/Immediate				
3	Individualized				
4	Comparison				Video #:____
5	Stated Correction				+ -
		Total Yes:			/___x100 =

Start Time:				**Stop Time:**	
Step	**Component Skill**	**Yes**	**No**	**N/A**	**Notes**
1	Specific Behavior				
2	During/Immediate				
3	Individualized				
4	Comparison				Video #:____
5	Stated Correction				+ -
		Total Yes:			/___x100 =

Page #: _______

Appendix B

Social Validity Survey

Please fill out the following ***anonymous*** survey. Thank you for participating in the study, and good luck next season!!

Scoring:

1 – Disagree **3 - Neutral** **5 - Agree**

1. How long have you been a coach? (write # of years below)

2. Did you find this study overall helpful in improving your feedback interactions?

   1 2 3 4 5

3. Did you feel the video-based feedback was helpful in improving your feedback interactions?

   1 2 3 4 5

4. Did you feel the self-monitoring datasheet was helpful in improving your feedback interactions?

   1 2 3 4 5

5. Do you feel that the video-feedback without the self-monitoring datasheet would have been helpful? (reminder, video-based feedback involves no verbal/written feedback, just video)

   1 2 3 4 5

6. Do you feel that the self-monitoring would have been helpful without the video? (just filling out the datasheet with no video/written/verbal feedback)

   1 2 3 4 5

7. Do you think you would continue using the video-feedback and self-monitoring?

1 2 3 4 5

8. Do you feel filming was invasive to practice time?

1 2 3 4 5

9. Do you feel there is value in how you provide feedback to your athletes and is important to their performance?

1 2 3 4 5

10. Did you feel that the video-feedback and self-monitoring sessions were invasive to practice?

1 2 3 4 5

11. Did you feel that video-feedback and self-monitoring was effective in changing your feedback interaction performance?

1 2 3 4 5

Comments:

_____

_____

_____

_____