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Training of Novice Trainers to Work With Athletes With Autism Spectrum Disorders in an Ice Hockey Practice Setting[1]

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This study was designed to evaluate the instruction of children with autism spectrum disorder as they were taught basic hockey skills. Novice instructors with no hockey background but a willingness to instruct the athletes completed skill training. The study was conducted across three phases: baseline where the coaches received no instruction on how to properly engage and reinforce the athletes to demonstrate hockey skills, training where the coaches received a hands-on 90-minute training session on proper teaching skills, and a post-training coaching training. Our results indicate that persons with limited hockey experience and knowledge can benefit from a brief training session followed by limited in-vivo training.

Keywords: **Autism Spectrum Disorder, Learning Disabilities, Hockey Training, Social Skills, Problem Behaviors**

Introduction

Autism spectrum disorders (ASD) are characterized by significant and persistent impairments in social interactions, unusual or delayed communication, and repetitive behavior activities (Patel, Preedy, & Martin, 2014). ASDs are associated with a number of other diagnoses; in particular, learning disabilities (LD), with a comorbidity rate of about 85% (Mpaka et al., 2016). Because ASD is so closely linked with a reduced ability to understand new or complex information and to learn new skills (Department of Health, 2001), there is some debate over the question whether ASD and LD can be viewed as entirely distinct syndromes (O'Brian & Pearson, 2004).

Due to their problems in receiving, processing, analyzing, and storing information, teaching children with ASD can be challenging. This not only per-

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tains to instructing them to read, write, spell, or do mathematics, but also to helping them to acquire social skills in non-educational settings. To this end, extensive research has been conducted to identify contexts that are most conducive for teaching social competencies to children with ASD (Beiers, Derby, & McLaughlin, 2016).

Setting-specific skillsets influence the ability of children with ASD to function in society (Gooding, 2011; Spence, 2003). These skillsets can be broken down into four categories for educational purposes: academic, leisure, social, and societal (Watkins et al., 2015). A lack of skills in any of these categories can lead to social isolation. Thus, it is necessary that all training activities encompass the four skill categories.

Typically, research in the field of ASD has focused on teaching skills to students in an academic setting by a trained educator. As a result, research is lacking on teaching students with ASD the skills necessary to perform developmentally appropriate activities in natural environments (Orsmond, Krauss, & Seltzer, 2004). Related to that, strategies for training community care providers such as coaches, employers, and peers in the workplace have not been established (Watkins et al., 2015). The benefit of teaching within the community and the home in addition to schools is that these settings provide a positive influence on the social growth of the individual. Further, teaching within naturalistic settings results in a greater likelihood of generalization of the skills (Watkins et al., 2015). With the number of children diagnosed with ASD on the rise (Centers for Disease Control, 2016), it is increasingly critical to establish systems of care to help these children overcome their social deficits so they can function successfully in the social world.

There are many different ways to teach care providers to become competent teachers and mentors for children diagnosed with ASD. For example, in-vivo training teaches an individual to be a mentor within naturally available contingencies. To evaluate parent teaching skills in the home, Shanley and Niec (2010) randomly selected 60 mothers to receive training on how to assist their children using behavioral parent training (BPT). Graduate student coaches were trained via an in vivo technique to interact with the children. Study participants were broken into two groups: Coach Group (CG) and Non-Coach Group (NCG). Both groups participated in a 25-min play session, and the mothers' positive verbalizations were recorded using the Dynamic Parent-Child Interaction Coding System (DPICS) criteria (Eyberg, Nelson, Duke, & Boggs, 2004). The session with the lowest frequency of interaction was then targeted for intervention. Intervention consisted of CG mothers being instructed in the use of appropriate verbal praise. Both CG and NCG were evaluated within 15-minute play sessions on child-led play, parent-led play, and clean-up.

Both mother groups wore ear bug devices in both baseline and intervention. In baseline, each group was instructed to play and interact with their children as they wished. In training, the CG was instructed to appropriately provide instruction and reinforcement via prompts delivered through the ear bug. The authors found no significant increases in the child's behaviors in either the control or the training group.

Arkoosh et al. (2007) evaluated the long-term use of a training package that incorporated differential reinforcement of (a) other behavior, (b) differential reinforcement of communication (appropriate behavior), and (c) a punishment contingency. A high level of reinforcement fidelity (>80%) was required for long-term maintenance of replacement and generalized social behaviors. Conversely, maintenance of low level aberrant behavior occurred for three of the five participants with only limited (0% for at least 1 participant) punishment integrity.

Involvement in exercise and athletic experiences has been shown to be very therapeutic for children with ASD (Reinders, Branco, Wright, Fletcher, & Bryden, 2019). Nevertheless, Ohrberg (2013) pointed out that both private and municipal leagues seldom provide ASD athletes with the supports required to gain the skills needed to be successful. Therefore, increased training of volunteers in community settings to provide integrated experiences for persons with ASD in local sports programs would be beneficial (Ohrberg, 2013).

The first step in integrating ASD athletes into community programs might involve designing environments to include athletes with ASD into social settings near other children participating in the same activities. Miltenberger and Charlop (2014) evaluated the merit of teaching social skills within group games such as handball and four square. Results showed that involvement in group games increased play activity and speech patterns for two of the three children evaluated (Miltenberger & Charlop, 2014).

The teaching of social skills to children with ASD does not typically take place in athletic settings. Rather, in general, play dates are used as a context for teaching social interaction skills (Jull, 2008). However, in two previous studies, we demonstrated the usefulness of hockey practices as an effective context for social skills training. Beiers et al. (2016) as well as Mortensen, Derby, and McLaughlin (2015) evaluated how teaching hockey skills affected children with a developmental disability.

Specifically, Beiers et al. (2016) assessed the social engagement of two children with ASD in the context of hockey practice. The children were provided with specific prompts and reinforcement contingent on performing certain hockey skills. Using a single-subject reversal design (ABAB), the authors demonstrated that the children's social interactions and skill performance increased.

Mortensen et al. (2015), in turn, assessed interactions between typically developing peers and children with ASD within an ice hockey environment. Each participant and his parent were asked to complete a short survey after practice to measure the student's interest in hockey. The parents also completed an end-of-season survey to measure parent and child satisfaction. Results indicated that hockey practices facilitated engagement in the athletic activity of playing hockey.

Given the promising results of the previous studies, In the current study, we developed a teaching module designed to provide novice coaches with the instructional skills required to assist children with ASD in participating in hockey practice. It was our hope that with a standardized curriculum we will be able to conduct additional studies across multiple sites. To determine the success of the teaching module, we measured both coach and player behaviors. Coaches were evaluated for the training fidelity; players were evaluated for their level of on-task behavior and social interaction during practice.

We trained graduate students with very limited hockey playing and coaching experience to teach children with ASD hockey skills in a community setting. The graduate student coaches were initially provided a list of skills to teach the players without explicit instruction on correct prompt or reinforcement procedures. Our goal was to produce a 60- to 90-minute training module to increase the coaches' teaching skills.

Method

Participants/Setting

Participants were young athletes and coaches from the greater Spokane, Washington, region; the athletes ranged in age from 4-12 years, and all had been diagnosed with ASD by either a developmental pediatrician or a child psychologist. Criteria for inclusion in the study were as follows: the participant (a) was diagnosed with ASD, (b) had no experience playing ice hockey, and (c) agreed to participate via both parental consent and participant assent. Coaches were all graduate students enrolled in a university in the Pacific Northwest. Coach inclusion criteria were as follows: the graduate student had a novice level of knowledge with regard to basic hockey skills and a willingness to coach.

The study took place at an ice rick in Spokane, Washington. Practice sessions were conducted from November 2014-Febuary 2015 with breaks to observe Thanksgiving and Christmas holidays. Three coach-player dyads were observed throughout the study: David and Andrea; Derrick and Brandi; and Carl and Anthony. Participants' names have been changed to protect their privacy.

Measurement

Data collection was completed for each athlete-coach dyad. For consistency, a primary data collector scored all video sessions for their assigned dyad

across baseline, training, and post-training phases. Video were recorded via handheld cameras and scored at a later date. Inter-observer agreement occurred for 43% of the sessions; it was calculated by dividing agreements over agreement plus disagreement and averaged 81.3%.

Materials

Materials consisted of the basic hockey equipment needed to conduct a hockey practice. All volunteer coaches and players were provided with ice skates and sticks. All players were required to wear helmets for protection. All data collectors were provided with ice skates to provide the best videos possible. After completion of all data collection sessions, a data system was used to measure athlete and coach behaviors (see Appendix A).

Dependent Variables

Three coach and player behaviors were measured. Coaches were measured on (a) *specific direction*, defined as correct instruction of a hockey skill; (b) *inappropriate reinforcement*, defined as verbal (praise)/physical (high five) delivered in the absence of the hockey skill being taught; and (c) *appropriate reinforcement*, defined as verbal/physical social positive reinforcement for the engagement of a hockey skill being taught. Athlete participants were measured on the following observable behaviors: (a) *problem behavior,* defined as bringing specific instruction to a stop (this did not include equipment issues and the participants needing water); (b) *task engagement*, defined as active participation in the hockey skill being taught; and (c) *interaction*, defined as social behavior directed toward the coach or a peer, including engagement in the hockey skill and verbal comments to the coach/peer.

Procedure

This study was submitted to and approved by the host university's Institutional Review Board (IRB). It consisted of three phases: baseline, training, and post-training. During baseline, the coaches were assigned a participant to teach basic hockey skills without being taught basic knowledge about either hockey or behavior contingencies. Coaches were given a specific order of tasks to complete during the each practice session, based on the athlete's age. Younger athletes were asked to complete skating, passing, and stick handling tasks. The older participant was asked to complete an additional task of shooting. If the coach assigned to a given athlete was not present at a specific session, data were not collected for that day. (This occurred rarely and did not affect overall outcomes.)

During the training phase, the coaches participated in an in-depth 90-minute training session and in-vivo review to acquire the skills needed to be effective coaches of the athletes with ASD. The 90-minute training consisted of a PowerPoint presentation and off-ice training trials with the trainer (first

and second authors). The in-vivo review consisted of a one-time model at the beginning of the practice. That is, a modeled review of how the skills were to be taught. Post-training, the coaches were expected to provide greater amounts of skill specific direction along with appropriate reinforcement of the specific skill and lower the amounts of inappropriate reinforcement. The post-training phase was implemented to help reduce the number of problem behaviors demonstrated by the athletes while increasing the likelihood of an increase in task engagement and interactions with coach(es) or peers.

Results

David and Andrea

Figures 1 and 2 show the results for coach and player behavior for David. As illustrated, during baseline, David's task engagement was high with a mean level of 73% (range of 43%-93%). During the post-training phase David's level of task engagement increased to a mean of 80.4% (with a range of 70%-93%). During both baseline and training, his problem behaviors rarely occurred. For social interaction, David engaged in a baseline mean level of 5.67% (range of 0%-13%). Following coach training, his level of social interaction increased to a mean of 14.25% (range of 0%-36%). Coach Andrea's correct use of specific directions averaged 35% (range of 6%-70%) during baseline. After training, Andrea's use of specific direction prompts increased to 46% (with a range of 30%-63%). Andrea's use of inappropriate reinforcement averaged 1% (with a range of 0%-6%) during baseline. After training, inappropriate reinforcement occurred at a mean level of 2.8% (with a range of 0%-10%). Andrea's level of appropriate reinforcement was 18% (with a range of 0%-40%) in baseline. After training, Andrea's level of appropriate reinforcement was 15.5% (with a range of 3%-36%).

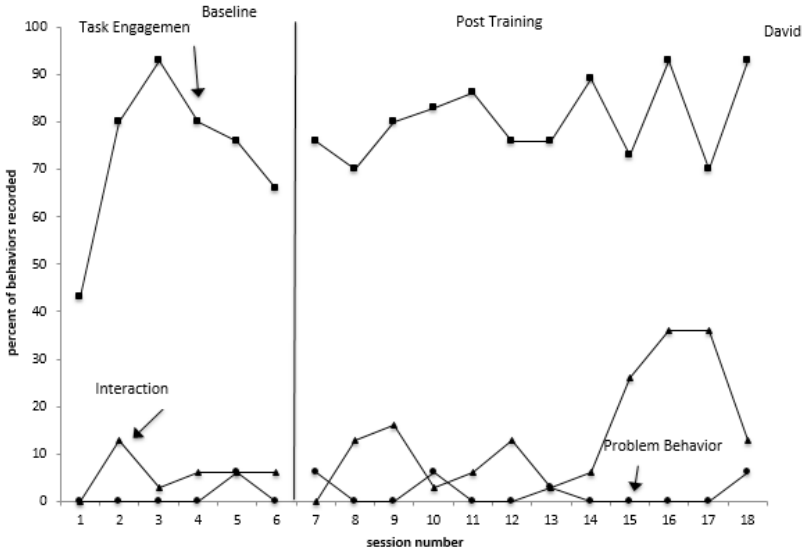

Figure 1. **Task engagement, interaction with coach, and problem behavior for David.**

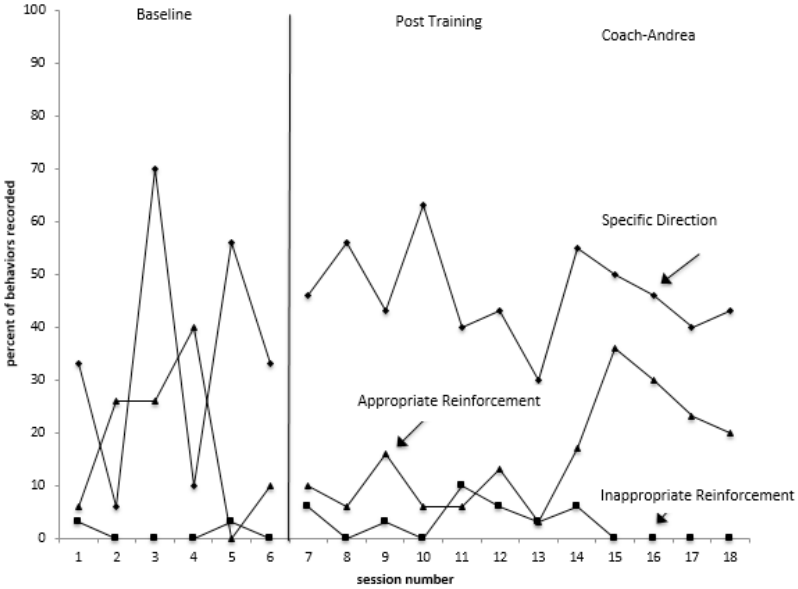

Figure 2. **Specific directions, appropriate reinforcements, and inappropriate reinforcements for Coach Andrea.**

Derrick and Brandi

Figure 3 shows Derrick's skill growth through baseline and the post-training phases of the study. As illustrated, his baseline level of problem behaviors was 9% (with a range of 0%-27%). During post-training, Derrick's problem behaviors fell to an average of 2.3% (with a range of 0%-8%). Derrick's task engagement during baseline averaged 73% (with a range of 27%-100%). During the post-training phase of the study, Derrick's task engagement increased to an average of 94% (with a range of 81%-100%). Derrick's social interaction during the baseline was 86% (with a range of 63%-100%). During the post-training phase, his social interactions to 98% (with a range of 96%-100%).

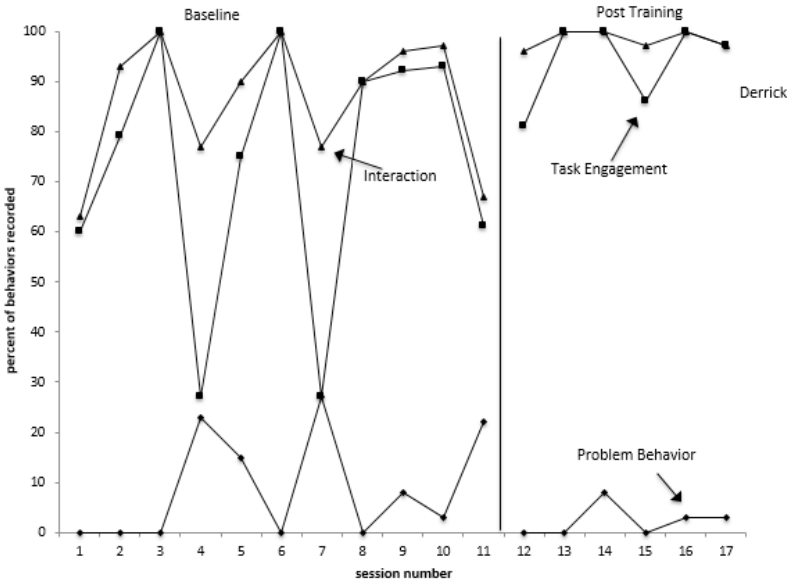

Figure 3. **Task engagement, interaction with coach, and problem behavior for Derrick.**

Brandi's coaching behaviors across baseline and treatment are shown in Figure 4. During baseline, Brandi's level of occurrence for specific direction was 11% (with a range of 0%-37%). During post-treatment, her average for specific directions was 46% (with a range of 22%-66%). After training, Brandi's inappropriate reinforcement slightly increased to 18.5% (with a range of 10%-26%). During baseline, Brandi's use of appropriate reinforcement averaged 4.6% (with a range of 0%-23%). Post-training, Brandi's average use of appropriate reinforcement rose slightly to 6.1% (with a range of 0%-20%).

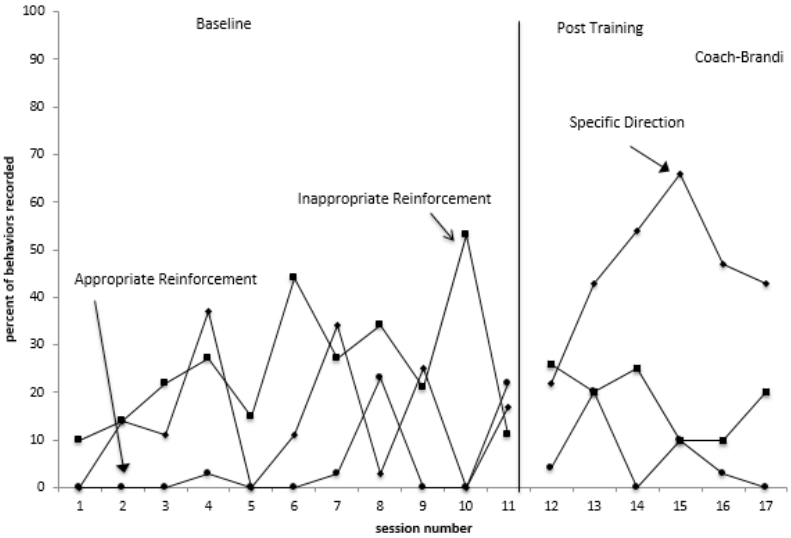

Figure 4. **Specific directions, appropriate reinforcements, and inappropriate reinforcements for Coach Brandi**

Carl and Anthony

Carl's results are shown in Figure 5. During baseline, average occurrence of problem behaviors was 3.7% (with a range of 0%-24%). During post-training, Carl's problem behaviors fell to 1.4% (with a range of 0%-7%). During baseline, Carl's task engagement averaged 82% (with a range of 59%-97%). Post-training, Carl's task engagement rose to 91% (with a range of 83%-100%). Finally, Carl's interaction behaviors averaged 89.7% (with a range of 59%-100%) within baseline. As Carl's behaviors moved into the post-training phase, his percentage of social behavior increased to 98.8% (with a range of 97%-100%) of interactions with the coach during practice time.

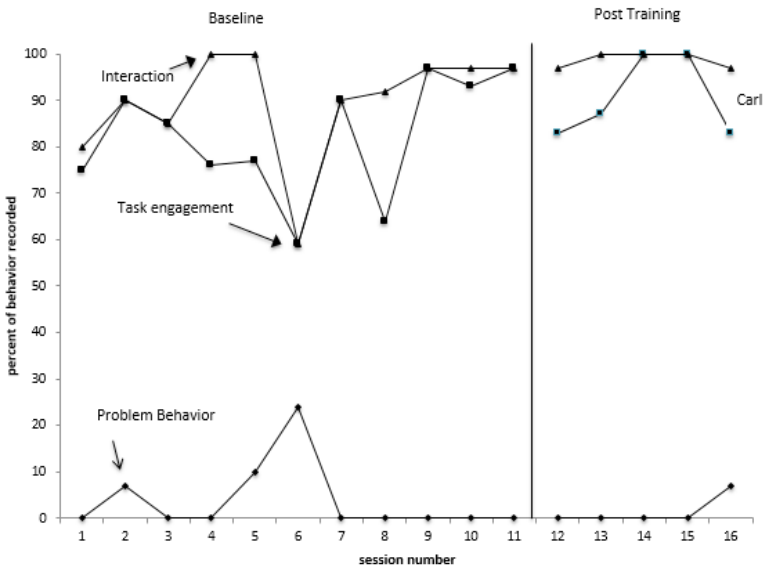

Figure 5. **Task engagement, interaction with coach, and problem behavior for Carl.**

Figure 6 demonstrates the outcomes of Carl's coach, Anthony. Coach Anthony's growth is demonstrated throughout all phases of the study. Specifically, Anthony correctly gave specific instructions correctly 7% (with a range of 0%-23%) during baseline. Conversely, his use of specific directions rose to 30% (with a range of 3%-50%) after training. Anthony's inappropriate delivery of reinforcement was 26% (with a range of 0%-46%) during baseline. After completing training and moving into the post-training phase, Anthony's instances of inappropriate reinforcement fell to 13.8% (with a range of 0%-40%). Finally, during baseline Anthony appropriately delivered reinforcement to Carl

4% (with a range of 0%-20%) of the time. Following training, Anthony's appropriate delivery of reinforcement fell slightly to 3.2% (with a range of 0%-7%).

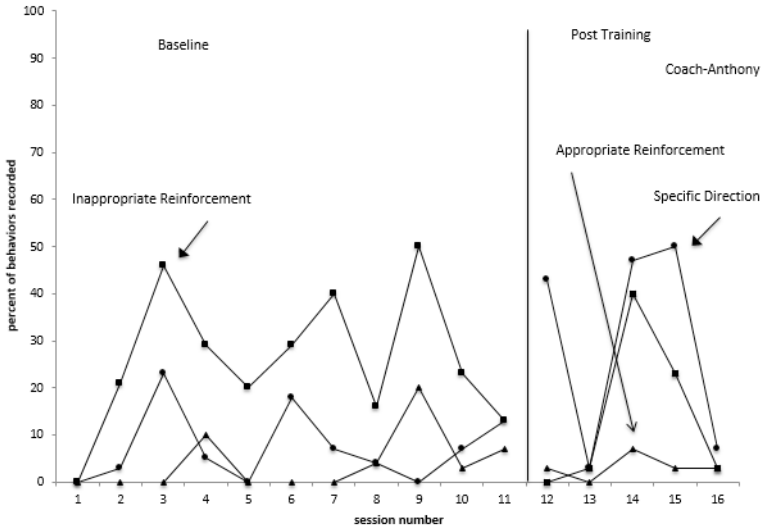

Figure 6. **Specific directions, appropriate reinforcements, and inappropriate reinforcements for Coach Anthony.**

Discussion

The goal of the current study was to improve the novice hockey skills of students with ASD while improving their social interaction with their coaches. Individuals with ADS are not only characterized by challenges in social interaction and communication, but in many cases also by difficulties in acquiring new information and skills. That is, many do not learn as fast as their typically developing peers. Thus, teaching them social-emotional skills is usually more demanding than when teaching students who also lack strategies to perform social tasks effectively but possess adequate learning abilities.

The students in this study demonstrated decreased problem behavior and increased task engagement. All three athletes increased their social interactions with coaches and peers throughout the length of the study. Except for a few instances, their problem behavior was reduced. With regard to coach behaviors, inappropriate use of reinforcement occurred at a low level throughout the study. Specifically, the coaches did not provide reinforcement following every on-task behavior displayed by the athlete (FR1 ratio schedule; i.e., following the occurrence of every targeted skill). Therefore, the schedule of reinforcement delivery was a variable-ratio schedule (intermittently delivered). It is possible that sup-

pression of problem behavior with a concomitant increase is best achieved with a thin schedule of reinforcement. Unfortunately, our definition of fidelity was the delivery of social praise following compliance to a task prompt. The results obtained by Arkoosh et al. (2007) suggest that variable schedules of reinforcement in the absence of a response reduction procedure can lead to long-term positive treatment gains.

Our results support the findings of previous work within athletic contexts. For example, similar to Miltenberger and Charlop (2014), all the participants in our study demonstrated decreased problem behavior, and social interaction was either maintained or increased. However, the results of the current investigation reflect positive outcomes across player/coach dyads rather than across peers. The current investigation extends our previous work in that the hockey practice context was shown to facilitate increased social behavior (Mortensen et al., 2015). The investigation also extended the work of Beiers et al. (2016) by demonstrating that interventions that include reinforcement contingencies can be taught to individuals with limited hockey experience.

Several limitations of the study bear mention. First, the facility was an open-air arena with poor acoustics, and thus did not provide for an optimal environment for data collection. In addition, given exposure to open air, the weather was an uncontrollable variable. Thus, some sessions took place in snowy weather with very low temperatures, making the conditions uncomfortable for coaches and athletes; other sessions, at the beginning and end of the study, took place in warmer weather, which resulted in melted ice, which made for treacherous conditions.

At a practical level, both students and coaches benefited from their participation in the study. The athletes greatly improved their hockey skills, and the coaches increased their use of appropriate prompts and reinforcement delivery. The procedures are easily replicated, lending themselves to contributing to the literature on an important aspect of supporting students with ASD in acquiring not only social skills but also other lifelong skills.

Overall, the use of a hockey practice as a context for teaching social skills to athletes with ASD needs to be further explored. This could include evaluating schedules of reinforcement, measuring generalized social behaviors toward peers, and measuring effects within a group rather than a one-to-one dyad. In sum, additional work within settings that result in the acquisition of age-appropriate leisure and social skills by individuals with ASD in the community environment is warranted.

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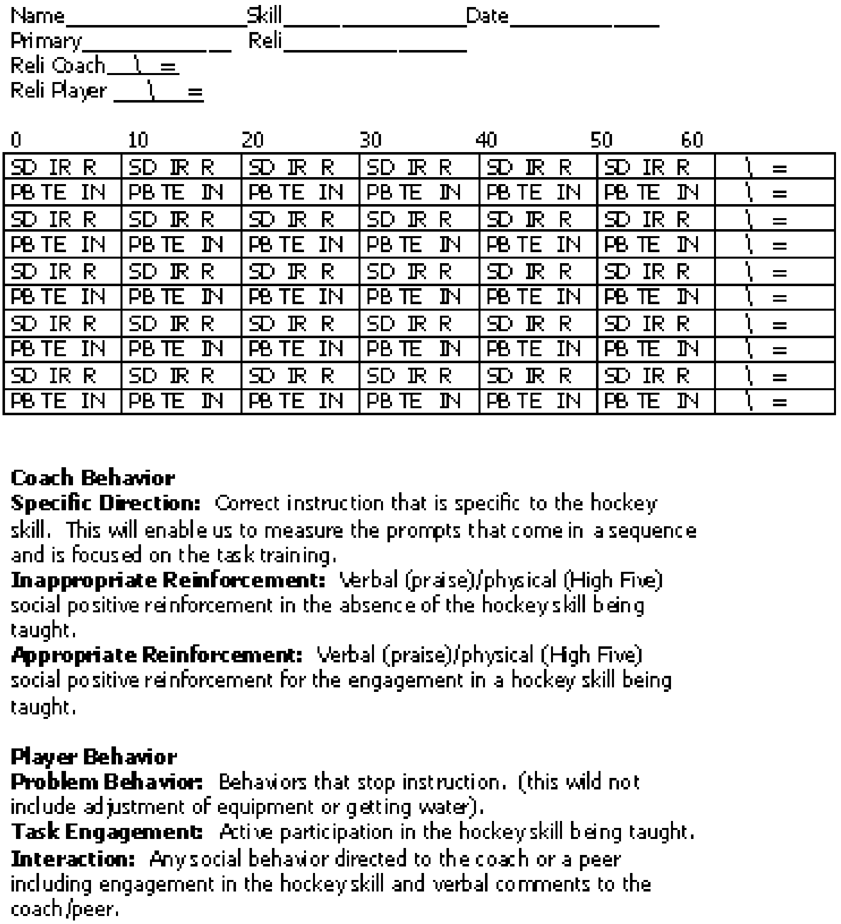
Appendix A



Name________________Skill________________Date______________
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Coach Behavior
Specific Direction: Correct instruction that is specific to the hockey skill. This will enable us to measure the prompts that come in a sequence and is focused on the task training.
Inappropriate Reinforcement: Verbal (praise)/physical (High Five) social positive reinforcement in the absence of the hockey skill being taught.
Appropriate Reinforcement: Verbal (praise)/physical (High Five) social positive reinforcement for the engagement in a hockey skill being taught.

Player Behavior
Problem Behavior: Behaviors that stop instruction. (this wild not include adjustment of equipment or getting water).
Task Engagement: Active participation in the hockey skill being taught.
Interaction: Any social behavior directed to the coach or a peer including engagement in the hockey skill and verbal comments to the coach/peer.