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Efficacy of parental use of a tagging procedure to enhance their child's sports performance training

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EFFICACY OF PARENTAL USE OF A TAGGING PROCEDURE TO ENHANCE THEIR CHILD'S SPORTS PERFORMANCE TRAINING.

by

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Youth sports have become increasingly popular and competitive, resulting in parents seeking out coaching and training facilities that can improve their children's sports performance. Tagging offers a promising way to enhance sports training by incorporating immediate audiblefeedback successfully used in the field of Behavior Analysis that was once reserved only for professional athletes. However, it is unclear whether parents can effectively use a tagging procedurewhen provided with a breakdown of the specific steps to skills needed (e.g. task analysis) to enhance their child's training received at a paid training facility. The purpose of this study wasto test the efficacy of parents using a tagging procedure to enhance baseball swing mechanics training of youth baseball players.

Key words: Behavioral Coaching, Tagging, Sports performance, Augmented Feedback, Multiple baseline probe.

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CHAPTER 1

INTRODUCTION

Youth sports are a five billion dollar industry with 30 to 45 million young athletes in the United States participating (Andrews, 2011). According to the National High School Athletic Association, sports participation is rising with over 7-million high school participants in 2011, which is up from 5.2-million from 2001 (Andrews, 2011).The increasing popularity of youth sports is putting a bigger focus on performance. Today's youth often specialize in one sport to improve their performance and the age of participation continues to drop. Alsever (2006) writes, "As the nation's love for sports grows, more children are focusing on one sport at an early age—sometimes as young as four- practicing it year round" (p. 1). Through interviews with high school coaches, Alsever found the players who do not get the extra help are likely to fall behind (2006). That is, children must continually improve their performance in order to participate and remain competitive for high school or college sports. Businesses claiming to help the young athlete develop can be found all over the United States, promising parents to help keep their child above the imaginary performance curve (Glanville, 2012). The need to improve a child's performance is leading to sports becoming more of an indication of socio economic status. Access to training facilities and coaches to improve a child's sports performance are often costly. Glanville (2012) reports the big business of youth sports is creating another rich-get-richer environment where only those families with resources can afford to compete. Therefore, it is important to find a way to help parents learn how sports performance interventions can help enhance the training their child receives from a knowledgeable coach or training facility.

A review of past research (Allison &Ayllon, 1980; Anderson & Kirkpatrick, 2002; Fogel, Weil, & Burris, 2010) often shows low levels of sports performance from athletes until coaches or

trainers are taught how to use a variety of behavioral coaching interventions (i.e. behavioral skills training). Given the success of behavioral interventions for helping coaches become more effective at training athletes, it is reasonable to assume that parents can also be taught to help enhance their child's training. If parents can be taught to enhance their child's training, it can help offset the costs of more intense performance training. However, parents need to be taught to discriminate the skills and mechanics needed, without causing their child to lose previously learned skills or learning the wrong skills all together. Another advantage would be the parent would also be able to identify if the skills were generalizing to the competitive environment. Luiselli, Woods, and Reed (2011) recommend behavior analysts conducting sports research continue to assess strategies for assessing and promoting generalization. Skills acquired during practice need to be displayed fluently during competition (Martin, Vause, & Schwartzman, 2005).

The following section reviews the existing literature on behavior analysis in sports and provides a framework for incorporating parents into a behavior analytic approach to sports performance training.

Behavior Analysis in Sports Performance

A behaviorally based focus in sports performance has been around for over forty years, using operant conditioning principles for teaching new sport skills, motivating players to practice and increase skill performance, and generalizing this higher rate of performance to the competition environment (Martin & Thomson, 2011). Sports behavior interventions tend to focus on defining target behaviors occurring during game play or on proper mechanics, along with collecting data and implementing training procedures (Luiselliet al., 2011). Improving a player's sports performance can be difficult if the trainer is not able to breakdown the repertoire of specific skills needed, assess the athlete's deficits, and utilize effective teaching strategies to

evoke desired responses (Fogel et al., 2010). The field of Behavior Analysis provides the science needed to break down desired target behaviors of athletes or coaches, a way to measure these behaviors, methods to evoke desired behaviors, and strategies to end undesired responding (Martin & Thomson, 2011). Using behavior analysis, many interventions have proven successful for improving sport performance, increasing athletic motivation, or improving an athlete's mechanics. These interventions typically include various combinations of positive reinforcement, goal setting, descriptive feedback, video feedback, video modeling, instructional cues, and tagging. Despite the many approaches that have been demonstrated in the literature, behavioral sports interventions are rarely studied independently (i.e., there are usually several behavior interventions as part of a treatment package) and some are more amenable to parent training than others. The following section reviews the literature on each of these techniques, noting the strengths and weakness that would be associated with parent training.

Positive Reinforcement

Based on the principles of operant conditioning, positive reinforcement can be a natural result of a player making a good play, if the play executed results in a desired outcome and increases future executions of the successful play. For instance, if a golf player sees a flat green (antecedent stimulus) then aims and hits the putt directly in the hole (behavior) making the putt is the reinforcing consequence if it increases the golfers future behavior of aiming directly for the hole upon seeing the flat green (Martin & Thomson, 2011). Additional forms of positivereinforcement can be used to improve sports performance, such as praise. In a study conducted by Buzas and Ayllon (1981), praise for components on a task analysis of steps executed correctly or near correctly (shaping) improved novice tennis players serve performance from 13% in baseline, where the coach pointed out errors, to almost 50% in only a few sessions.

A separate study by Anderson and Kirkpatrick (2002) found an intervention package for improving speed skater tags with contingent reinforcement in the form of verbal praise along with post session feedback (i.e. athlete was given a performance score for that day and a verbal explanation of how to perform correct execution of a tag) was successful for all four participants.

Positive reinforcement in the form of specific praise is something parents may be able to successfully implement during training sessions. It requires parents to observe their child and make specific feedback on targeted skills that are executed correctly. Once that skill is seen consistently, a new desired skill could be targeted with praise. However, a major weakness is to qualify as positive reinforcement, praise would have to be deliveredclose to the execution of the desired skill. This means specific praise for a targeted skill during a game situation would most likely not occur due to the parent not being on the playing field to deliver praise for the behavior occurring. Also, it is typically not socially acceptable or may not be desired by the youth player to hear parents yell specific praise from the bleachers during their game play.

Goal Setting

Having players commit to a desired result by setting a concrete goal can serve as a motivating operation and increase or decrease behaviors that will help a player reach those desired results (Cooper, Heron, &Heward, 2007). Researchers have used goal setting interventions as a way to motivate athletes to perform better. A study conducted by Wanlin, Hrycaiko, Martin, and Mahon (1997) utilized weekly and daily written goals for three members of a speed skating team preparing for the Canada Winter Games and effectively reduced off task behavior during skating drill practice showing an average of 73% increase in the number of laps skated per practice. Mellalieu, Hanton, and O'Brien (2006) found a goal intervention (goal determination, goal setting, and goal reviewing) was successful on increasing the frequency of

targeted performance behaviors of five collegiate rugby players during game play over those performance behaviors not targeted through goal setting. Goals that emphasize short-term immediate outcomes and are made public usually strengthen goal setting (Locke & Latham, 1990).

Goal setting is a skill parents could help their child develop. Parents have to be taught to set the goals based on measurable and observable behaviors the youth has control over. Some weaknesses are that a typical parent may make the goal outcome based versus behavior based (e.g., hitting a homerun versus following through on a baseball swing). Another weakness may be the goal could be set too high and not attainable which may lead to frustration. Smith and Ward (2006) found goal setting alone was the least preferred intervention of 3 collegiate football players due to the absence of visual feedback.

Public Posting

Public posting is an intervention giving performance feedback in textual format in open view of others. Posting graphic feedback of an athlete's performance may be more influenced by motivational factors (i.e. motivating operations). Motivation Operations can have value-altering and behavior altering effects (Cooper et al., p. 375). In public posting, the public feedback of ones' performance is believed to have a value–altering effect because it is likely to increase the reinforcing effectiveness of performance goals set since performance feedback is made public. Behavior-altering effect of public posting is likely to have an evocative effect of increasing the current frequency of specific behavior to lead to better performance scores (i.e. public posting is more likely to be an establishing operation as opposed to abolishing operation which would decrease the reinforcing effectiveness). Smith and Ward (2006) found an immediate performance change between baseline and public posting intervention of 3 collegiate football

players, which makes it more probable performance was influenced by motivational factors instead of learning. It is unsure if players were increasing their performance based on the contingency of positive reinforcement (e.g. they liked the recognition of doing good) or negative reinforcement (e.g. they wanted to avoid adverse effects of not doing well). Smith and Ward (2006) also found the levels of the increased performance did not last once the public posting ceased. For this reason, antecedent behavioral interventions (e.g., motivating operations) are usually paired with other strategies (e.g., goal setting, verbal feedback) in an attempt to produce lasting behavior change (Cooper et al. 2007, p. 488). A study by Brobst and Ward (2002) combined public posting, goal setting and oral feedback for 3 female soccer players and found their performances improved and became more stable during the intervention phase. Two of the three participants reported that seeing their performances fall below the criterion frustrated them and caused some distress.

Public posting at the youth level,while possible, is most commonly outcome based from stats in the scorebook due to less response cost (i.e. the scorebook stats are easily available whereas specific feedback for each player during game play is not typical and would require an extra effort). However, the added stress and competition between team members with publically posted stats may be more detrimental to the team and therefore is more likely working on the contingency of negative reinforcement (i.e. the player is working just to avoid having the worst stats on the team).

Feedback

Researchers have described the use of feedback in several studies (e.g., Allison &Ayllon, 1980; Boyer, Miltenberger, Batsche, &Fogel. 2009; Komaki & Barnett, 1977). In their description of feedback, researchers have used the terms augmented feedback, descriptive or

specific feedback. Despite the different terms, all three versions can be defined as information about the nature of a specific performance either after it occurred or during the performance (Zetou, Tzetzis, Vernadakis, &Kioumourtzglou, 2002). Although all three fit the above definition, there are some minor differences. For example, augmented feedback informs a person if they achieved the criterion. In other words, if they were correct or incorrect (Quinn, Miltenberger&Fogel, 2015).Alvero, Bucklin, and Austin (2001) describe descriptive feedback as comments about measurable behaviors observed to help a person discriminate between their performance and a desired criterionof performance (e.g. task analysis given to participants)Whereas, specific feedbackdescribesthe quality or quantity of a person'sperformance (Alveroet al.2001).Many coaches will demonstrate the desired skill (model) and/or the incorrect performance as they are giving feedback to players. Allison and Ayllon (1980) found a behavioral coaching package containing verbal instructions, descriptive feedback and modeling the correct performance was effective in the development of skills in football, gymnastics and tennis. A study by Kladopoulos and McComas (2001) teaching 3 college basketball players proper form found descriptive praise, focusing only on specific feedback of desired behaviors observed (i.e., augmented feedback and positive reinforcement), increased all 3 players use of correct form above 90% criterion for player 2, and 100% criterion for players 1 and 3 after 3 sessions. Using the correct form lead to a higher average percentage of shots made from 40% to 60.4% (Kladopoulos&McComas, 2001). A delayed written performance feedback intervention implemented by Stokes and Luiselli (2010) used a 10-step task analysis for football tackling to review correct and incorrect execution of steps following a pass blocking drill. Stokes and Luiselli (2010) found a slight improvement in 4 out of the 5

participants from baseline leading them to conclude that descriptive feedback alone did not have a significant effect on improving pass-blocking skills until it was paired with video feedback.

Video feedback involves showing a recording of an individual's own performance for viewing (Hazen, Johnstone, Martin, &Srikameswaran, 1990). Video feedback includes negative and positive behaviors of performances (Ives,Straub, & Shelley, 2010). Interventions that use video feedback usually contain descriptive feedback as it is natural a coach would review the players performance with them. Stokes and Luiselli (2010) found descriptive and video feedback had the greatest effect on improving high school football player's tackling performance and participants rated this coaching condition most favorably on a social validity questionnaire.

Video Modeling

Video modeling can be one of two forms. The first is an expert model. An expert model is a visually recorded example of an expert performing the desired skill with the purpose of another individual discriminating skills and as a result, evoking a similar imitative response. A study by Boschker and Bakker (2002) found inexperienced climbers perceived new opportunities for climbing a wall after watching video of an expert model climbing the same wall and they were able to apply the observed methods typically executed by more experienced climbers (i.e. arm crossing versus dual grasping method). Boyer, Miltenberger, Batsche, and Fogel (2009) suggest that video modeling by experts with video feedback to typical coaching can reduce the amount of practice sessions needed. A second form of video modeling is a self-modeling video, also called positive self-review or virtual self-modeling. Self modeling uses video that is edited so the performer can observe themselves executing the desired steps correctly, and therefore evoke the same response which they may or may not have done before (Ives et al., 2010). Welch (2006) used video modeling to teach three adolescents with developmental disabilities golf skills

(e.g., chipping and putting). Two participant's data showed no difference between expert modeling and self-modeling. A third participant did better during the virtual (self) modeling phase on putting skills but the expert model for chipping. All three participants preferred to watch the training video with the expert model over their virtual self-modeling video (Welch, 2006).

Tagging and Teaching with Acoustical Guidance (TAG)

Teaching with acoustical guidance (TAG) is a tagging procedure with specific guidelines to its protocol. Both tagging and TAG are training procedures that use an audible stimulus and pairs that sound with a desired behavior as it occurs (i.e. a form of augmented feedback). In sports, a coach will create a task analysis of specific behaviors needed for successful performance. Once specific mechanics are clarified, chaining and shaping can be successfully utilized through the immediate delivery of acoustical feedback for the desired targeted behavior. Tagging establishes a tag point for a particular skill an athlete may be working on where the coach sounds an audible noise at the exact moment the athlete performs that skill correctly (McKeon, 2007). The sound becomes a conditioned reinforcer and lets the athlete know they have correctly performed the skill that was tagged with the audible stimulus. Tagging eliminates the need for verbal corrections, allows the athlete to assess and self correct their own performance (McKeon, 2007). Fogel (2010) was able to teach a novice golfer four out of five targeted skill sets in just seven training sessions. Stokes, Luiselli, Reed and Fleming (2010) evaluated TAG for improving 5 high school varsity football players' offensive line pass-blocking skills. Fogel et al. (2006) found all five participants performance levels increased with TAG when it was implemented after descriptive and video feedback. However, social validity measures identified the combination of descriptive and video feedback more favorable by 4 out

of 5 of the participants (Fogel et al., 2006). Harrison and Pyles (2013) used tagging to teach three high school students four skills within the context of tackling to above an 80% criterion using progressive speeds. Slowing down a skill provides a better opportunity for the beep (i.e., tag) to be provided at the precise moment. Harrison and Pyles (2013) noted the limitation of providing the beep (i.e. tag) at the exact moment of completion of the target behavior during the sprinting speeds of their progressive speed trials.

Despite the promising effects of tagging, training parents to discriminate, chain, and shape in the precise moment could prove challenging and would require a level of training that may offset the potential financial gains of having parents supplement training (i.e., it would cost as much to train the parents as it would to just provide the children with more training sessions). Parents also may not have the skills to break down proper mechanics into measurable behaviors. The benefit of tagging by parents is the elimination of verbal feedback and focus of the youth athlete to self assess and correct their own mechanics. This may increase the athlete's ability to generalize skills acquired from practice to game play. Parents would also be able to see if skills worked on in training sessions are generalizing to game play.

Summary and Purpose

The field of behavior analysis has empirically shown many successful interventions for improving sports performance. However, some behavior interventions may be better suited for parental use than others. For instance, public posting in youth sports may risk parents and team mates competing against each other, jeopardizing team moral.Positive reinforcement in the form of descriptive praise on skills implemented correctly may be hard if parents can't discriminate the specific mechanics to reinforce in a skill set. Most parents are likely to praise outcomes instead of specific skills. When it comes to video and audio feedback, parents may not possess

the knowledge to review and provide feedback to their child about their performance of a skill that has not been broken down into measurable steps.

Certain mechanics required to be competitive in sports take a well-trained eye to recognize and therefore, there is no substitute for a good coach. However, access to coaches can be limited and expensive. The increasingly competitive environment of youth sports has some parents seeking out ways to enhance their child's training to improve their performance in sports. It is unclear whether parents can effectively use behavior techniquesto enhance sports training without a thorough understanding and breakdown of the specific steps to the mechanics needed. The purpose of this study is to test the efficacy of parents using a tagging procedureon a slowed down baseball swing to enhance the training a youth baseball player receives on hitting mechanics.

CHAPTER 2

METHOD

Participants

A flyer regarding enhancing hitting training was distributed to youth between the ages of 8-13 years old who received training on their baseball swing mechanics. Interested partiesmetwith the researcher where all features of the study were described and any questions posed by parents or youth players was answered. Informed consent was received from parents/guardians and assent was received from the participant.One 9-year old typically developing male youth and his parents participated in this study. Participants volunteered their time and no compensation was received.

Setting

The study was conducted at a Southern Illinois baseball training facility. Facility training sessions took place in one of four batting cages with nets around the interior perimeter. Each batting cage contained an 8’ x 8’ pitching L-screen, a grocery cart with baseballs, a plastic stack chair behind the screen, and a home plate spray painted with white paint on artificial grass turf. A larger playing area was located between the batting cages for fielding and pitching practice. Baseballs were pitched by a hitting coach who either stoodor sat behind the pitching screen. During Baseline, the experimenter recorded swings from 6 to 8 feet away, directly facing the batter.

Taggingtraining sessions were held separate of regularly scheduled hitting practice in one of three locations; the training facilities practice field, the participants’ home, or the training facility’s parent waiting area. No facilitytrainer was used during the taggingsessions to simulate

what parents typically have available to them if they were trying to enhance their child's training received from the facility.

Materials

Ubersense version 4.1.2, a video analysis and sports coaching mobile application, was used for video recording. Ubersense is available for Apple brand mobile products and slows down video for ease of scoring. An Apple iPad Mini Model ME856LL/A was used forparticipant recording. The participant providedhisown bat. Baseballs typically used during game play of various brands were used during hitting training sessions. APetSafeClik-R Dog Trainer clicker was used for the tagging sessions.

Operational Definitions and Dependent Variables

Steps on the task analysis (Tables 1 and 2) were divided into component skills based on individual performance (i.e., deficit skills for tagging were specific to the youth player). Component skills were the breakdown of a single measurable and observable skill.

Load. Weight is primarily on the inner portion of the back leg and foot(stacking your weight), front shoulder closes slightly, bringing back the hands (loading) and tilting the bat head forward toward the pitcher (hands visible to pitcher) and front knee kicks inward (showing pitcher batters pocket).

The Step. Small step less than 12 inches with front foot softly landing on pad near the big toe, foot straight or toes slightly pointed in, knee pointed in, weight back primarily on rear leg, steady head with chin over shoulder.

Launch the Hips. Pivot rear hip forward toward the pitcher while keeping head still, rear elbow tucks to the hip directing knob of the bat toward the ball with most of the batter's weight on the rear leg (some shifting to the firming front leg).

Launch the Hands. Bat knob driving toward the ball, wrist flick the bat barrel to contact while front leg is firm and creates resistance for the body to propel the bat head, and keeping a steady head.

Extend (Power V). Hands finish their flicking motion without rolling over, bat points to pitcher at chest level, front leg firms up and straightens out, and batter's head looks directly down the V with chin down.

Finish the Swing. Top hand pulls up, hands finish above shoulder, and the bat head wraps around the back of the hitter.

Correct Tag. A click occurring within 2 seconds of a targeted component skill performed correctly.

Incorrect Tag. A click occurring after 2 seconds of a targeted component skill performed correct or occurring when a component skill was performed incorrectly.

Measures

The researcher scored the percentage of correct steps on the 21-step Hitting Task Analysis score sheetusing Ubersense mobile Application with reliability conductedby a seconduniversity student in the Behavior Analysis and Therapy masters program. The second observer was trained by the primary researcher. The primary researcher reviewed the operational definitions and pictures of the dependent measures with the second observer before scoring practice videos. The second scorer had to meet an eighty-five percent criterion correct with primary observer (18 steps out of 21 total steps scored the same) before scoring participant data. Any disagreements were reviewed together until an agreement was made for scoring purposes.

Observers scored bat swings independently using video recordings made on Ubersense mobile application and could be viewed as many times needed by second observer to score task analysis.

Ubersense video wasrecorded at a 90-degree angle (i.e. from 6-8 feet directly in front of batter) to increase sight of all batting steps and viewed as many times needed to score task analysis.A trialconsisted of 1good pitch (i.e. balls thrown over the plate in the strike zone). Therewere 10 trials in each session.

Each step was scored independently per session. For example, correct scores for each step from all 10 trials in a session were added together and multiplied by 10 to come up with a performance score percentage for that specific skill.This score was used to identify thetarget stepsfor the participant. Preference was given to the earlier steps in the task analysis due to the participant being able to execute the previous skill correct to start at a point where they executed the skill correctly (i.e., forward chaining).

Performance scores werealso figuredby taking all correct steps in the task analysis from each trial after each training session and dividing the total steps correct by twenty-one (i.e. total steps on task analysis). That number was then mutiplied by 100% to get the percentage of correctly implemented steps per trial within each session. In addition, performance scores were also averaged for the entire session to get an average performance score over sessions.

Interobserver Agreement

The total number of agreements divided by total number of disagreements plus agreements on the task analysis target component skills on facility training session data was scored (i.e., component skills targeted for tagging sessions were scored by a second observer).Interobserver agreement for 100% of Step 1 (i.e. stacking your weight) sessions during baseline was 100% for

all component skills of foot straight, knee in, and pole. Facility session Interobserver agreement during the tagging treatment was also conducted for 100% of trials in sessions eight, nine, and ten and was 100% agreement for all trials across the three component skills. Interobserver agreement for session eleven was conducted for 70% of the ten trials and was also 100% across the three component skills.

Eighty-nine percent of step 5 (i.e. small step) baseline sessions scored interobserver agreement for component steps less than twelve inches, land on ball, and front foot straight, and beach ball (i.e. knees in). Interobserver agreement was 98.1% (range = 80-100%), 94.4% (range = 50-100%), 95.3% (80-100%), and 99.1% (90-100%) respectively. All step 5 tagging sessions occurred between two facility training sessions and therefore no probes occurred. Follow up training facility interobserver agreement was conducted for 66% of follow up sessions and was 100% for both component skills of less than 12 inches and land on ball. Front foot straight interobserver agreement was 95% of trials with a session range of 90 to 100%. Component skill beach ball was 90% with a range of 80 to 100% over two sessions.

Probes for the third target step of load your hands (i.e. step 3) started at facility session eleven. This was due to being unsure of what skill was going to be targeted and therefore, the step was not broken down into smaller component skills. Loading the hands was selected due to the facility targeting the subsequent steps 9 and 11 which both require hands to be loaded correctly to start the subsequent skills. Interobserver agreement was conducted for 83.3% of baseline probe sessions. Component skills of hands at shoulder and back elbow up had 100% interobserver agreement. Bat knob to catcher baseline sessions had 92% of agreements across trials (session range of 70-100%). One facility session probe occurred during the tagging session intervention and interobserver agreement was conducted for 100% of trials. Interobserver

agreement was 100%, 100%, and 90% for hands at shoulder, back elbow up, and bat knob to catcher respectively. One follow up probe for step three occurred at the training facility where interobserver agreement was conducted for 40% of the trials and was 100% for all three component skills.

Procedural Integrity

A second observer recorded whether component skills were correctly tagged or not tagged when implemented incorrectly.No feedback other than the taggingor not tagging was provided during the training sessions throughout the study. Procedural integrity for the tags were calculated by dividing the number of trialstaggedor not tagged correctly for each component skill in each session by thetotal number of trials for the component skill per session and multiplied by 100%.Procedural integrity was calculated for two of the five tagging sessions(i.e. forty percent of sessions) that targetedcomponent skill of back foot straight for step 1 and was 100%. The second component skill, back knee in, was targeted three of the eight tagging sessions with procedural integrity collected for one of the three sessions (i.e.,33% of sessions) and tagged correctly 100% of trials. Procedural integrity data on the third component skill of straight pole for sessions four, five, seven, and eight and were 88.8%, 80%, 100% and 100% respectively.

Procedural integrity data were recorded for small step (i.e. step 5) tagging sessionsand front foot straight was tagged 100% correct for all trials for both sessions. Procedural integrity data for land on ball was collected during 50% of the targeted tagging sessions (i.e. one session). Tags were implemented correctly 90% of component skill land on ball tagging trials. The component skill of less than 12-inch step procedural integrity data was scored for sessions two and three and was 100% during both sessions. Component skill land heal, toes in procedural integrity data was 100% of all trials during sessionstwo and three.

The third step targeted for tagging sessions (i.e. step 5 or load the hands) was collected on 75% of the sessions. Procedural integrity was 100% for all hands at shoulder and back elbow up trials. Bat knob to catcher procedural integrity data for sessions two, three, and four were 90%, 100%, and 100% respectively.

Procedure

A multiple probe design across behaviorswas used to examine the effects ofa taggingprocedure. Data collected at the hitting training facilityidentified weak target skillsbased off of a 21-step batting performance task analysis. Steps implemented inconsistently or incorrectly(i.e., below 60%of trials)were selected as the target skills for tagging sessions.Once a target skill (i.e., step on the task analysis) was identified, it was broken down into measurable component skills for tagging. The earliest skill based on the task analysiswasgiven preference for forward chaining. The first two skills targeted (i.e., stacking your weight and small step) were not being targeted by the training facility. The third skill targeted (i.e., load the hands) was not being directly targeted by the facility. However, a subsequent skill Step 9 (i.e., rear elbow tucks to the hip) was being targeted and would logically require the youths' hands to be loaded correctly to properly execute the later step.

Baseline (training facility batting cage). The experimenter took video using Ubersense of theparticipant'ssession consisting of 10 hits made from good pitches. No feedback was provided to the parents, participant, or hitting instructors during baseline phase. Each of the participant's hits were scored using the 21-step swing performance score sheet(i.e.,task analysis).Standard coaching was provided by the training facility which focused on teaching proper mechanics, repeated exposure of proper mechanics to instill muscle memory of proper batting sequence so the batter had the skills to self-correct and generalize skills learned in the training facility to the

baseball field. The hitting instructor threw pitches to the batter and verbally instructed the batter on the proper execution of the baseball swing sequence focusing on the weakest point identified by the instructor which could change from session to session.At times the instructor would stop pitching and have the batter swing in slow motion with verbal directives. The hitting instructor would sometimes model the movements desired from batter and at times model the batter's incorrect performance. The hitting instructor had the batter end on a swing with the instructors targeted skills implemented correctly.Criterion for moving to the next stage(i.e., tagging sessions) was when a batter had at least 3 sessions where a task analysis step was identified as inconsistently implemented at least 60% of the session(i.e.,one step of the task analysis was being scored as being incorrectly executed).If theparticipant hadan erratic or unpredictable state of responding, the next phase will occur after 5 performance scores as long as the batter's data had a consistent pattern.

Training sessions (tagging). The first skills in the task analysis showing consistent deficits were selected as target skills for tagging. This allowed for a forward chaining procedure and allowedsubsequent skills to start in the correct position. The participant was informed about the tag (i.e. click). To receive a clickfor correct form, the participant had to perform the targeted component skill correctly in a slowed down speed of the hitting sequence (i.e., slow practice swings with no ball). The component skill tagged was independent of prior skills being implemented correctly (i.e., only the targeted skill had to be implemented correctly to receive the tag).The participant only executed the swing up until the target component skill occurred. Verbal instruction and a photo of the hitting coach modelingthe target component of the swing was provided for a reference throughout each tagging session. Tagging sessions occurred in the participant's home and at the training facility's practice field or parent waiting area. They were

recorded using the mobile application Ubersence for procedural integrity data. Criterion for moving to next phasewas three consecutive sessions with a performance score above 80%. If a component skill was consistently performed correctly during the first component skills tagging trials, then it was not targeted. This was to prevent tagging sessions from becoming boring to the participant. Theparticipant continued to attend weekly scheduled training sessions independent of their taggingsession progress.

Generalization probe (training facilitybatting cage). After meeting criterion on the step targeted for tagging, tagging sessionsstopped for that skill. The participant was again recorded using the mobile application Ubersense utilizing the same procedures in baseline.Tagging sessions on the next skill were started after collecting data from a facility training session.

Social Validity

Social validity questionnaires adapted from Quinn et al (2015) were completed by the youth and parent participant at the end of the study. Four questions asked about their opinions of the tagging procedure versus typical training as well as the likelihood they would use or refer the tagging procedure in the future again. There were also 6 questions that were scored using a6-point Likert scale that rated the impact they felt the tagging intervention had on training.

CHAPTER 3

RESULTS

The results, shown in figure 1, show the participant was performing stacking your weight component (see Load, in dependent measures) mechanics correct less than 3% of trials during baseline. Tagging sessions began after the seventh baseline session. During the tagging procedure, the participant was able to meet criterion after eight sessions. The most trials for a component of the target step 1 (i.e., stacking your weight) was55 trials in session three. However, even though the participant met criterion during the tagging sessions, whichoccurred separate of the training facility sessions, the stacking your weight components never generalized to the training facility sessions.

Data show the second behavior targeted (i.e., small step), the participant was performing at an average of 57% correct during the 12 facility sessions in baseline. It only took three tagging sessions between the twelfth and thirteenth facility sessions for the participant to meet criterion on the four component skills. Once tagging sessions were removed, data show a slight increase in facility training hitting sessions. Due to the slight increasing trend in the small step data and the continued increase after the tagging sessions, it is likely the tagging procedure was not the cause of this increase. No formal data was taken but it should be noted, at some time during the study the facility did target some of the component skills needed in the small step.

The third step targeted was loading the hands (i.e., step 5). The participant was performing component skills correct at 33.3% accuracy during baseline. Data show the participant meet criterion in four tagging sessions. During the tagging phase, a facility training session probe showed 30% accuracy. Follow up data after the participant met criterion in tagging sessions show no change from baseline levels at 33.3% accurate performance.

Within tagging session data for the first targeted skill (i.e., stacking your weight)are shown in Figure 2. Data show component skill back foot straight was performed at 100% accuracy during all sessions with the exception of session two which was performed at 63.6% accuracy. Component skill first session data for back knee in was performed at 84.6%of the trials correct and the remainder of session data show100% of trials were performed correct. Data show the third component skill of straight pole required the most sessions to acquire at 149 trials. The first three tagging sessions for component skill of straight pole had a performance score of 50% of trials performed correct. Data increase to 88.8% on the fourth session, 80% on the fifth session, and 100% for the sixth through eighth sessions.

Figure 3 shows data on component skills of small step (step 3). Data show the participant acquired all four component skills to criterion within three tagging sessions. Front foot straight was performed at 100%, 100% and 88.9%. The first session, land heal toes in, was performed correctly throughout tagging trials for the other component skills so it was not directly targeted (i.e., when subsequent component skills were correctly demonstrated during previous tagging trials or on initial trials they were not targeted in that session). In addition, land on ball was performed correctly during the front foot straight tagging trials.

Figure 4 shows the third targeted step of loading the hands was broken into three component behaviors. Within session tagging data show the participant met criterion in just four sessions. The first component skill of hands at shoulder was performed correctly 68.75% of the 16 trials during the first session. The second through fourth sessions trials were performed 100%, 90.9%, and 100% respectively. Component skill of back elbow up was performed correctly 100% of all trials during all four tagging sessions. Bat knob to catcher was not added until the second

tagging session and was performed 95% correctly during the second sessions 20 trials. Trials in tagging sessions three and four were performed 100% correct with 10trials each.

Data for facility training sessions for the three targeted skills for tagging are shown in figure 5. Data for all steps show no effect on performance during or after the tagging sessions. It is interesting to note data on step 5 show an improvement from 0 to 30% of the step performed correct just prior to tagging sessions and returned to 0% after tagging sessions occurred.

Figure 6 show data representing the average performance scores over all steps in the hitting task analysis. Over the 15 sessions, no improvement was demonstrated in the overall performance scores once tagging sessions began. Overall, data show only a slight increasing trend in performance scores and should be expected from typical training sessions from the facility.Overall, during this study, executing the tagging procedure outside of training sessions using a slowed down version of a baseball swing until the participant hit criterion was not enough to evoke the targeted hitting mechanics in the facility training sessions.

Within session data (Figures 7, 8, and 9) show performance scores over the 15 facility lead training sessions. Overall performance scores (i.e., the number of steps performed correctly for each trial in the session) are displayed in the line graphs. All performance scores over the 10 trials in each facility scored sessions remain stable throughout the study with no significant change in performance throughout each session. The histograms (Figures 7, 8, and 9) show the percent of correct trials for each step on the task analysis (i.e., each of the 21 steps on the task analysis was averaged over the session). Targeted steps 1, 2, and 3 for the tagging intervention showed no improvement in overall performance for training facility sessions. It is interesting to note, that while targeted skills showed no change, overall, data for all skills show no lasting improvements.

At the end of the study, social validity questionnaires (Appendixes A and B) were completed by the youth and parent participant. Both participants would recommend this training to a friend and had nothing marked to change. When asked what they liked most about the tagging training, the youth participant responded all of it. The parent liked the flexibility of training days and times and the one-on-one training. Both participants also agreed they would like the hitting instructor at the training facility to use tagging. It is interesting to note both the youth participant and parent participant felt hitting mechanics were better following the intervention despite no change in performance at the facility training sessions. The youth participant reportedhe strongly agreesheis more confident in batting than at the start of the study. The parent participant also agrees with this. Despite the parent agreeing with being interested in continuing tagging to enhance their child's baseball training, the youth participant marked slightly disagree.

CHAPTER 4

DISCUSSION

The purpose of the present study was to determine if parents could enhance the training their child received for baseball swing mechanics by targeting specific behaviors using a tagging only procedure.Across three target behaviors, implementation of the tagging procedure on a slowed down version of a baseball swing did not result in higher percentage of correct implementation for this participant. This study sought to create a novel way to enhance youth sport mechanics by using parents using a tagging procedure instead of coaches or a training facility. Parents could provide additional opportunities for a youth sports participants to practice necessary skills needed to stay competitive. The implications of these results serve as an indicator that even when the target skills met criteria of 80% across two sessions, it may not be enough to evoke correct mechanics during typical play speeds.

Perhaps future research should have parents tagging target skills at progressive speeds which past research shown more likely to obtain positive results (Harrison&Pyles, 2013). However, progressive speeds would require a good eye since the entire baseball swing occurs in a very short period of time (i.e. less than 2 seconds) which may not be conducive to parent lead training sessions. As an alternative, future research with parents tagging should consider extending the training sessions until results of targeted skills show improvement in training facility sessions or game play. Another option for future research would be to use parents with a history of playing or coaching baseball, which may have produced more favorable results.

Although the participant was not observed during game play, future research could reduce the confounding variables. It is possible the training facility's coach's verbal instructions had stimulus control over the presence of the researcher and the targeted skills of the study. In

other words, one would believe a certain degree of reactivity would be likely to evoke targeted skills due to the participant knowing the researcher was observing and recording training facility sessions. A thirdlimitation of the current study was the facility was not working on the same skills targeted in the tagging sessions. Data from game play situations would give a more accurate performance score across many exemplars (e.g. game play with a coach versus training facility with atrainer versus parent led tagging sessions). Future research could work directly with the training facility and conduct tagging sessions during part of each session to help evoke skills in the setting as well as help trainers select a limited number of skills to target at one time until there is noticeable improvement in performance. Past research (Quinn et. al. 2015) found coaches implementing a tagging procedure were able to evoke the desired skill with pre sessions lasting less than 15 minutes and those acquired skills generalized to the typical training sessions.

A fourth limitation was only one participant participated in the study who had previous baseball experience. Future research should consider using less experienced players where there would be a greater potential for improvement. Younger, less experienced players may also be more conducive to the less experienced eye to tag at progressive speeds due to the younger players having a slower swing.

The current study aimed to examine the effectiveness of parents using a tagging procedure to enhance their child's sports mechanics. Continuing research may help identify variables needed for parents to successfully enhance training youth sports participants.

Table 1

Baseball Swing Task Analysis

Starts swing	**Load**	1. "Stacking your weight" a. back foot straight or pointed in b. back knee pointed in (beach ball back knee) c. Pole (back knee, hip & shoulder all aligned)
		2. Front shoulder closes slightly
		3. Loading the hands and **"Getting Started"** Fat letter A made with arms a. Hands at shoulder b. Front elbow points down (arms at 90 degree angle) c. Bat knob points toward catcher d. Back elbow up (back arm at 70-90 degree angle, not above shoulder)
		4. Front knee kicks inward
	The Step	5. Small step a. Less than 12" b. Lands on ball of foot c. Knee is pointed in (beach ball) d. Foot is straight or toes pointed in when heal lands *double step (a, b, d) counted wrong, needs to land heal before launching hands
		6. Weight back a. Back knee, hip, shoulder aligned b. At least 60% of weight stays on back leg- c. Lands heal and stays back prior to pivot-batter does not move forward
		7. Steady head *(from start of the swing to end of the step)* a. Maintains chin over front shoulder before pivot b. Eyes stay on the ball/pitcher
Mid Swing	**Launch the Hips**	8. Pivot rear hip *(will pivot on leg with weight)* a. Rear hip fires level towards pitcher (draw horizontal line) b. front hip provides resistance (remains stationary) *if batter starts to pivot back hip and then moves forward, this step is counted incorrect*
		9. Rear elbow tucks towards the hip *(top arm should not be extended/straight)*
		10. Most of the batters weight remains on rear leg a. Batter will appear to be leaning back or standing straight (knee, hips, shoulders in line) b. Back knee goes down (leg more parallel with ground) Body, not hands, getting on plane with the ball
	Launch the Hands to Contact	11. Bat knob driving toward the ball begins the sequence -A to C position-the bat knob motion should be a straight line towards the pitcher *(The bat barrel should not drop down or hands drop below shoulder causing the bat to swing up)*
		12. Wrist flick or snap the barrel to contact. a. right hand separates from shoulder-bat will be parallel to ground as the knob is propelled forward towards the pitcher b. The wrist flicks to contact around area in front of front leg to the front knee
		13. Top hand is in a palm up position at contact
		14. Front leg is firm and creates resistance for the body to propel the bat head. a. Foot stays planted flat on ground b. Leg is firm and straightening; creating resistance, not necessarily straight.
		15. Steady head-chin stays on swivel ending on the opposite shoulder at the end of the swing
End Swing	**Extend (Powe**	16. Hands finish their flicking motion started at the contact –bottom hand is palm down and top hand is palm up bat is pointed towards the pitcher
		17. Front leg firms up and straightens out
		18. Batters head looks directly down the Power V (chest level, not above shoulders)
	h the Swin	19. Top hand does not roll over bottom hand
		20. Hands finish above shoulder- bat goes from power V and up over shoulder
		21. Bat head finishes over the shoulder at the back of the hitter

Table 2:

Tagging points

Task Analysis Steps targeted for Tagging procedure	Tagging points
Step 1: Weight primarily on the inner portion of the back leg and foot ("stacking your weight")	A. "Foot Straight": Back foot is parallel to back of home plate. B. "Beach ball": knees in as if holding beach ball C. "Pole": knee, hip, shoulder aligned
Step 5: Small step (softly landing on pad near the big toe)	A. Less than 12' B. Land on ball of foot C. Toes parallel or pointed in D. Beach ball
Step 3: Loading the hands and tilting the bat head forward toward the pitcher (Don't hide hands, knob looks at catcher) "Getting Started" Fat Letter A (triangle)	A. Front elbow points down (Elbow of front arm at 90 degree angle) B. "Bat knob": Bat knob points towards catcher C. "Back elbow up": back arm at 70-90 degree angle, not above shoulder

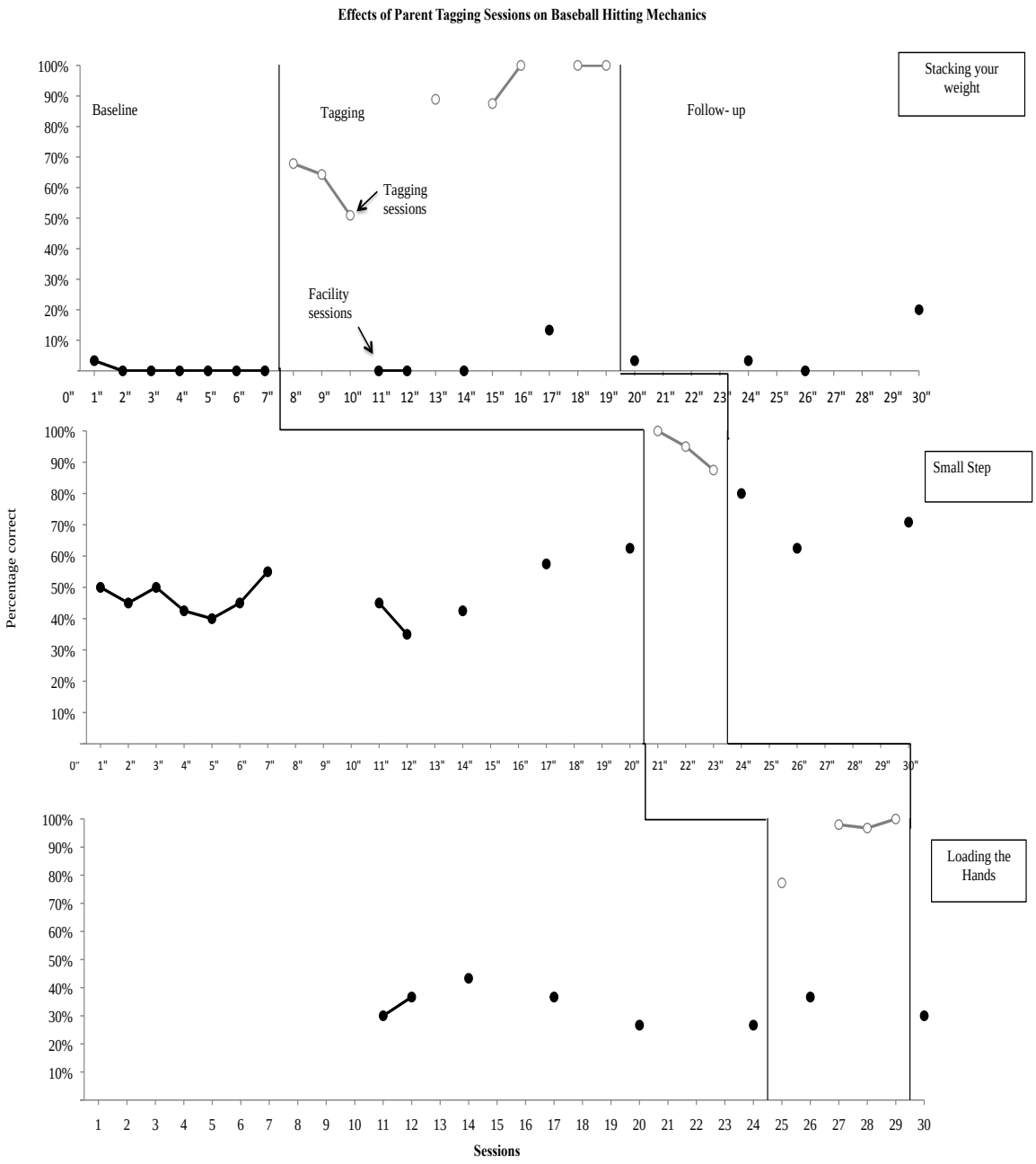

*Figure 1:*Percent of component skills executed correctly (y-axis) for each session (x-axis) consisting of ten trials each. The closed circles indicate facility ran training sessions. Open circles represent tagging sessionsconducted outside of the facility.

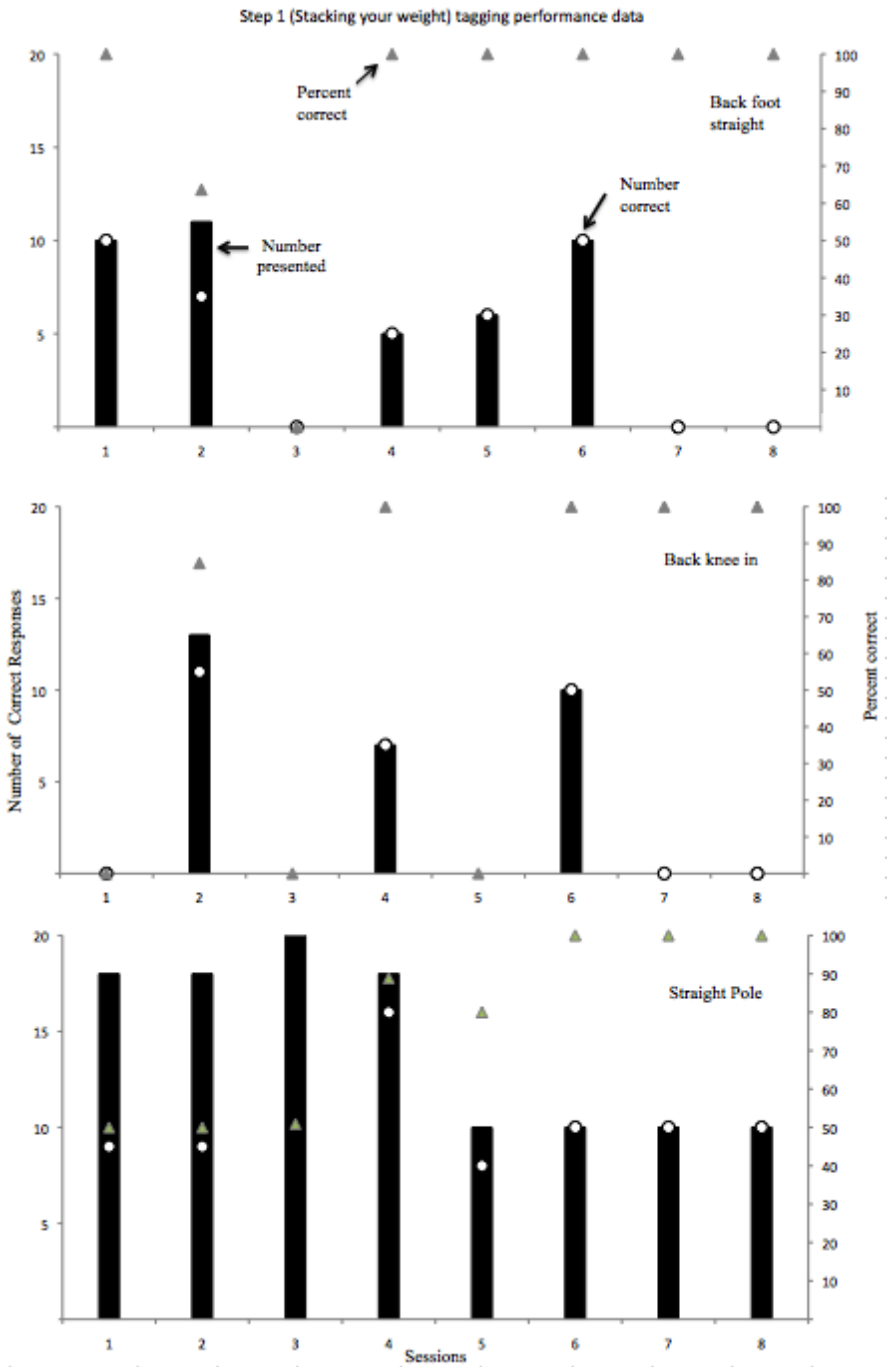

Figure 2: Number of tagging trials presented (bars; primary y-axis) and number of tagging trials performed correct (open circles, primary y-axis). The percentage of correct performance (triangles; secondary y-axis) for three component skills of back foot straight (top panel), back knee in (middle panel) and straight pole (bottom panel) for step 1 on task analysis (stacking your weight).

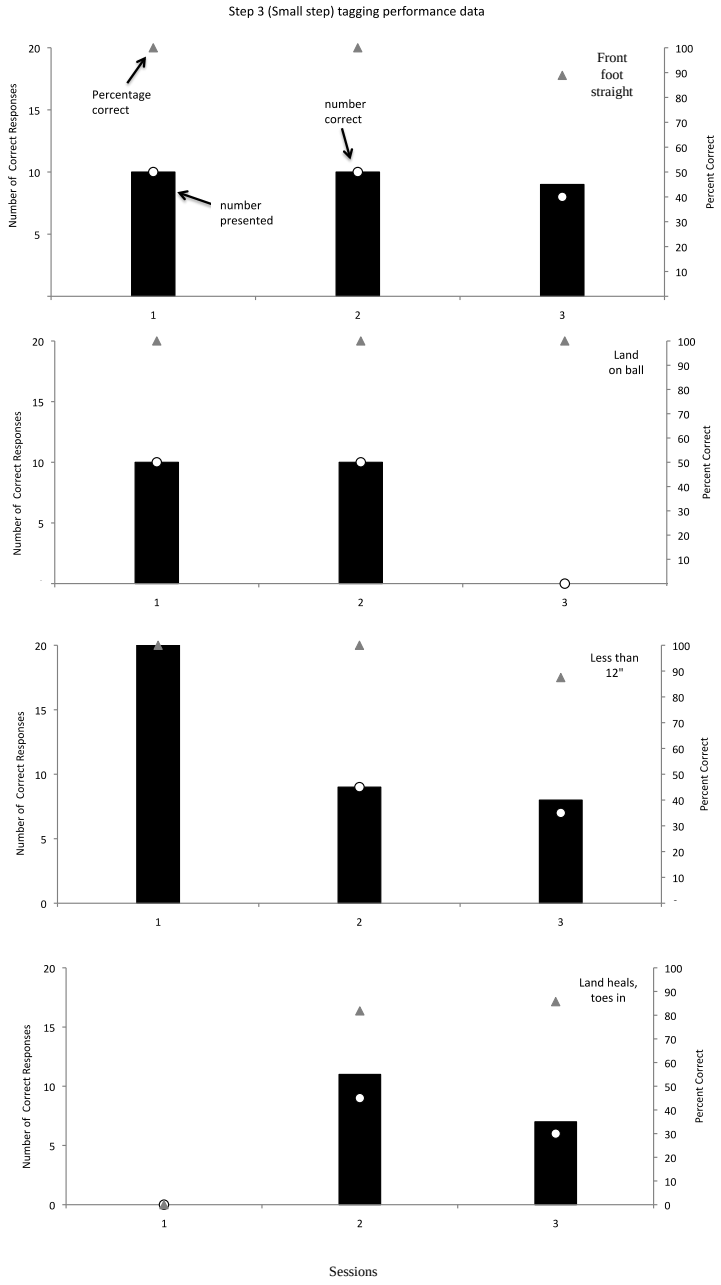

Figure 3: Number of tagging trials presented (bars; primary y-axis) and number of tagging trials performed correct (open circles, primary y-axis). The percentage of correct performance (triangles; secondary y-axis) for four component skills of front foot straight (top panel), land on ball (top middle panel), less than 12 inches (middle bottom panel) and land heal, toes in (bottom panel) for step 3 on task analysis (small step).

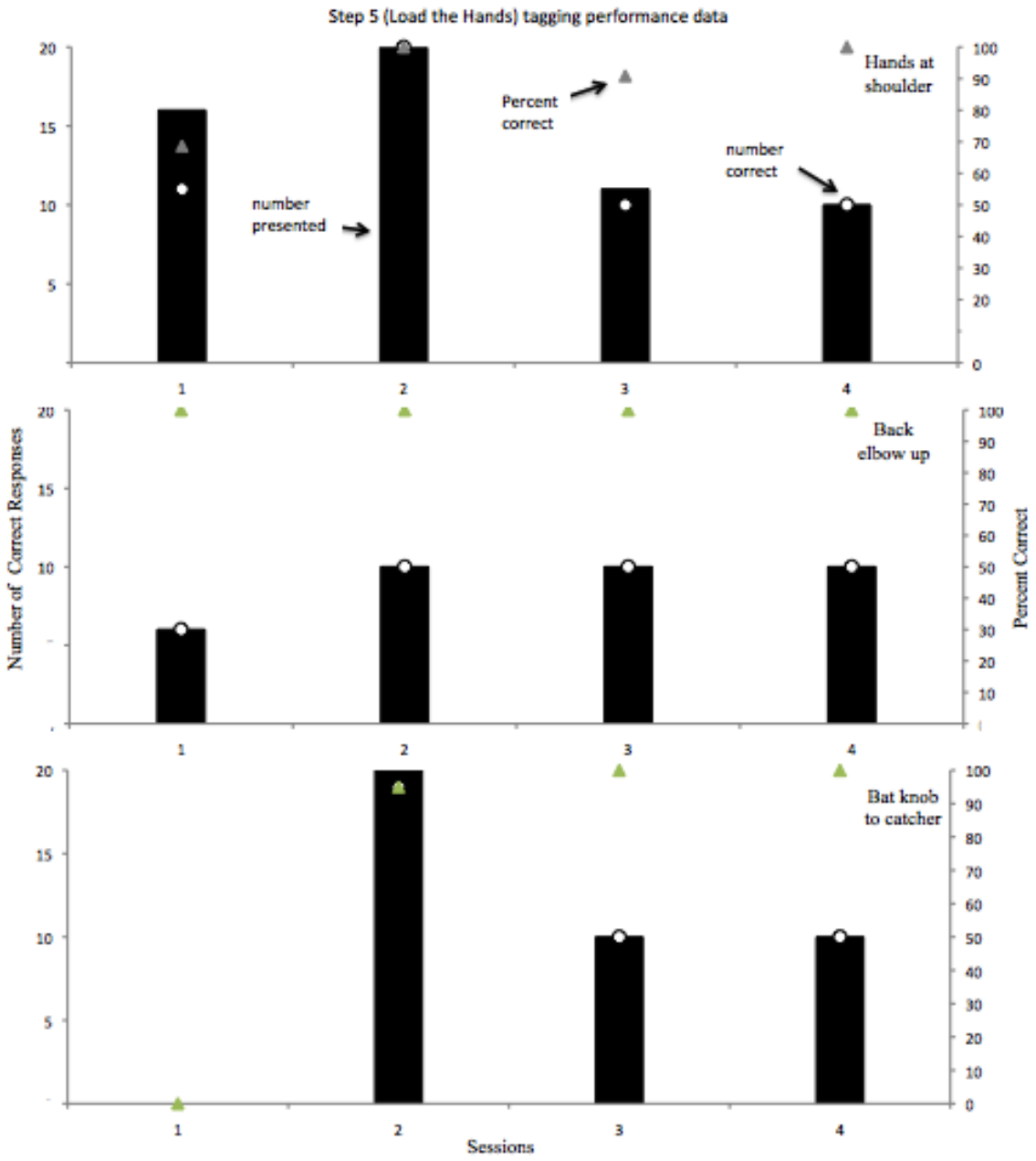

*Figure 4:*Number of tagging trials presented (bars; primary y-axis) and number of tagging trials performed correct (open circles, primary y-axis). The percentage of correct performance (triangles; secondary y-axis) for three component skills of hands at shoulder (top panel), back elbow up (middle panel) and bat knob to catcher (bottom panel) for step 5 on task analysis (Load your hands).

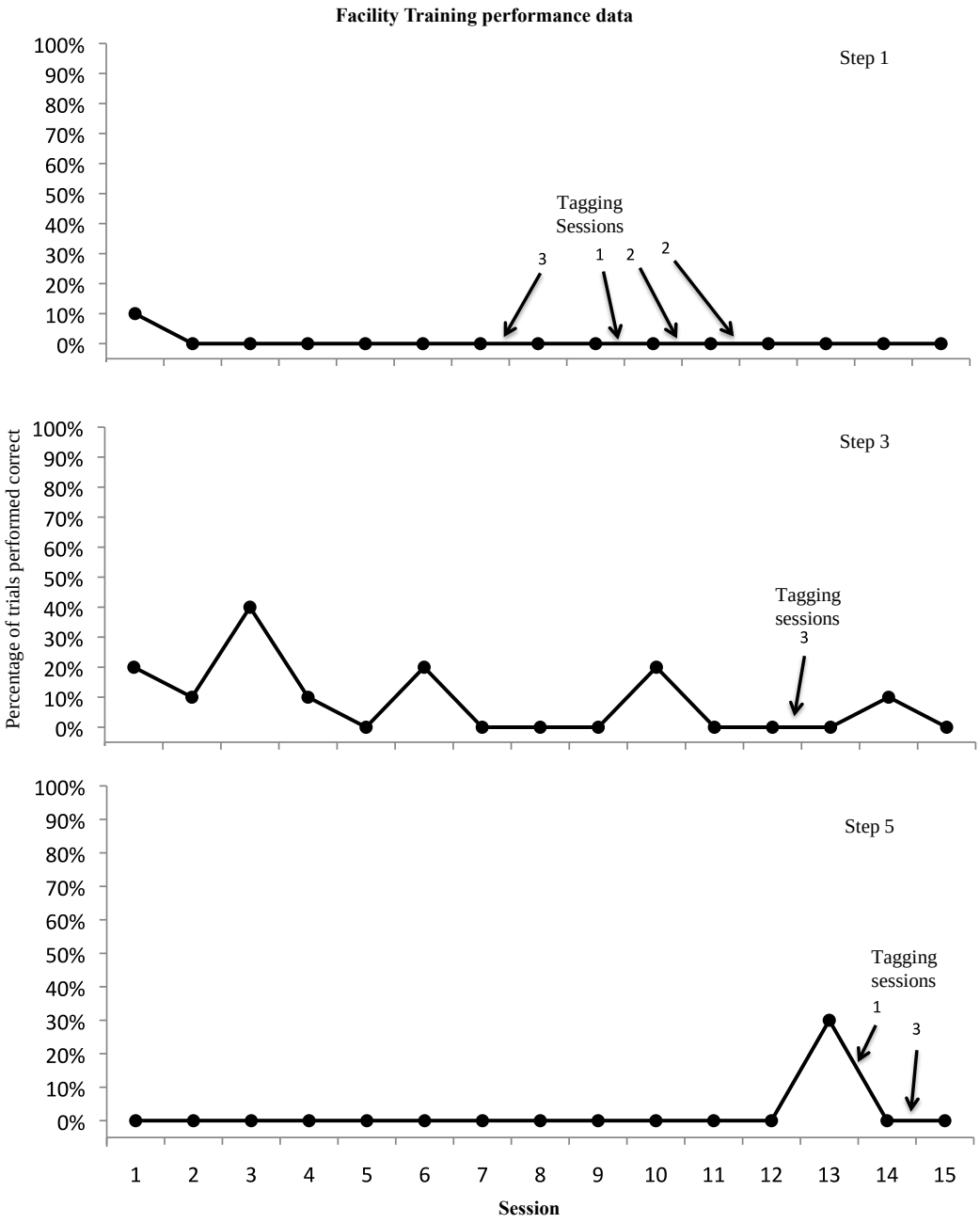

Figure 5: Percentage of trials each step was performed correct (y-axis) over facility training sessions (x-axis). The small number on top of the arrows represent the number of tagging sessions that occurred between facility training sessions.

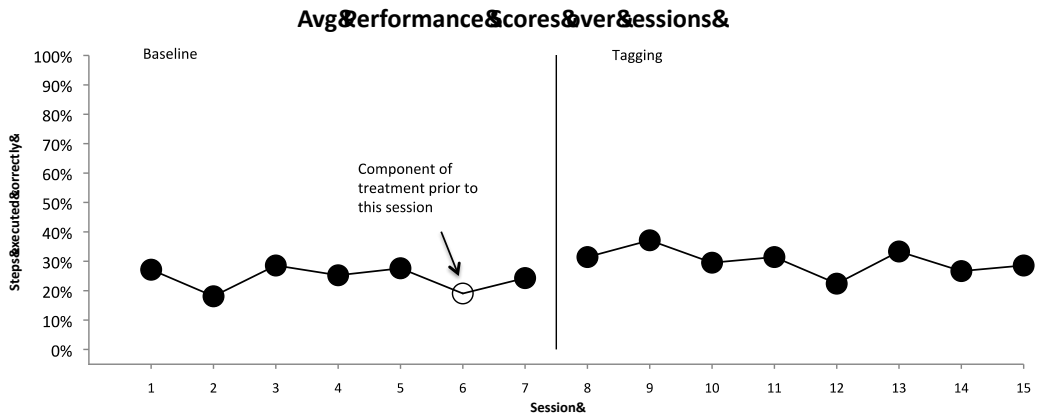

Figure 6: Average performance scores (circles) from all 21 steps on the task analysis performed correct (y-axis) over facility training sessions (x-axis).

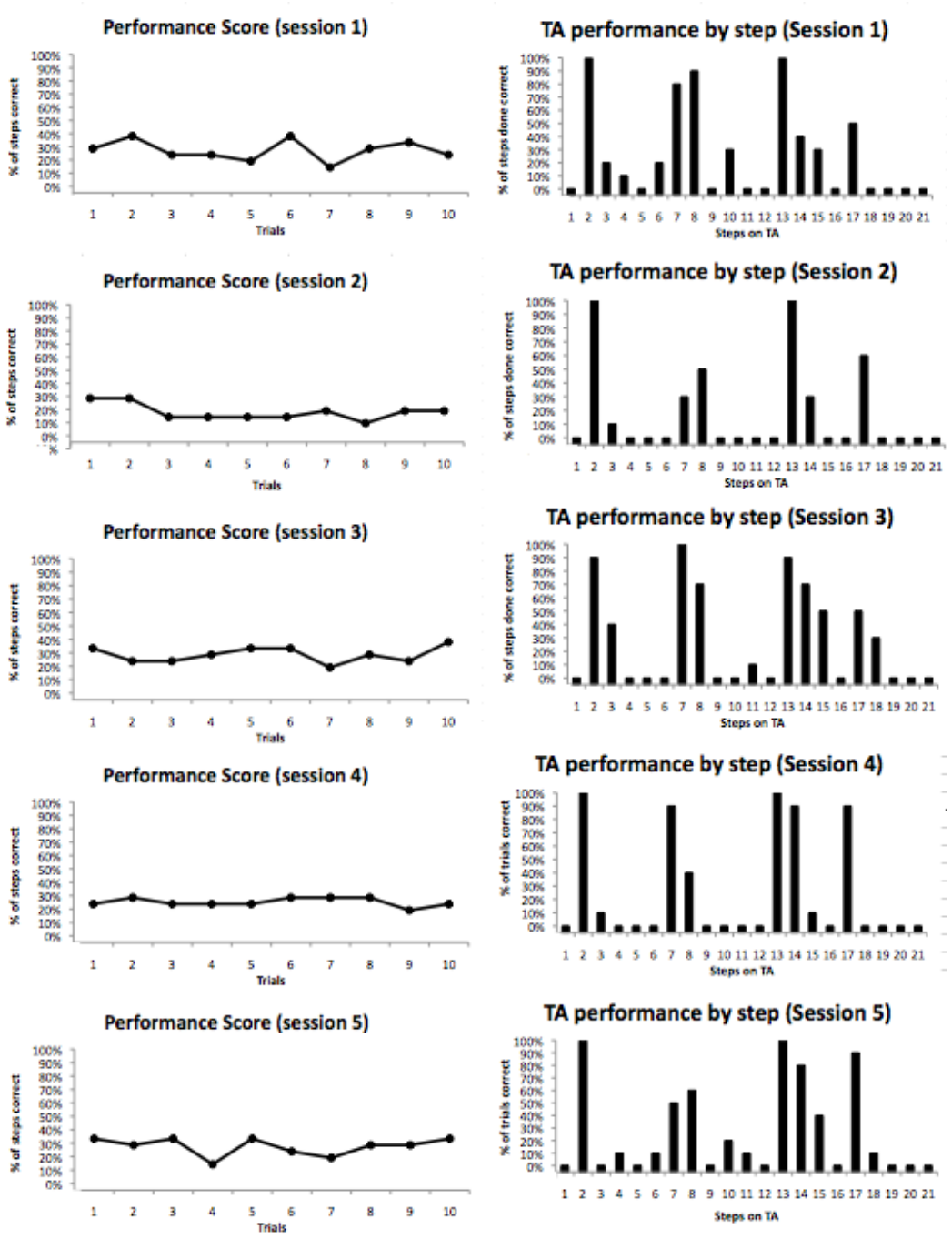

Figure 7: Within Session data for sessions 1 through 5. Line graphs (left) show average performance (y-axis) across all 21 steps on the task analysis over the ten trials in each session (x-axis). Bar graphs (right) show average performance (y-axis) over the ten trials in each session for each of the 21 steps on the task analysis.

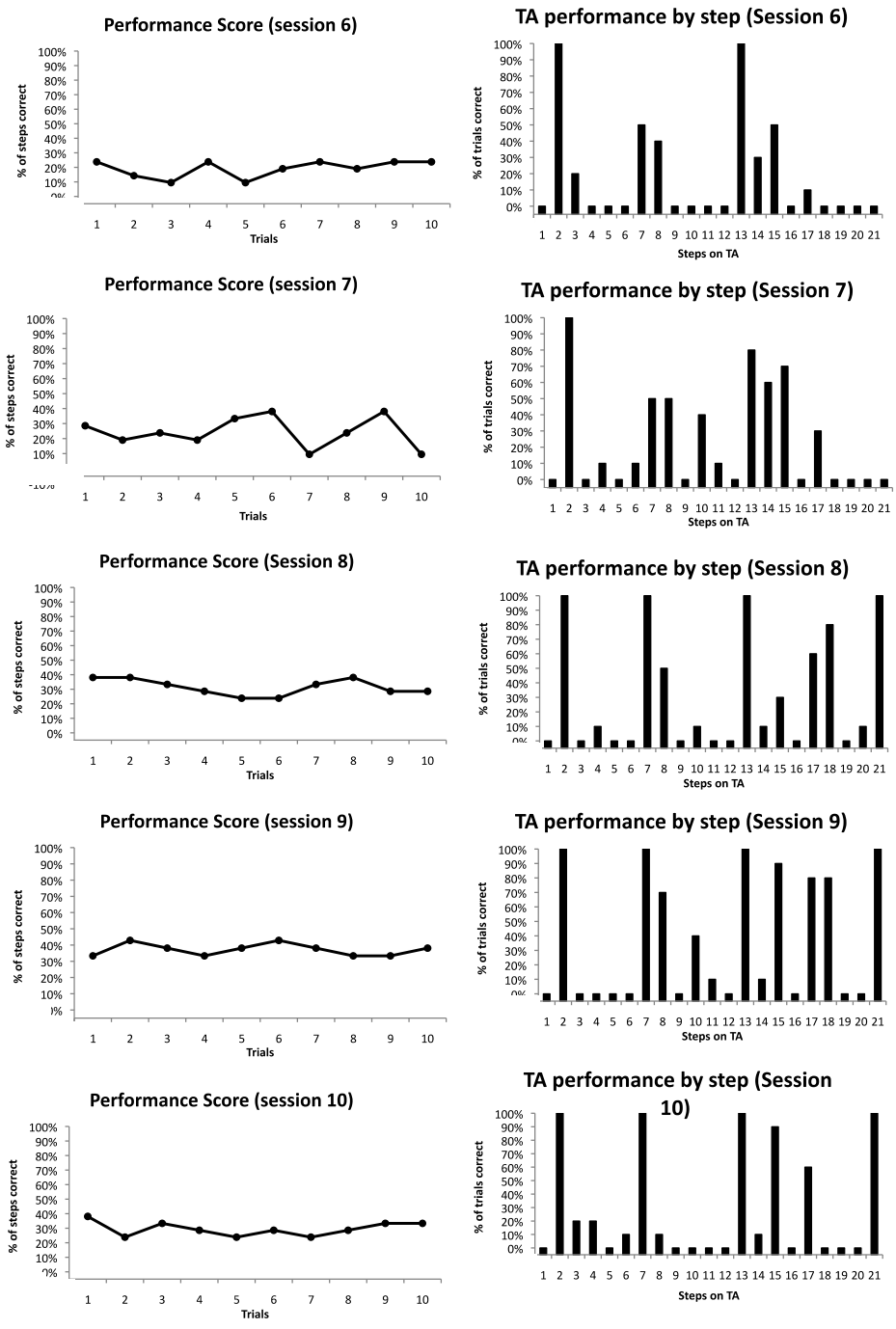

Figure 8: Within Session data for sessions 6 through 10. Line graphs (left) show average performance (y-axis) across all 21 steps on the task analysis over the ten trials in each session (x-axis). Bar graphs (right) show average performance (y-axis) over the ten trials in each session for each of the 21 steps on the task analysis.

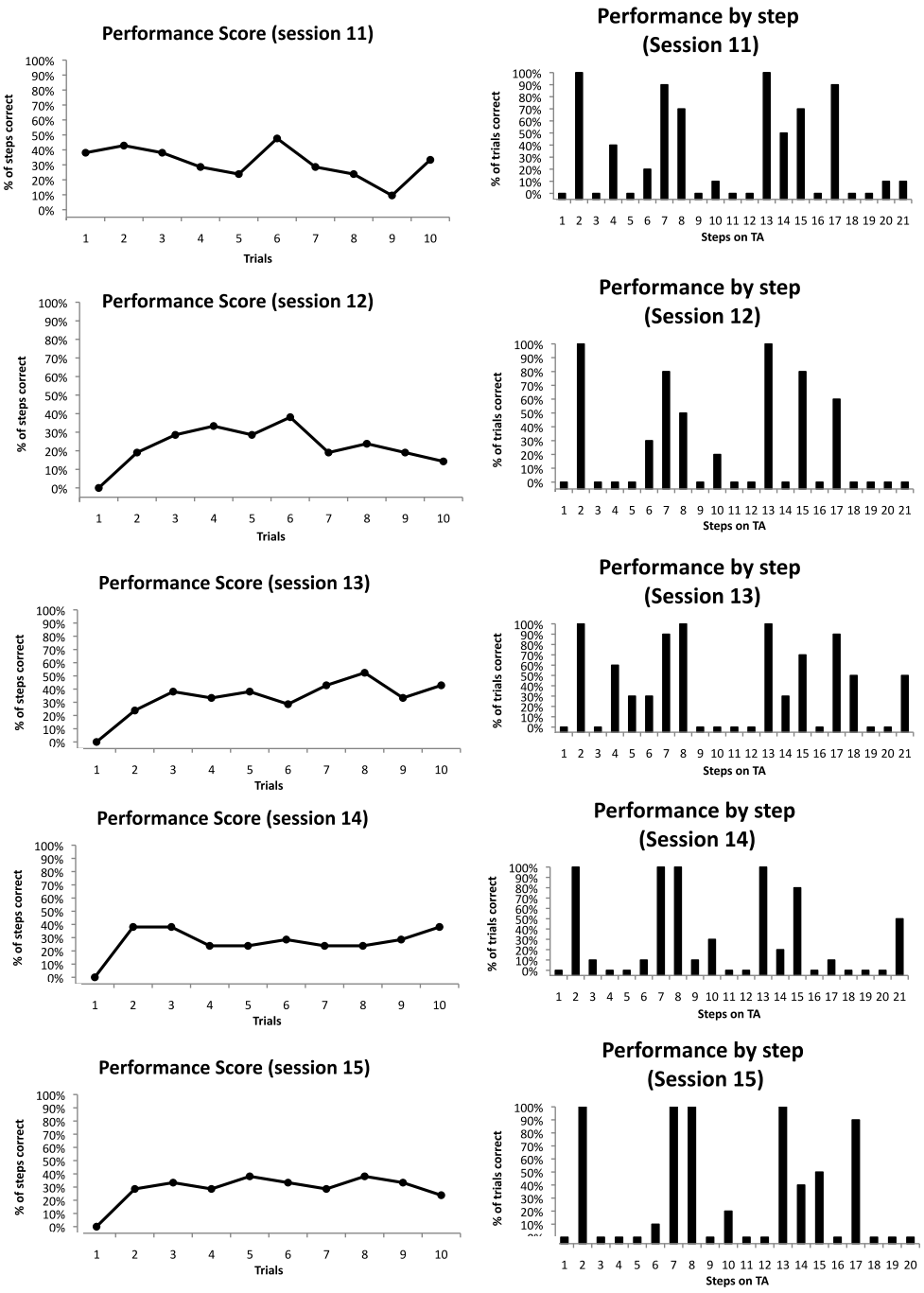

Figure 9: Within Session data for sessions 6 through 10. Line graphs (left) show average performance (y-axis) across all 21 steps on the task analysis over the ten trials in each session (x-axis). Bar graphs (right) show average performance (y-axis) over the ten trials in each session for each of the 21 steps on the task analysis.

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APPENDIX

Appendix A: Social Validity Post-Study Questionnaire for youth participants

1. How did the tagging procedure compare to your typical baseball training as far as difficulty and fun?
2. Would you recommend this training to a friend?
3. What did you like most about the tagging training?
4. What if anything, did you dislike about the tagging training or what would you change?

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
My baseball hitting mechanics are better following the tagging intervention?						
Learning mechanics with TAGteach will help me become a better hitter?						
I am more confident in batting than I was in the beginning of the study?						
I would be more confident in being able to bat in a competition game?						
I would like my hitting instructor to train me using tagging?						
I would like my parent to enhance my training using tagging?						

Adapted from Quinn, Miltenberger, and Fogel (2015)

Appendix B:Social Validity Post-Study Questionnaire for youth parent/guardian

1. How did the tagging procedure compare to your child's/ward's typical baseball training as far as difficulty and fun?
2. Would you recommend this training for a friend's child?
3. What did you like most about the tagging training?
4. What if anything, did you dislike about the tagging training or what would you change?

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
My child's baseball hitting mechanics are better following the tagging intervention.						
Teaching mechanics with tagging will help my child become a better hitter.						
My child is more confident in batting than he was in the beginning of the study.						
I would like my child's hitting instructor to teach him using tagging.						
I would be interested in using tagging to enhance my child's baseball training.						

Adapted from Quinn, Miltenberger, and Fogel (2015)

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