UNTANGLING THE EFFECTS OF SCHEDULED EXERCISE ON CHILD ENGAGEMENT, STEREOTYPY, AND CHALLENGING BEHAVIOR

Thomas D. R. Currier, B.A.

Thesis Prepared for the Degree of

MASTER OF SCIENCE

UNIVERSITY OF NORTH TEXAS

August 2012

APPROVED:

Shahla Ala'i-Rosales, Major Professor
Jesús Rosales-Ruiz, Committee Member
Einar Ingvarsson, Committee Member
Richard Smith, Chair of the Department of Behavior Analysis
Thomas Evenson, Dean of the College of Public Affairs and Community Service
Mark Wardell, Acting Dean of the Toulouse Graduate School

Currier, Thomas D. R., Untangling the Effects of Scheduled Exercise on Child Engagement, Stereotypy, and Challenging Behavior. Master of Science (Behavior Analysis), August 2012, 59 pp., 8 figures, 2 tables, references, 31 titles.

There is limited research pertaining to the effects of exercise on the behavior of children with autism. Previous researchers focused on exploring the dimensions of the exercise itself, leaving a functional account of the effects of exercise undetermined. There is recent evidence that exercise suppresses responses maintained by automatic reinforcement. The purpose of the present study was to better identify the relevant independent variable in such research and to assess if there were differential effects of exercise across functional response classes. The experimenter conducted a trial-based functional analysis and then implemented a sedentary or vigorous activity on alternating days to determine the impact of exercise on engagement, stereotypy, and challenging behavior. Results across functional response classes were variable as were data across individual sessions. There was a mean suppression of behavior maintained by non-social reinforcement during post-sedentary (4.3%) and post-exercise sessions (2.3%). A discussion of the role of matched stimulation and heart rate as a pertinent variable follows.

ACKNOWLEDGEMENTS

I would like to thank Dr. Shahla Ala'i Rosales for her role in making this research a reality; I hope that her support and invaluable feedback are evident in this manuscript. Montrose Wolf wrote about behavior analysis finding its heart, thank you Shahla for helping me find mine. Thank you to the other members of my committee, Dr. Jesús Rosales-Ruiz, and Dr. Einar Ingvarsson for your insight and for allocating valuable time toward the improvement of the manuscript. The long hours that Wes Lowery, Brittany Vaughn, and Donna Townley-Cochran spent collecting agreement data are certainly appreciated. Thank you Amy Yauger and Elissa Hamilton for feedback on earlier drafts of the manuscript. To my friends in the Department of Behavior Analysis, I will always appreciate the thoughtful discussion, and when necessary, the critical feedback that reflects the scientific culture here at UNT. Last, thank you Kelly. It has been said before, but none of this would have been possible without you. Thank you for your unconditional support and encouragement.

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

INTRODUCTION

Restricted, repetitive patterns of behavior are a characteristic of individuals diagnosed with autism spectrum disorder (ASD; American Psychological Association, 2000). In many cases, these patterns of behavior interfere with engagement in the immediate environment and with learning opportunities throughout the day (Morrissey, Franzini, & Karen, 1992). The marked restriction of activities and interests can also pose unique problems for parents, teachers, and other caregivers. The elimination or control of these behaviors is an important part of participation in a productive learning environment (Powell, Dunlap, & Fox, 2006).

An emerging area of research concerns the effects of physical exertion on the rates of stereotypic and other challenging behaviors (National Autism Center, 2009; Petrus et al., 2008). Allison, Faith, and Franklin (1995) defined antecedent, or noncontingent exercise, as some level of exertion beyond simple participation that is implemented with the intent to prevent future behavior. For example, Watters and Watters (1980) required participants to run for 8 to 10 min and then compared pre-run rates of stereotypy to post-run rates to determine if exercise resulted in decreased stereotypy. Although jogging is the predominant form of exercise used in antecedent exercise studies (e.g., Celiberti, Bobo, Kelly, Harris, & Handleman, 1997; Gabler-Halle, Halle, & Chung, 1993; Kern, Koegel, Dyer, Blew, & Fenton, 1982; Watters & Watters, 1980; Yell, 1988), exertion has been embedded into other activities such as roller-skating (Powers, Thibadeau, & Rose, 1992), aerobic dancing (Bachman & Sluyter, 1988), and unstructured exercise (McGimsey & Favell, 1988).

Antecedent exercise has yielded positive results with mildly disruptive behavior (Celiberti et al., 1997), severe problem behavior (Elliott, Dobbin, Rose, & Soper, 1994), motor stereotypy (Levinson & Reid, 1993), vocal stereotypy (Kern, Koegel, & Dunlap, 1984) and visual stereotypy (Levinson & Reid, 1993), although to a lesser degree in the latter two cases. The initial findings regarding the intensity of the exercise and behavioral processes are incomplete and more research is needed to establish the conditions under which antecedent exercise is effective.

Watters and Watters (1980) demonstrated a reduction in self-stimulatory behavior using an alternating treatments design involving jogging, academic work, and watching television. The authors reported suppression only after the exercise condition. In their discussion however, the authors pointed out that there was no difference in the participants' performance on language tasks following any of the conditions. Kern et al. (1982) reported similar results; increased rates of desirable behaviors such as ball-rolling and imitative responses paired with decreased rates of self-stimulatory behavior (e.g., rocking, babbling, flapping, and staring) following jogging sessions.

Elliott et al. (1994) found that response suppression was ephemeral. In their study, rates of stereotypic behavior increased over a 30 min post-exercise interval. Similarly, Larson and Miltenberger (1992) concluded that they failed to replicate previous findings when stereotypic behavior remained near baseline levels 1 hr after exercise. Although Larson and Miltenberger failed to demonstrate response suppression, their results are consistent with more recent research regarding the lasting duration of the suppression. Celiberti et al. (1997) found that the mean percentage of intervals including motor and visual stereotypy and out-of-seat behaviors decreased

sharply immediately following the exercise. Those rates began to increase toward baseline 10 min after jogging and stabilized between 30 and 40 min following the exercise. Interestingly, the mean percentage of all three behaviors remained below baseline levels at the end of the daily observation.

The level of exertion may be an important dimension of the intervention. In a study comparing general motor training and vigorous exercise, Elliott and colleagues (1994) manipulated heart rate in topographically similar exercises. The authors reported little response suppression following lower heart rates (i.e., general motor training), but a significant decrease following the vigorous exercise. Levinson and Reid (1993) compared the effects of mild versus vigorous exercise on the rates of vocal, motor, and visual stereotypy. In this study, repetitive behaviors decreased following strenuous exercise, whereas mild activity had no effect on stereotypy.

Morrissey et al. (1992) provided data that conflicted with other studies after showing that levels of self-stimulation decreased following both light calisthenics (e.g., stretching, jogging in-place) and relaxation training involving deep breathing and contract-relax exercises. In response to conflicting results regarding the effective dimensions of the intervention, Petrus et al. (2008) recommended further research.

Antecedent exercise studies have traditionally included measures of response topographies without a functional assessment. Previous authors posited several explanations including fatigue, endorphin satiation, negative practice, and sensory satiation (Allison et al., 1995), but until recently no research addressed the behavioral process involved in the suppression of stereotypy following exercise.

In light of this gap in the antecedent exercise literature, Morrison, Roscoe, and Atwell (2011) conducted functional analyses prior to their exercise intervention and identified topographies maintained by non-social reinforcement. Morrison and colleagues then exposed participants to a series of conditions including exercise, a leisure activity, and a social activity. The authors reported response suppression with 3 of 4 participants following the exercise condition. Consistent with other studies (e.g., Levinson & Reid, 1993; Morrissey et al., 1992), Morrison et al. (2011) suggested an abolishing operation of automatic reinforcers. This conclusion is tantamount to the satiation of perceptual reinforcement (Lovaas, Newsom, & Hickman, 1987). Lovaas et al. (1987) stated that stereotypic topographies maintain because they operate to produce either interoceptive or exteroceptive stimulation. In the case of Morrison et al. (2011), the authors concluded that the exercise produced similar perceptual reinforcement as the stereotypy and altered the value of the perceptual reinforcers as a result. These conclusions with regard to antecedent exercise should be considered tentative at this point.

Morrison et al. (2011) attempted to identify variables pertaining to the efficacy of antecedent exercise, but the study was not without limitations. For one, the experimenters assessed target behaviors during both the functional analysis and the pre- and post-intervention components in a barren room. One may need to assess the function and observe the rates of target behaviors in the context in which behavior change would be meaningful, rather than an austere room. Additionally, Morrison and colleagues (2011) failed to gather precise measurements of the independent variable, but instead chose to provide qualitative descriptions of the exercise and control

conditions. As shown previously, exertion may or may not play an important role in the efficacy of exercise as a behavioral intervention; better control of exertion may provide insight into how large a role it may play. The current study included electronic heart rate monitoring to facilitate control of the independent variable.

The purpose of the present study was to examine the functional relation between physical activity and the subsequent suppression of stereotypic and other challenging behaviors. Specifically, does scheduled exercise yield differential suppression of responses based on the function of the behavior?

EXPERIMENT I

Method

Participant

A 4.5-year-old boy diagnosed with pervasive developmental disorder not otherwise specified (PDD-NOS) served as the participant for this study. The participant was chosen due to parent concerns regarding the frequency and intensity of stereotypy. The participant demonstrated high rates of vocal and motor stereotypy and engaged in frequent bouts of crying, whining, and/or flopping to the ground. These behaviors negatively impacted the frequency of learning opportunities and restricted the family's social opportunities. The participant showed delays in communicative behavior; he achieved a score of 27-40 months in the language domain of the Hawaii Early Learning Profile (HELP; Parks, 1988). The participant showed delays, although less severe, in gross motor functioning (30-36 months). The boy attended 1 hr of speech therapy and 1 hr of physical therapy per week in addition to attending a 25 hr/week comprehensive clinic-based autism treatment program.

Settings and Materials

I conducted a trial-based functional analysis (TBFA) in three locations at an autism treatment clinic in Carrollton, TX. The general classroom had dimensions of 12 x 10 m and contained a small library, a play area, a circle time area, lockers, two art tables, a reading sofa, and a variety of toys and play materials. The alone with toys condition was conducted in a treatment room with dimensions of 4.5 x 3 m. This room contained a table and chairs, an observation window, blinds, and a bin containing preferred toys. Finally, I exposed the participant to conditions in a physical therapy gym

with dimensions of 20 x 10 m. The gym contained an anti-burst gym ball (diameter = 76.2 cm), a Skillbuilders™ barrel (dimensions 96 cm x 81 cm), a 1.8 m balance beam elevated 10 cm from the floor, a Pacific Play Tents™ tunnel, and a variety of hoops, rings, and other obstacles. Trainers used stopwatches, paper, and pencils to monitor the duration of activities and record data.

Therapists and Observers

Four graduate-level trainers conducted the TBFA sessions. Each trainer had at least one year of experience in applied behavior analysis (ABA)-based treatment of children with autism. I observed and scored TBFA sessions; two additional observers collected reliability data during direct observations.

Response Definitions and Measurement

During the TBFA sessions, observers scored the occurrence of four behaviors using a partial interval 2 min recording method. The first target behavior, vocal stereotypy, was defined as when the child emitted one or more vocalizations pertaining to stimuli not present or not being discussed. Vocal stereotypy included sustained vowel sounds and repetitive statements. Observers noted the onset of vocal stereotypy and scored an occurrence of vocal stereotypy once the child discontinued the stereotypy for 1 s, or began to scream, protest, or emit a vocalization. Screaming was defined as any vocalization that exceeded the speaking volume of other persons within 5 ft of the child; the definition excluded laughter and screams with the phonetic sound “EEEE.” Protesting was defined as when the child emitted a repetitive vocalization (phonetically characterized as “uh-huh-huh-huh-huh-huh” or an elongated “uh” sound) paired with downturned lips, creased eyebrows, and/or tears. Protest vocalizations could, but were

not required to be paired with flopping to the ground. Observers scored an occurrence of protesting when the child discontinued the protest vocalizations for at least 3 s. Last, motor stereotypy was defined as the up-down or side-to-side movement of both hands simultaneously at least twice in 2 s; motor stereotypy could occur with or without objects grasped in his hands.

Interobserver Agreement

Scorers participated in a training sequence that included a review of response definitions, viewing example video clips, scoring practice videos, feedback, and a final performance. Interobserver agreement (IOA) was calculated for 35% of TBFA sequences. IOA was calculated by dividing the frequency of identically scored trials by the total number of simultaneously-scored trials in each condition and multiplying by 100. The percentages for a given target behavior across conditions were added and then divided by the number of conditions included. Final agreement for vocal stereotypy was 98% (range, 93% to 100%), for screaming 98% (range, 93% to 100%), 100% for protesting, and 92% (range, 75% to 100%) for motor stereotypy.

Procedures

Preference assessment

Prior to conducting an experimental manipulation, the participant took part in a free-choice preference assessment. First, information regarding suspected preferences was obtained from direct therapists familiar with the child. These items were placed in the individual room and schoolroom and a direct therapist delivered an instruction to the child to “go play.” The direct therapist remained in the room and allowed the child to access any item, including activities with the instructor. Interaction was defined as the

child's manipulation of the item for at least 10 s. The observer allowed the child to interact with the item for up to 2 min or until the child discontinued interacting with the item for 10 s. Once the child discontinued interaction with the item or when 2 min elapsed, the observer removed the item from the room. The observer assigned a rank to the items based on the order of choice. For example, the observer marked the first item as 5, the second item as 4 and so on until the child chose 5 items. The assessment was repeated on subsequent days until at least 3 items accumulated a score of 15.

Trial-based functional analysis

In an extension of a new functional analysis methodology, Bloom, Iwata, Fritz, Roscoe, and Carreau (2011) exposed participants to four conditions (i.e., tangible, demand, attention, and play) in discrete three-trial sequences. Each sequence consisted of a 2 min control trial, a 2 min test trial, and another 2 min control trial. The purpose of the control trials were to create comparison conditions for the particular consequences being tested. Motivating operations were absent during control trials and present during test trials; the researchers provided no consequence for target behaviors during control trials and reinforced target behavior during test trials based on the current condition. The procedures for the TBFA in the present study resembled the Bloom et al. (2011) procedures with the following variations: (1) trial sequences consisted of only two segments, a control trial (i.e., motivating operation [MO] absent) and a test trial (i.e., MO present). The control trial lasted 2 min in all sequences across all conditions, the following test trial lasted 2 min or until the occurrence of the target behavior; (2) the instructor signaled the beginning of each two-trial sequence by escorting the child from the current area or activity and then re-entering the area/activity within 15 s; and (3) the

participant was exposed to an adapted alone condition in an empty room save for a variety of preferred items. This condition was adapted based on direct and indirect observations that indicated screaming and/or motor stereotypy occurred when the participant had access to toys and no adults supervised the play.

The assessment consisted of 10 sequences in each of the attention (control/test), tangible (control/test), demand (control/test), and alone with toys (control/control) conditions.

The control trial of the attention condition required the direct therapist to remain within 1 m of the child and to provide continuous attention in the form of labeling the child's actions. The direct therapist ignored target behaviors for the entire 2 min trial and delayed providing attention for 5 s following the target behavior to avoid adventitious reinforcement. At the beginning of the test trial the direct therapist provided the instruction "I have some things to do" and retreated to an area at least 10 ft from the child. The direct therapist acted as though he/she was examining paperwork and ignored all but the target behavior. The test trial lasted 2 min unless the child demonstrated the target behavior. Upon the occurrence of the target behavior, the direct therapist approached the child and issued a statement such as "stop that" or "shhh", consequences that mapped onto reactions present in his home environment.

The control trial of each sequence in the tangible condition required the trainer to remain within 3 ft of the child and to avoid placing demands. Direct therapists provided attention throughout the control trial by describing and complimenting the child's actions. Therapists ignored target behaviors and again observed the 5 s delay for attention following target behaviors. Instructors terminated the control trial by beginning

to restrict the child's access to any items or activities; this restriction continued with all items and activities during the remainder of the test trial. The participant's attempts to acquire items resulted in the instructor's statement "I want to see this right now." Again, the test trial lasted 2 min unless the child demonstrated the target behavior. Upon the occurrence of the target behavior, the direct therapist issued the statement "okay, you can have it" paired with the delivery of the item.

During control trials of the demand condition, direct therapists remained within 3 ft of the participant and refrained from placing any demands on him. Direct therapists delivered attention in the form of descriptions and compliments of the child's actions. Therapists ignored target behaviors and observed the 5 s delay for attention during the entire 2 min trial. After 2 min elapsed the therapist began to deliver instructions, which signaled the beginning of the test trial. Therapists delivered demands similar to those present in a typical teaching interaction (e.g., tact training, functional communication training [Carr & Durand, 1985], and one-step receptive instructions) at a pace similar to a therapy session, approximately one demand every 10 s. The test trial lasted 2 min unless the child demonstrated the target behavior. Upon an occurrence of the target behavior, the instructor issued the statement "you don't have to do that" and terminated the delivery of instructions.

For the alone with toys condition, the direct therapist escorted the child to the barren treatment room that contained a bin of the child's preferred items. Direct therapists issued the statement "you are going to be in here for a little while" and allowed the child to enter the room and access the toys. The therapist closed the treatment room door and remained outside of the room for 2 min. Direct therapists

ignored all instances of the target behavior while observers scored target behaviors from behind an observation window. Following the initial 2 min trial, the child participated in an additional 2 min trial of the exact same nature, omitting the initial entrance to the room. The child opened the door to look into the hallway on three occasions. Direct therapists ignored this behavior and the child eventually returned to the treatment room.

The participant did not encounter all conditions for each target behavior. Due to the consistent rate of vocal stereotypy in the first three conditions (i.e., attention, tangible, and alone with toys), I opted not to expose the child to the demand condition. Similar rationale was used in deciding to omit the demand conditions for motor stereotypy and screaming as well. Protesting was assessed in the demand and tangible conditions based on preliminary data that the behavior occurred almost exclusively after a teacher directed the child to put his toys away or to start a new activity.

Results

Figure 1 depicts the results of the trial-based functional analyses summarized across sessions. Vocal stereotypy occurred in all of the test trials and all but one control trial of the observed conditions. Motor stereotypy occurred more frequently in the test trials of the attention and tangible conditions as compared to the control trials of those conditions. Motor stereotypy occurred in 90% and 100% of trials in the alone with toys condition. Screaming occurred in 50% of test trials in the attention condition as compared to 30% of control trials. The frequency of screaming was distributed equally in control and test trials of the tangible condition. Screaming occurred in 50% and 40% of trials in the alone with toys condition. Protesting occurred in 80% of test trials in the

demand condition and 0% of control trials. Similarly, protesting occurred in 90% of test trials in the tangible condition and 10% of control trials.

Discussion

The results of the functional analyses for three response topographies were clear; the results for the other topography were less so. One can suggest from the data that the participant's vocal stereotypy was maintained by non-social reinforcement. In the case of protesting vocalizations, the rate of occurrence in the test trials of both the demand and the access to tangible conditions lead one to conclude that the behavior was maintained by multiple sources of reinforcement (i.e., access to tangibles and escape from demands). Motor stereotypy also appeared to be maintained by multiple sources of reinforcement (i.e., non-social reinforcement and access to attention). Data for screaming make the determination of reinforcing consequences more difficult.

Consistent with Morrison et al. (2011), the functional analyses in this study were not intended to inform treatment. The functional analyses conducted here provided initial evidence of the maintaining variables of various response topographies. The second experiment focused on assessing the differential effects of mild and vigorous aerobic exercise on the participant's engagement, stereotypy, and challenging behavior.

EXPERIMENT II

Method

Participant, Settings, and Materials

The participant from Experiment I served as the participant in Experiment II. Pre- and post-intervention sessions, baseline, toy (sedentary), and chase (vigorous) activities were conducted in the schoolroom and physical therapy gym. Direct therapists equipped the gym with the necessary materials for each of the activities. For the toy condition, therapists included the same bin of preferred items as described in Experiment I. Direct therapists monitored the participant's heart rate with a Polar™ Vantage XL heart rate monitor with T31 transmitter during both the toy and chase activities. Assistants recorded all sessions with a Sony Handycam® HDR-XR160 camcorder. Therapists used stopwatches, paper, and pencils to monitor the duration of activities and record data.

Therapists and Observers

The same four graduate-level therapists conducted baseline and intervention sessions during Experiment II.

Response Definitions and Measurement

Observers recorded the occurrence of vocal stereotypy, screaming, protesting, and motor stereotypy during each component of the baseline and intervention sessions using a partial interval 15 s recording method. The observers recorded the occurrence of two additional behaviors during these sessions. One additional behavior was vocalizations, defined as when the child emitted a contextual and audible vocal response including full-word responses, approximations, and contextual sounds.

Observers noted the onset of a vocalization and scored an occurrence of a vocalization when the child discontinued emitting a vocalization for 1 s, or upon the occurrence of vocal stereotypy, protesting, or screaming. Last, observers scored the occurrence of engagement with teacher*,* defined as vocalizations directed toward the instructor, eye contact with the instructor, orientation of the child's face toward the instructor, manipulating the same item as the instructor, and/or completing an instructed task. Engagement with teacher did not include instances when engagement occurred simultaneously with screaming and/or protesting.

Direct therapists recorded the child's heart rate in beats per minute (BPM) during the first and last 30 s of playing in the classroom, toy, and chase activities. The participant's target heart rate range matched pediatrician recommendations of 140 to 175 BPM during exercise sessions; instructors monitored qualitative measures of exertion such as a flushed face, heavy breathing, and sweating as well. The target heart rate for toy activities was between 90 and 135 BPM.

Interobserver Agreement

Four observers scored the occurrence of target behaviors from filmed sessions following the completion of the training sequence outlined in Experiment I. Scorers collected IOA data during 32% of pre- and post-activity sessions. IOA was calculated using a block-by-block method. The lower frequency of each 5 min interval was divided by the higher frequency of that same interval and multiplied by 100; this produced a percent agreement for each 5 min interval. This figure was then added to figures from the remaining 5 min intervals of the same session and divided by the total number of intervals included. Final agreement for vocal stereotypy was 88% (range, 83% to 95%),

93% (range, 85% to 100%) for screaming, 85% (range, 72% to 94%) for protesting, 89% (range, 79% to 100%) for motor stereotypy, and 89% (range, 83% to 94%) and 90% (range, 84% to 96%) for vocalizations and engagement with teacher, respectively.

Procedures

Session outline

Instructors implemented sessions in the following three-component sequence: (1) a 20 min pre-activity session; (2) a 10 min activity; and (3) a 20 min post-activity session. Direct therapists provided no eye contact or physical contact for vocal stereotypy, motor stereotypy, and screaming during all three components of baseline and intervention sessions. If the behavior interrupted an instruction, the direct therapist would repeat the instruction. The consequence for protesting during these sessions was for the direct therapist to point to a location or item and wait for the participant to comply with the stated instruction. If the child protested when leaving an item, the direct therapist would prompt a more desirable vocal response and then deliver the item to the participant.

Baseline

Pre- and post-activity sessions. Therapists conducted pre- and post-activity sessions in the schoolroom for 20 min. During pre-activity sessions the instructors implemented functional communication training (Carr & Durand, 1985), tact training (e.g., common items, animals, foods, etc.) and imitation programming (e.g., gross motor imitation, oral motor imitation, vocal imitation, and imitation with objects). Immediately following the conclusion of the pre-activity component, the instructor either remained in the schoolroom (for playing in the classroom) or escorted the participant to the gym for

either the toy or chase activity. Following the second component the therapist escorted the child back to the schoolroom and conducted the third component, which consisted of the same academic and communication programming from the pre-activity session.

Playing in the classroom. The participant played in the classroom during the second component of baseline sessions. Direct therapists refrained from placing demands on the participant and allowed him to access any item in the schoolroom (omitting dangerous items/activities). The participant played in the schoolroom for 10 min at which point the direct therapist informed him that it was time to return to his schoolwork.

Intervention

Pre- and post-activity sessions. The pre- and post-activity sessions in the intervention sessions were identical to those in the baseline sessions.

Toy (sedentary) activities. Therapists presented a board containing a 5 x 5 cm picture of the participant's preferred items and physically prompted the participant to remove the picture from the board while providing the vocal model "play with toys." Following this forced choice, the instructor measured the child's heart rate and then directed him to access the toys in the room while the instructor remained in close proximity to the participant for the entire 10 min session. During this time the adult provided physical feedback (e.g., back rubs, pats, tickles, and arm squeezes), social praise, and labeled toys or the child's actions. The instructor refrained from placing any direct demands (e.g., "put the marker over here") on the participant during the activity. At the end of the 10 min toy activity, the instructor measured the participant's heart rate

again and then escorted him back to the schoolroom to conduct the post-activity session.

Chase (vigorous) activities. Therapists presented a 5 x 5 cm picture of the gym ball, barrel, and other exercise equipment in the same manner as before the toy activity, only paired with the vocal model “play chase.” Once inside the room, the instructor conducted a heart rate check and began the chase activity. Again, the instructor refrained from placing direct demands on the participant. Chase activities included chase with a ball (imagine the beginning scene of Raiders of the Lost Ark), racing the gym ball, and/or instructor-participant chase. Following the chase activity, the instructor measured the participant’s heart rate, returned to the schoolroom, and began the post-activity session.

Experimental Design

The impact of toy and chase activities compared to playing in the classroom on child engagement, stereotypy, and challenging behavior was assessed using an alternating treatments design.

Results

The average percent change for each target behavior can be found in Figure 2. Data for percent change of vocal stereotypy were 3.5% (range, -4% to 32%) following playing in the classroom, -4.3% (range, -23% to 17%) following toy activities, and -2.3% (range, -12% to 17%) after chase activities. The mean percent change for motor stereotypy following playing in the classroom was -2.1% (range, -10% to 13%). There was a 4.5% decrease (range, -27% to 7%) in motor stereotypy after toy activities, and a 3.8% decrease (range, -20% to 8%) following chase activities. There were similar

results for screaming across conditions. There was a mean decrease of 5.75% (range, -17% to 1%) following playing in the classroom. There was a slight decrease of .7% (range, -8 %to 7%) after toy activities and motor stereotypy decreased 4.3% (range, -17% to 4%) in post-chase sessions. There was an average decrease of 1.3% (range, -19% to 3%) in protesting after playing in the classroom and increases of 13.2% (range, -16% to 46%) and 21.5% (range, -9% to 67%) following toy and chase activities, respectively. Average occurrence of vocalizations was 12.4% lower (range, -26% to 7%) after playing in the classroom, 14.2% lower (range, -31% to -2%) after toy activities, and 3.2% (range, -22% to 14%) lower after chase activities. Overall, engagement with the teacher fell 7.25% after playing in the classroom. Engagement decreased by 13.7% (range, -45% to 4%) following toy activities, and by 9.5% (range, -32% to 14%) following chase activities.

Figure 3 shows the percent change of vocal stereotypy across individual sessions. The occurrence of vocal stereotypy remained near the upper limits of baseline levels following both the toy and chase activities. In several sessions following both toy and chase activities the percent change was either 0% or within 2% of the pre-activity session (i.e., sessions 9, 13, and 21 following the toy activity and sessions 12, 18, and 22 following the chase activity).

Figure 4 depicts the individual session data for motor stereotypy. Although the initial values often fell below baseline levels in the toy and chase conditions, the percent change per day was modest in all but sessions 18 and 19 (percent decrease of 20% and 27%, respectively).

Figure 5 shows individual session data for the occurrence of screaming. This behavior seemed particularly resistant to change, with rates changing less than 1% in six separate sessions.

Data for protesting across individual sessions are shown in Figure 6. Notably, protesting increased more than 45% following the activity in sessions 14, 16, 18, and 19. During these sessions the participant began protesting almost immediately following the therapist's cue that the activity was over and it was time to return to the schoolroom. Protesting often continued through the subsequent post-activity session, although the experimenter failed to measure the intensity of the protesting across individual sessions.

The final two dependent variables, vocalizations and engagement with teacher, were measures for appropriate alternative behaviors. Figure 7 contains individual session data for vocalizations. Vocalizations typically decreased following the scheduled activity; neither the initial nor final percent occurrence of vocalizations in the toy and chase conditions ever exceeded the upper baseline limit (i.e., 75% of intervals). Following several intervention activities, the percent of intervals that included vocalizations fell below 25%.

There was a similar pattern for engagement with teacher. Figure 8 includes data for engagement across experimental sessions. The participant's engagement with the teacher was particularly low during sessions 18 and 19, occurring in only 34% and 28% of intervals.

Summaries and figures of the alternating treatments design do not include data from sessions 11 (toy condition) and 20 (chase condition) as the heart rate following those sessions did not meet the specified criteria. The participant began session 11 with

an elevated heart rate and therapists were unable to provide an activity to bring his heart rate into the acceptable range. The participant stopped participating in the chase activity during session 20 and thus the final heart rate was well below the target range for the vigorous condition.

Discussion

The inclusion of the functional analyses prior to baseline and intervention represents a step toward a better understanding of the variables involved in the suppression of stereotypic and challenging behavior following exercise. At least one target behavior (i.e., vocal stereotypy) showed clear results from a functional analysis as maintained by non-social reinforcement. However, scheduled exercise had little effect on this functional response class in this case.

Individual session data for stereotypy and challenging behavior were variable across sessions. Data for protesting, vocalizations, and engagement with the teacher were more stable. Protesting reliably increased following both toy and chase activities while more desirable behaviors such as vocalizations and engagement with the teacher regularly decreased.

Morrison et al. (2011) concluded that the exercise served as an abolishing operation for the value of the proprioceptive stimuli that maintained stereotypy for 3 of 4 participants. Contrary to Morrison et al. (2011), the current results demonstrate at least one instance in which scheduled exercise did not result in the suppression of presumably automatically-maintained behaviors.

Lovaas et al. (1987) proposed that perceptual reinforcers maintained stereotypy and served as response-produced reinforcers. However, in the current study, matching

topographies (and presumably perceptual reinforcers) did not have an impact. Laughing and running are quite similar in topography to screaming and hand flapping and thus one could assume that the proprioceptive stimuli are similar as well. However, neither screaming nor motor stereotypy decreased reliably following exercise.

More evidence that the role of matched topography is questionable can be found in Morrison et al. (2011). Two, possibly three subjects participated in exercise that would not appear to match the stimulation of the stereotypy. In one case, a boy with a history of biting his finger exercised on a stationary bike, an activity that was likely incompatible with the stereotypy rather than matched stimulation. Morrison et al. (2011) reported that finger biting decreased following all exercise sessions.

One avenue of future research should be an investigation of the importance of matching physical activity with the topography of the target challenging or stereotypic behavior. As discussed above, conducting such an analysis may provide information regarding the role of proprioceptive feedback in the suppression of stereotypy.

Heart rate, measured in beats per minute, has been the traditional independent variable in a selection of the published studies evaluating the efficacy of antecedent exercise. The current study attained a level of precision with the measurement of the independent variable that was absent in previous studies. When previous studies did contain a quantitative measure of heart rate, those measurements were often produced through a radial pulse check (e.g., Allison, Basile, & MacDonald, 1991; Levinson & Reid, 1993), which can be unreliable. Bachman and Fuqua (1983) improved on these measures by attaining reliability data for the radial pulse rate by conducting

simultaneous pulse rate observations by separate people on each of the participants' arms. The precision of the radial pulse rate is still unknown.

Given the data presented in this study it is possible that heart rate is not the independent variable responsible for observed changes in previous research. The exercise in this study was indeed vigorous, but there were similar frequencies of target behaviors during pre- and post-activity sessions in both the toy and chase conditions. This conclusion is supported by results from other studies. Morrissey et al. (1992) reported up to a 28% decrease in stereotypy following light calisthenics and slightly less of an effect following relaxation training. Also, because previous researchers often failed to measure heart rate precisely, it may be the case that even mild aerobic exercise falls within the effective range (Morrissey et al., 1992).

One limitation of the current study is that only one child participated. Matched stimulation and heart rate did not have an effect on the participant's engagement, challenging behavior, or stereotypy. While most instances of failure to replicate are likely unpublished, a further analysis of heart rate across multiple participants would be worthwhile.

A strength of the current study is the similarity between the functional analyses and experimental and clinical environments. The participant in this study engaged in the same activities in which he would have engaged in otherwise. Other than the trials of the alone with toys condition, the experimenter conducted all trials of this assessment in what would be the relevant context for the analysis of the subsequent intervention.

Experimental manipulations conducted in analog settings have been criticized for a lack of ecological validity (Hanley, Iwata, & McCord, 2003). Conversely, trial-based

procedures have been specifically designed to circumvent this criticism (Bloom et al., 2011; Sigafoos & Saggers, 1995). The nature of the discrete-trial approach to functional analysis requires experimenters to recruit and use information from indirect and direct assessments (e.g., parent interview or descriptive observations) to design the appropriate environments for each condition. The establishing operations in many standard conditions do not necessarily map onto the relevant antecedents in more natural contexts.

Another area of future research could focus on recording the frequency of consequences during the pre- and post-intervention observations to ensure that direct therapists are not inadvertently eliminating target behaviors. Morrison et al. (2011) were able to provide this level of control by conducting those sessions in an austere room, however this environment only seems appropriate for behaviors maintained by non-socially mediated consequences, if at all. In the case of escape-maintained behaviors, it would be necessary to detail the absence of extinction procedures.

Last, there was never a need to prompt the participant to continue to engage in the functional analyses or the experimental sessions. The participant was free to leave the experimental area at any time, but did not. Direct therapists observed the child for behaviors indicating the termination of the session (e.g., crying, leaving the area, etc.) and found none, thus the experimenter conducted all trials of the functional analysis and the exercise activities with total assent from the participant.

Participants' preference for exercise activities is an area with little empirical support, although it does appear that providing choices can influence participation (Bannerman, Sheldon, Sherman, & Harchik, 1990). Previous investigators promoted

exercise by using a range of tactics from differential reinforcement to forced guidance. Consequently, the impact of the qualitatively different exercises on participant affect and continued engagement in exercise is unknown. Hanley (2010) presented technology developed to include the client in determining programming techniques and treatment outcomes. The procedure consisted of presenting treatment options and allowing clients to choose among those options. A similar assessment embedded in an alternating treatments design may be valuable in identifying exercise preference and thus facilitating the maintenance of those activities outside of research conditions.

While exercise did not have an impact under the conditions of the current experiment, this does not mean that it will not under other conditions. An expansive literature that details modest to substantial effects is still relevant. However, the conditions under which exercise can produce behavioral benefits remain unclear.

On a final note, regardless of its effects on the behavioral health of an individual, exercise remains an important activity for children. Janssen and LeBlanc (2010) reported that school-aged children require at least 60 min of moderate-to-vigorous exercise per day in order to produce optimal gains in muscle strength, bone density, and cardiovascular health. The Physical Activity Guidelines Advisory Committee (PAGAC) included the same recommendation in its report to the United States Department of Human Services (PAGAC, 2008). In stark contrast, the PAGAC reported that people with developmental disabilities often participate in far less exercise, in many cases less than 60 min *per week.*

It is important to provide children with the opportunity to exercise several times throughout the week, but for the right reasons. In the case that exercise does not result

in desired behavior change, then it would be necessary to consider alternative treatments for stereotypic behaviors.

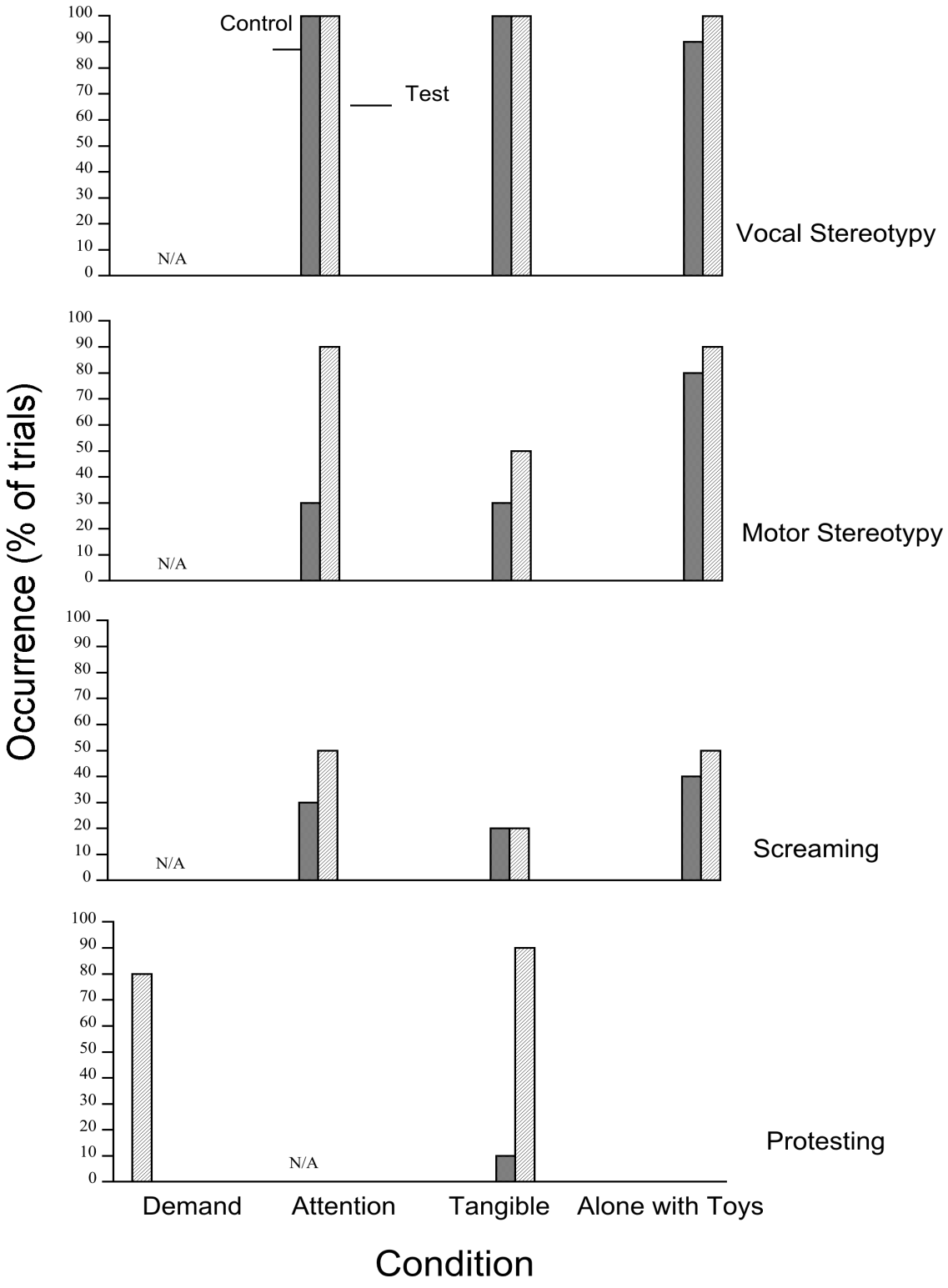

Figure 1. Results of the trial-based functional analysis summarized across sessions.

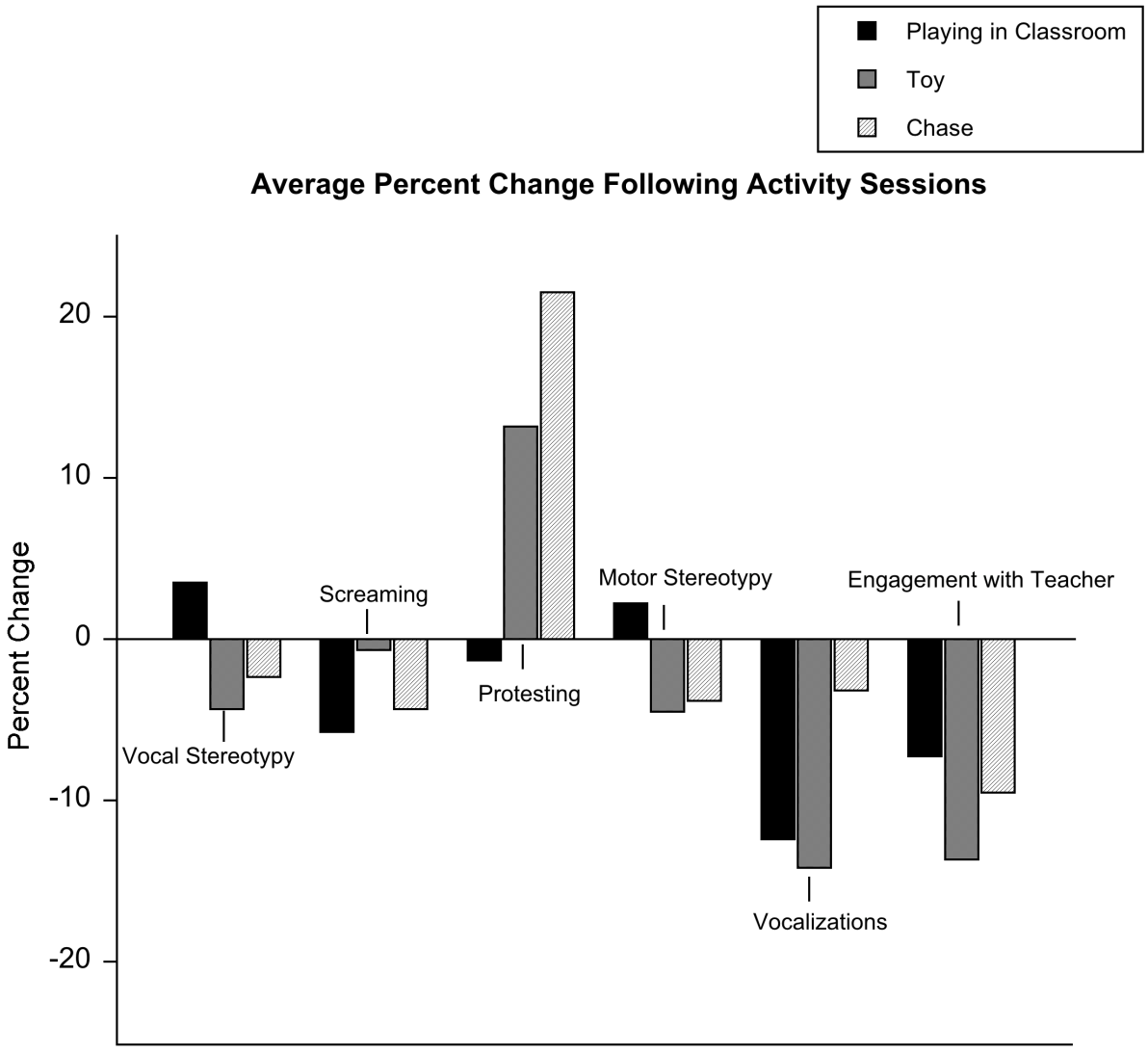

Figure 2. Summary of percent change between pre- and post-intervention sessions for 8 playing in classroom activities, 6 toy activities, and 6 chase activities.

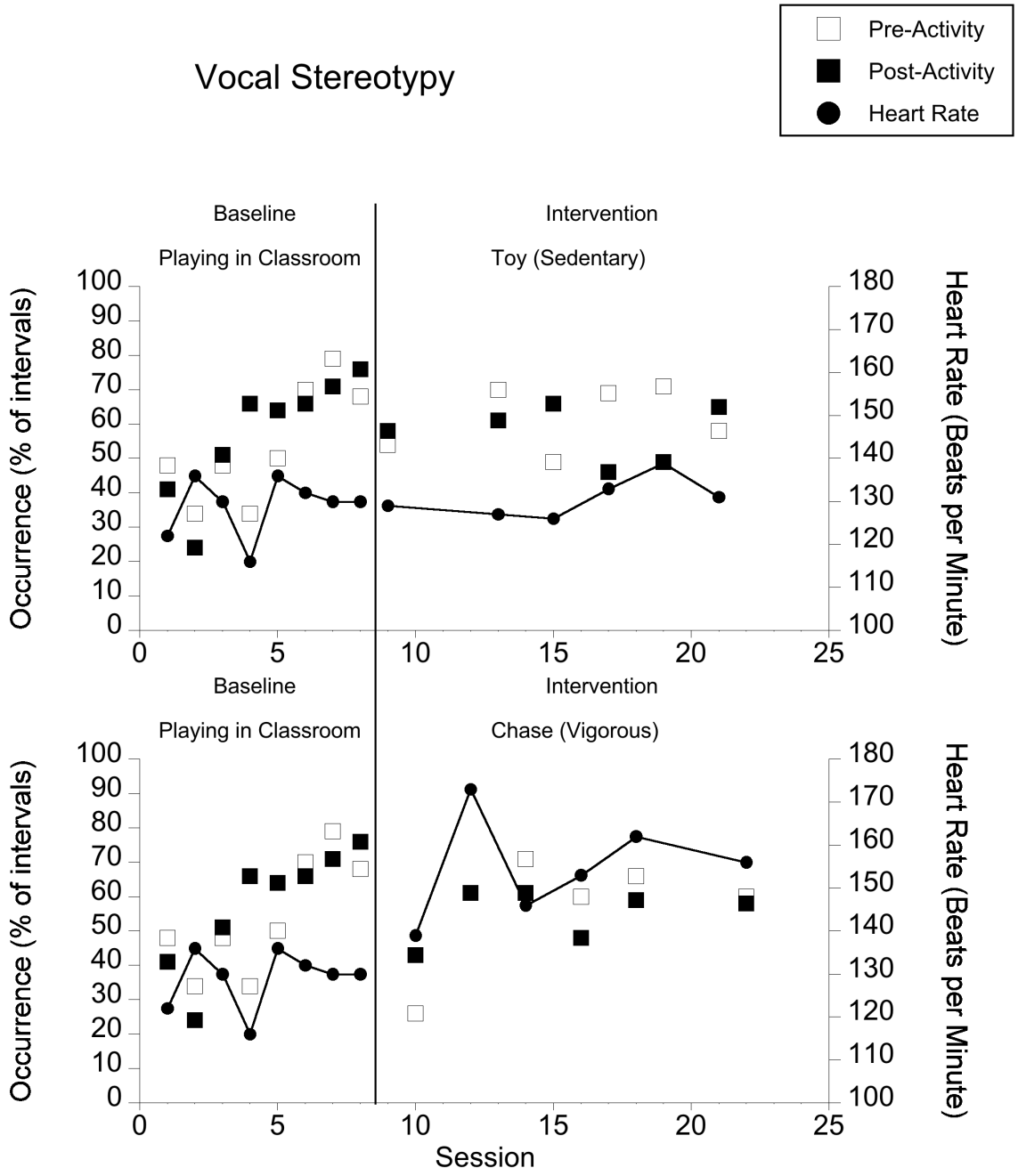

Figure 3. Heart rate (beats per minute) and percentage of intervals in which vocal stereotypy occurred during pre- and post-activity sessions.

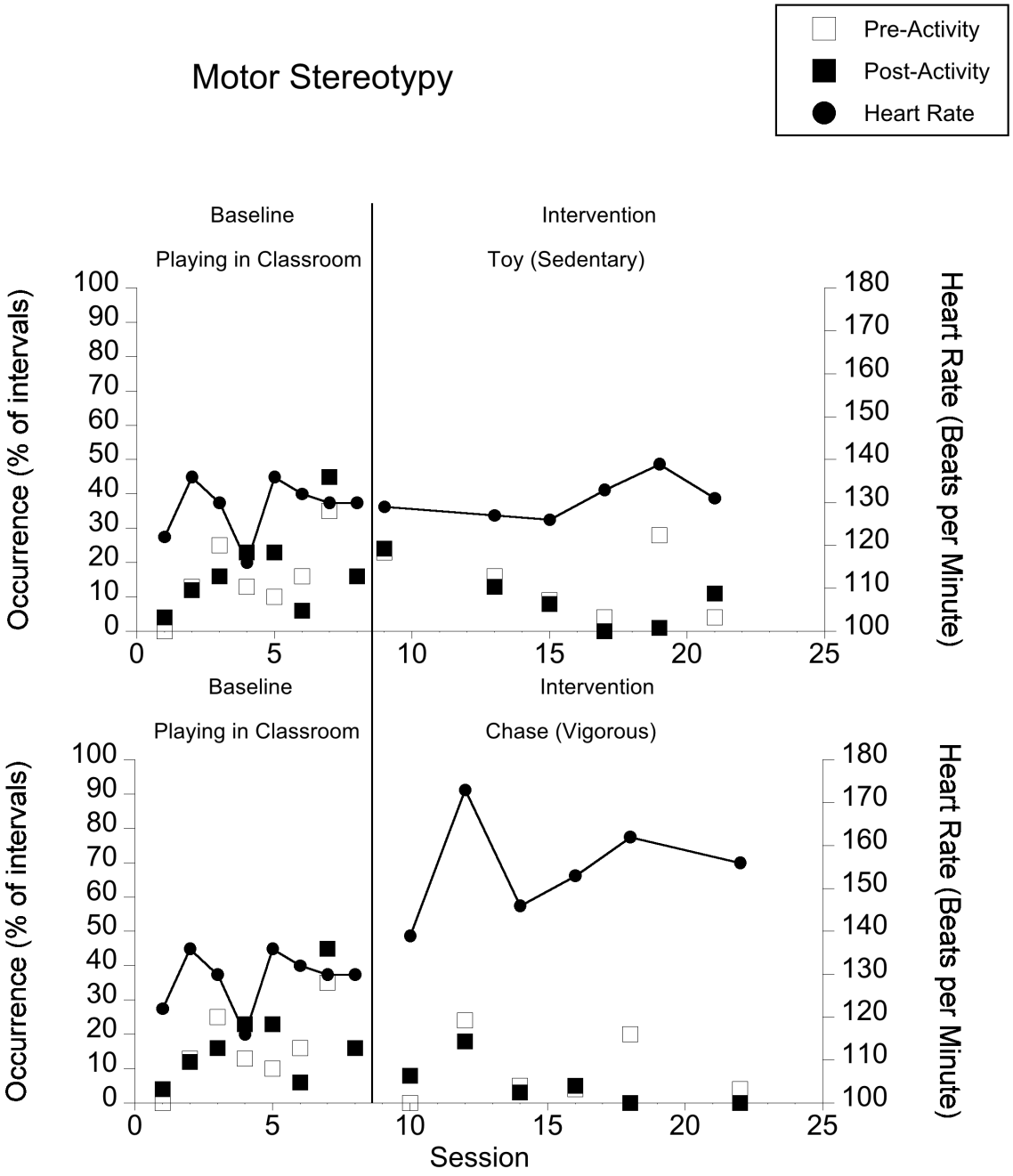

Figure 4. Heart rate (beats per minute) and percentage of intervals in which motor stereotypy occurred during pre- and post-activity sessions.

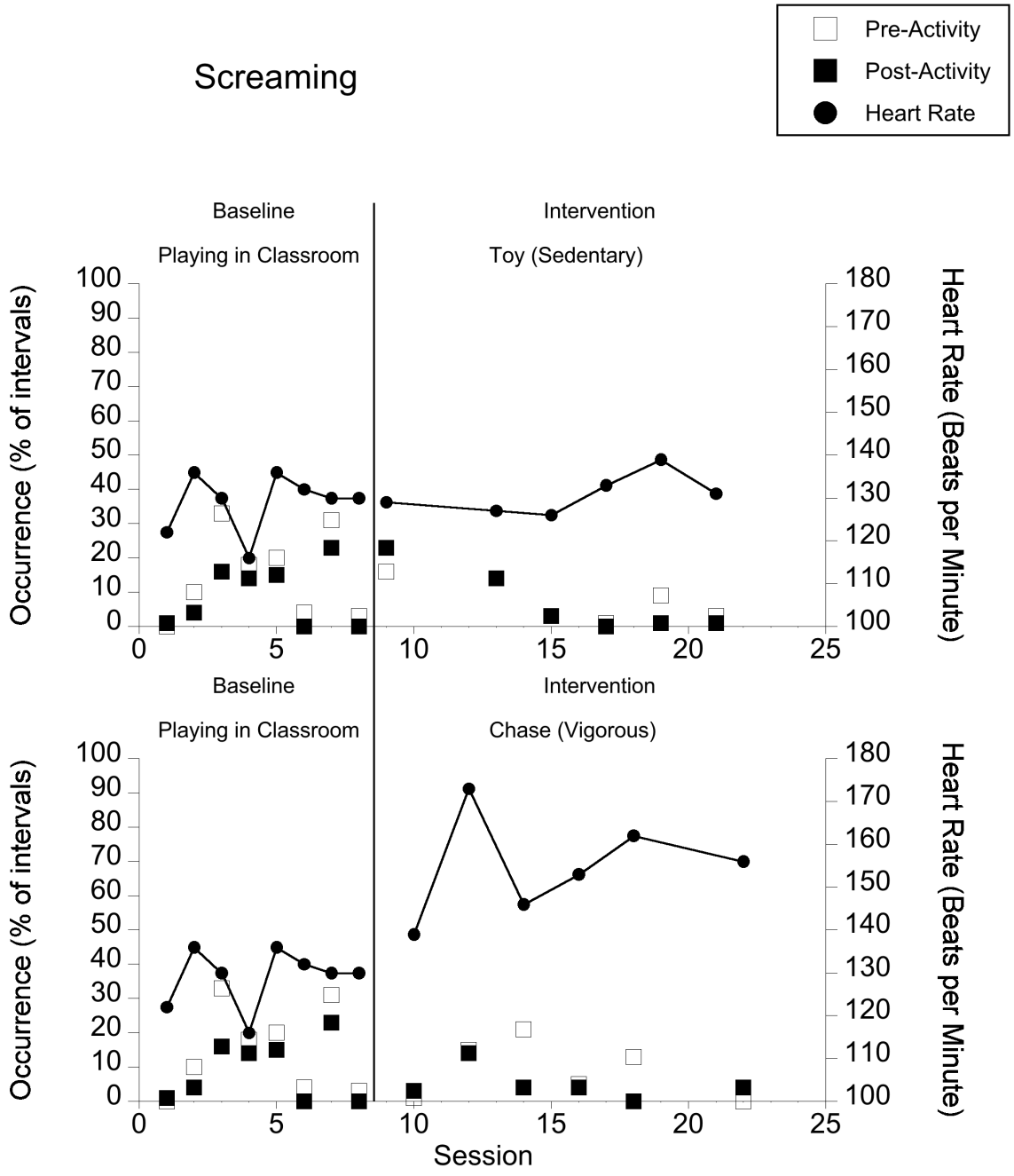

Figure 5. Heart rate (beats per minute) and percentage of intervals in which screaming occurred during pre- and post-activity sessions.

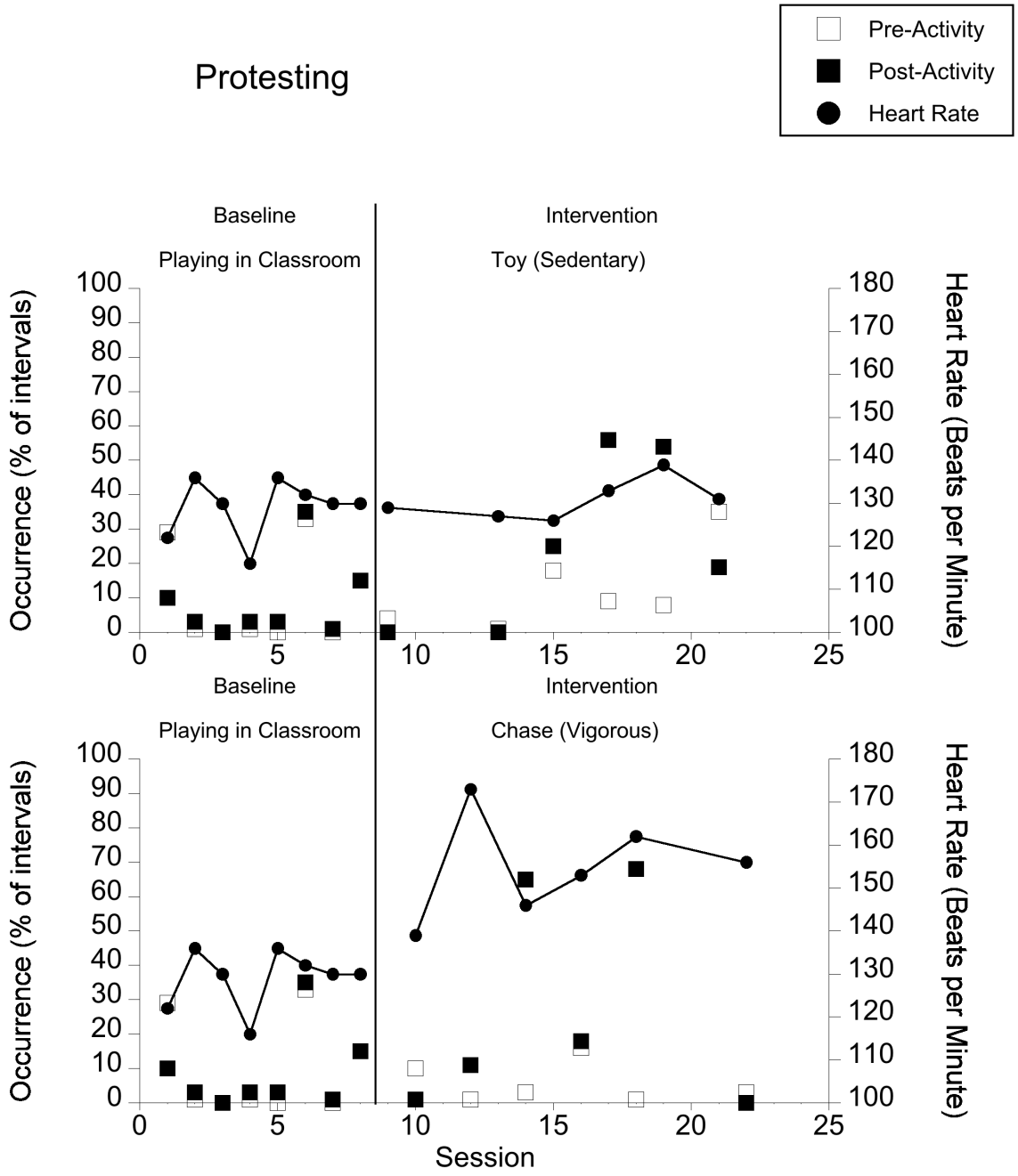

Figure 6. Heart rate (beats per minute) and percentage of intervals in which protesting occurred during pre- and post-activity sessions.

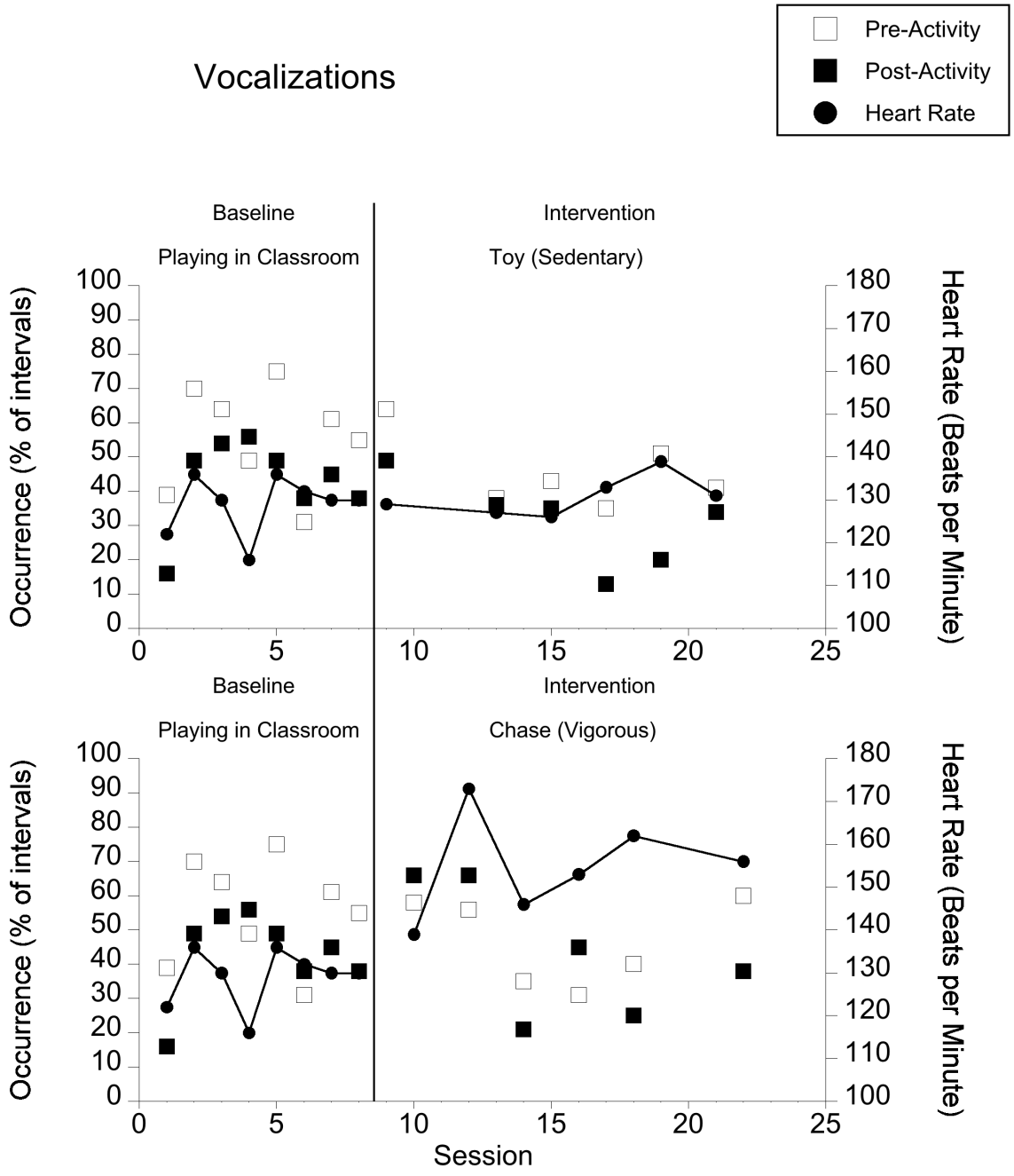

Figure 7. Heart rate (beats per minute) and percentage of intervals in which vocalizations occurred during pre- and post-activity sessions.

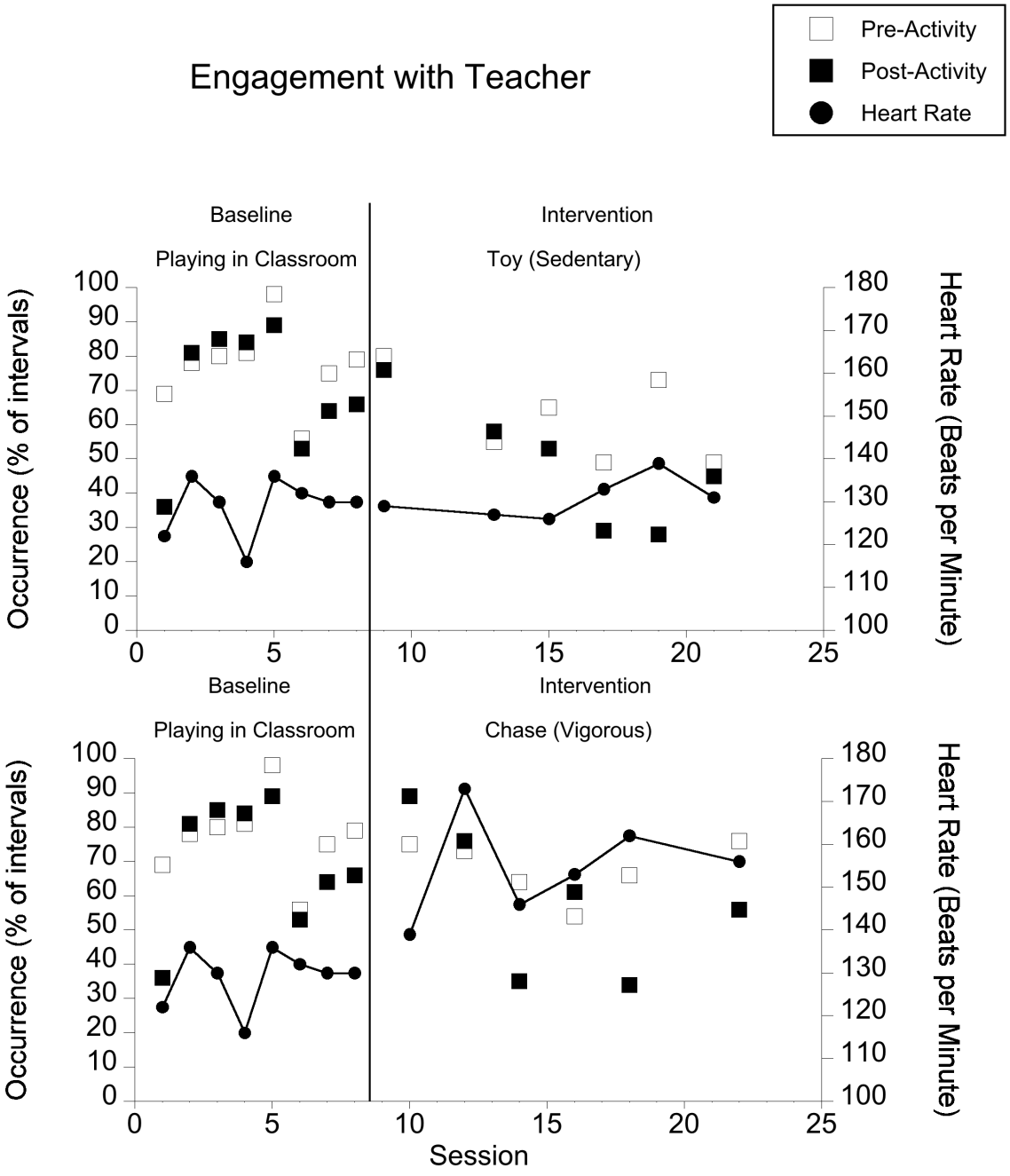

Figure 8. Heart rate (beats per minute) and percentage of intervals in which engagement with teacher occurred during pre- and post-activity sessions.

Table 1

Percent of Interobserver Agreement- Experiment I

Measure	*Demand*	*Attention*	*Tangible*	*Alone with Toys*
Vocal Stereotypy	n/a	100	100	93
Motor Stereotypy	n/a	100	75	100
Screaming	n/a	100	100	93
Protesting	100	n/a	100	n/a

Table 2

Percent of Interobserver Agreement- Experiment II

Measure	*Baseline*	*Intervention*
Vocal Stereotypy	83 88 87	88 90 86 95
Motor Stereotypy	95 95 84	82 79 100 88
Screaming	100 87 85	95 97 90 100
Protesting	90 88 78	72 75 88 94
Vocalizations	91 94 83	92 86 88 89
Engagement with Teacher	92 96 87	85 84 94 91

APPENDIX A

INFORMED CONSENT AND CHILD ASSENT FORMS

University of North Texas Institutional Review Board

Informed Consent Form

Before agreeing to participate in this research study, it is important that you read and understand the following explanation of the purpose, benefits and risks of the study and how it will be conducted.

Title of Study: Service-Learning in Action: A Description of a University and Community Treatment Program Designed to Address Disparities and Increase Quality Interventions in Autism

Investigator: Shahla Alai-Rosales, University of North Texas (UNT) Department of Behavior Analysis.

Purpose of the Study: You are being asked to give permission for information from your participation in the ***Easter Seals-North Texas Autism Treatment Program*** (ESATP) to be confidentially reported for educational and research purposes.

The purpose of this research study is report a series of case studies describing the ESATP program outcomes. Specifically, we will describe the social and political climate surrounding autism services that led to the creation of the ESATP. We will describe the implementation process (how interventions are developed within an scientific framework, how staff are trained to implement scientifically sound practices). We will also describe the program features (recruitment and intake procedures, family and staff demographics, the number of children and families served, and number and type of services offered) and the outcomes achieved to date (progress on treatment goals and standardized testing, staff performance, and parent and staff satisfaction with program procedures and results).

In the series of case studies, we will provide examples of staff, parent and child process and outcomes to illustrate the program design and success.

Study Procedures: We would like to review and analyze your data that were already collected as part of your involvement in the ESATP program. Your only time commitment for this new research project is the time it will take to go through the consent process that we are doing right now.

Foreseeable Risks: There are no foreseeable risks involved with participation in this study. No identifiable descriptions will be given in manuscripts or presentations. In the event that vignettes are included, they will involve pseudonyms and composite characteristics and behaviors of several staff/child/parents so that they illustrate a concept rather than describe an individual. In the event actual outcomes are reported, pseudonyms will be used to refer to the person.

APPROVED BY THE UNT IRB
FROM 5/21/12 TO 5/20/13

Benefits to the Subjects or Others: There are no immediate benefits to you as the participants. It is possible that reporting the favorable outcomes of this program will increase the likelihood of sustained funding of the program and increased overall support of programs for traditionally underserved populations. Furthermore, the reporting of this information may provide other providers and universities resources for initiating similar programs designed to train students and contribute to the overall well-being of home communities.

Compensation for Participants: None

Procedures for Maintaining Confidentiality of Research Records:
No identifiable data will leave the ESATP site. ESATP staff will mask all ESATP records to maintain the confidentiality of the clients and staff. The investigators will only enter study data by groups and pseudonyms rather than by identifiable individual information. The confidentiality of your participant information will be maintained in any publications or presentations regarding this study.

Questions about the Study: If you have any questions about the study, you may contact *Shahla Alai-Rosales* at *940-565-2274.*

Review for the Protection of Participants: This research study has been reviewed and approved by the UNT Institutional Review Board (IRB). The UNT IRB can be contacted at (940) 565-3940 with any questions regarding the rights of research subjects.

Research Participants' Rights: Your signature below indicates that you have read or have had read to you all of the above and that you confirm all of the following:

- *Shahla Alai-Rosales, or a designee,* has explained the study to you and answered all of your questions. You have been told the possible benefits and the potential risks and/or discomforts of the study.
- You understand that you do not have to take part in this study, and your refusal to participate or your decision to withdraw will involve no penalty or loss of rights or benefits. The study personnel may choose to stop your participation at any time.
- Your decision whether to participate or to withdraw from the study will have no effect on your employment or enrollment at Easter Seals Autism Treatment Program.
- You understand why the study is being conducted and how it will be performed.

APPROVED BY THE UNT IRB
FROM 5/21/12 TO 5/20/13

- You understand your rights as a research participant and you voluntarily consent to participate in this study.
- You have been told you will receive a copy of this form.

_____
Printed Name of Participant

_____ _____
Signature of Participant Date

For the Investigator or Designee:

I certify that I have reviewed the contents of this form with the subject signing above. I have explained the possible benefits and the potential risks and/or discomforts of the study. It is my opinion that the participant understood the explanation.

_____ _____
Signature of Investigator or Designee Date

APPROVED BY THE UNIT IRB
FROM 5/21/12 TO 5/20/13

CHILD ASSENT FORM

The Purpose of this Study:

My name is Shahla Rosales and my students and I would like to see what you do and how you feel after exercising. I would like to do this by playing gym ball games with you in the basketball gym. Other people have exercised like this and they have found that children enjoy the project. I would like for you to have fun while exercising with the teachers.

- I would like to share all that I learn from working with you with other people who work with kids.
- I would like to video tape you while I am teaching. I will watch and write down what you do before, during and after I teach you. This means I will count things like how many times you play with the teachers and how often you talk and say other things.
- I will write the information you share in my paper. This paper will teach others how to make exercise fun and teach kids to say things.

Study Procedures:

1) We would like to exercise with you for 10 minutes about every other day. We will also go to the basketball gym and play with markers, blocks, dinosaurs and water for 10 minutes on some days.
3) I would also like to videotape you during 20 minute play periods so that I can see if the teaching is working.
4) We would like to make pictures and to write about how well the teaching works. Your name will never be on any of the information we write down about you or the answers you give so that your privacy will be protected. Instead, we will use a made-up nickname for you.
5) We will give you a copy of the final report.

Voluntary Participation: You can stop helping us whenever you want to. If you do not wish to help or decide at any time that you want to stop, no one will be upset with you.

Foreseeable Risks: If you do not feel like exercising, or being videotaped, just let me or your parents know at anytime.

Confidentiality: Other professors, my students, and I will watch the videotapes of you playing so that we can learn more about making exercise fun. We will always use nicknames for you and only the people who promise not to tell who is in the tapes will be able to view these tapes.

CHILD ASSENT

I_____, have read (or it has been read to me), and Shahla or one of her graduate students has explained and answered any of my questions. I understand that I do not have to agree to be in this project if I do not want to and I can stop at anytime. By signing or printing I agree to participate in the study mentioned above.

_____ _____
Printed Name of Child Date

_____ _____
Printed Name of Child Date

WAIVER OF ASSENT FOR CHILDREN 6 AND UNDER

The child named_____ has been waived from signing an assent for the following reason: ____ Age ____ Maturity ____ Psychological State of the Child

_____ _____
Signature of Participant's Parent or Guardian Date

APPENDIX B

DATA SHEET FOR PREFERENCE ASSESSMENT

Free Operant Preference Assessment Datasheet

Location: ________________ Date: ____________

	Item	Score
1.		5
2.		4
3.		3
4.		2
5.		1

Location: ________________ Date: ____________

	Item	Score
1.		5
2.		4
3.		3
4.		2
5.		1

Location: ________________ Date: ____________

	Item	Score
1.		5
2.		4
3.		3
4.		2
5.		1

Location: ________________ Date: ____________

	Item	Score
1.		5
2.		4
3.		3
4.		2
5.		1

Thomas D. R. Currier (2011)

APPENDIX C

INSTRUCTIONS AND DATA SHEET FOR TRIAL-BASED FUNCTIONAL ANALYSIS

Trial-based Functional Analysis Procedures

General Procedures

- Inform other therapists of the assessment in order to avoid inadvertent interference.
- Observers should formalize definitions for target behavior(s) prior to conducting the assessment.
- Observers/therapists should run each trial in a sequence (i.e., control-test trials) consecutively with no delay between trials.
- Order of trials is control-test; complete 10 trials of each (i.e., 20 total data points for each target behavior).
- Reset between each sequence by exiting the immediate area and then re-entering the area.

Demand Condition

The direct therapist should run these trials in any of the following contexts:

1. OT gym
2. Snack
3. Art
4. Game time
5. PT gym
6. Lunch
7. 1:1 program time

No Demand Trials: Set the timer for 2 min, press start at the beginning of the trial. During the trial, the direct therapist should remain in close proximity (i.e., within 2 ft) to the child but refrain from placing any demands on the child. Trials will end after 2 min. The subsequent demand trial will begin immediately after the 2 min duration.

Demand Trials: The beginning of the trial will be signaled by the direct therapist placing a demand on the child; these demands should be matched to the child's current level of programming (e.g., gross motor imitation, reading task, match-to-sample trial). If needed, the therapist should utilize prompts from least to most intrusive in the following hierarchy: 1) verbal prompt; 2) gestural prompt; 3) physical prompt. The direct therapist will continue to place demands on the child for up to 2 min. Trials will end after 2 min or upon the occurrence of the target behavior, whichever occurs first. If the target behavior occurs, the direct therapist will immediately cease demands and offer an informative statement such as "we don't have to work right now".

General Procedure: Following each No Demand/Demand sequence, the direct therapist should remove the child from the immediate area to end the sequence. Returning to the area signals the beginning of the next sequence.

Attention Condition

The direct therapist should run these trials in any of the following contexts:

1. OT gym
2. Snack
3. Art
4. Game time
5. PT gym
6. Lunch
7. 1:1 program time

Attention Trials: Set the timer for 2 min, start the timer at the beginning of the trial. During the trial, the direct therapist should provide social and/or physical attention continuously throughout the trial. The therapist can provide descriptive praise, compliments, and honor child's requests during this condition. Trials will end after 2 min. The subsequent "no attention" trial will begin immediately following the end of an "attention" trial.

No Attention Trials: Set the timer for 2 min, start the timer at the beginning of the trial. The direct therapist should tell the child "Play here, I have some stuff to do." while turning away from the child. The therapist can redirect any of the child's attempts to gain attention by repeating the instruction and pointing back to the original area. If the child demonstrates the target behavior, the direct therapist should respond by delivering a statement of concern such as "you shouldn't do that" paired with 5 s of physical contact The trial will end after 2 min or upon the occurrence of the target behavior, whichever occurs first.

General Procedure: Following each Attention/No Attention sequence, the direct therapist should remove the child from the immediate area to end the sequence. Returning to the area signals the beginning of the next sequence.

Tangible Condition

The direct therapist should run these trials in any of the following contexts:

1. 1. OT gym
2. Snack
3. Art
4. Game time
5. PT gym
6. Lunch
7. 1:1 program time

Free-Access Trials: Set the timer for 2 min, start the timer at the beginning of the trial. During the trial, the direct therapist should make previously identified preferred items accessible to the child in the context of the trial. The direct therapist should remain in close proximity to the child and allow the child to access the items during the trials, but otherwise withhold attention. Trials will end after 2 min. The subsequent “restricted access” trial will begin immediately following the end of a “free access” trial.

Restricted Access Trials: Set the timer for 2 min, start the timer at the beginning of the trial. During the trial, the direct therapist should remove items from child’s immediate area as well as block child’s attempts to access other items. If the child demonstrates the target behavior, the direct therapist should respond by delivering a generic statement of appeasement such as “oh, you can have it”. Trials will end after 2 min or upon the occurrence of the target behavior, whichever occurs first.

General Procedure: Following each Free Access/Restricted Access sequence, the direct therapist should remove the child from the immediate area to end the sequence. Returning to the area signals the beginning of the next sequence.

Alone with Toys Condition

The direct therapist should run these trials in any of the following contexts:

1. In a barren treatment room with bin of preferred items.

Alone1/Alone 2 Trials: Set the timer for 2 min, start the timer at the beginning of the trial. Ensure that no items or activities are accessible to the child during the trial. The direct therapist should observe from outside of the treatment room, but allow the child to engage in any activity that the child chooses, omitting physically dangerous activities. Alone 1 trials will end after 2 min. The subsequent “alone 2” trial will begin immediately following the end of an “alone 1” trial. Repeat the same procedure for Alone 2 trials.

General Procedure: Following each Alone 1/Alone 2 sequence, the direct therapist should remove the child from the immediate area to end the sequence. Returning to the area signals the beginning of the next sequence.

Observer: _____
Direct Therapist: _____

Target Behavior: _____

Client: _____
Date: _____

Demand

Date	Trial	Activity	No Demand	Demand
	1		+ -	+ -
	2		+ -	+ -
	3		+ -	+ -
	4		+ -	+ -
	5		+ -	+ -
	6		+ -	+ -
	7		+ -	+ -
	8		+ -	+ -
	9		+ -	+ -
	10		+ -	+ -
			Total(+):	Total(+):

Attention

Date	Trial	Activity	Attention	No Attention
	1		+ -	+ -
	2		+ -	+ -
	3		+ -	+ -
	4		+ -	+ -
	5		+ -	+ -
	6		+ -	+ -
	7		+ -	+ -
	8		+ -	+ -
	9		+ -	+ -
	10		+ -	+ -
			Total(+):	Total(+):

Tangible

Date	Trial	Activity	Free Access	Restricted Access
	1		+ -	+ -
	2		+ -	+ -
	3		+ -	+ -
	4		+ -	+ -
	5		+ -	+ -
	6		+ -	+ -
	7		+ -	+ -
	8		+ -	+ -
	9		+ -	+ -
	10		+ -	+ -
			Total(+):	Total(+):

Alone with Toys

Date	Trial	Activity	Alone	Alone
	1		+ -	+ -
	2		+ -	+ -
	3		+ -	+ -
	4		+ -	+ -
	5		+ -	+ -
	6		+ -	+ -
	7		+ -	+ -
	8		+ -	+ -
	9		+ -	+ -
	10		+ -	+ -
			Total(+):	Total(+):

APPENDIX D

INSTRUCTIONS AND DATA SHEET FOR EXPERIMENT II

Instructions for Direct Therapist

1. From 11-12 each day (Monday-Thursday), please follow these instructions for child's programming.
2. Each hour will consist of 20 minutes in the schoolroom, 10 minutes in the physical therapy gym (or in the school room during baseline), and another 20 minutes in the schoolroom.
3. Begin the first school session by setting the timer for 21 minutes. Press start and inform the camera operator that you are beginning.
4. While in the school room (beginning and final periods), please refer to the child's data sheet to determine which programs to run. The applicable programs will be highlighted in blue.
5. After the timer goes off, escort the child to the PT gym (or remain in school room during baseline).
6. Before entering the schoolroom, present the picture board to the child with the picture corresponding to that day's activity. See data sheet for schedule of activities by day. Deliver an echoic prompt to child and prompt him to remove picture from the board. For example, if the data sheet indicates a sedentary activity, then equip the picture board with the sedentary picture, present the board to the child, prompt "Play with toys" and then prompt the child to remove the toy picture from the board.
7. Once inside the gym, begin the session by taking the child's heart rate with the monitor. Following this, set the timer for 10 minutes. Have the child participate the day's activity (i.e., sedentary or active) until the timer goes off. Take the child's heart rate immediately (i.e., within 20 seconds) following the completion of the activity.
    a. To use the heart rate monitor:
        i. Set the watch piece to receive transmissions from the chest band. Begin with the digital clock on the watch. Press the select button until "Measure" appears in a black box on the bottom of the watch face. Next, press the red "Store/Recall" firmly until the transmission icon and the heart rate reading of "00" appears.
        ii. Wet the textured strips on the backside of the chest band.
        iii. Prompt the child to raise his arms.
        iv. Lift child's shirt enough to wrap chest band around his torso, just below his pectoral muscles; the textured strips should make contact with his skin.
        v. Hold (or wear) the watch within 3 feet of the chest band.
        vi. Have the child count to 10-15 with you while the monitor reads his heart rate. Once you have the post-activity reading, then proceed to step 8.
8. Return to the schoolroom. Set the timer for 21 minutes again begin the last session.

Refer again to the data sheet to indicate which programs to run during this time.

Instructions for Filming

1. The video camcorder will be stored on the bookshelf in the case manager's office at the Easter Seals North Texas Trinity Center location.
2. Bring the camcorder to the schoolroom and find the child and his therapist.
3. To turn the camera on, first open the video screen. The camera should be set to film, not to photo. There are illuminated icons on the end of the camera that indicate video or photo mode.
4. The therapist will be in charge of setting the timer for each session. Begin recording once the therapist begins the timer for the first session. Continue recording the first session in the schoolroom and turn the camera off when the timer chimes. Begin filming the second session (10 min) once the therapist starts the timer, again end filming when the timer chimes. Record the third and final session in the same manner.
5. Turn off the camera by closing the video screen.
6. Return the camera to the bookshelf in the case manager's office.

Thank you for everything!

Thom

Instructions for Video Scorers

1. The videos will be located on the Mac computer in Chilton Hall Room 364E.
2. Initial scorers will find a data sheet in the red binder in the file cabinet drawer marked “Thom”.
3. Have a pencil, data sheet, a timer, and the headphones available.
4. Locate the correct video in the exercise project folder. To locate this folder, open a finder window and select the folder entitled “Documents”--“Thom”—“Exercise” and then choose the folder with the date of the session you intend to score.
5. Open video and begin recording data at :00 seconds.
6. Record an “X” in each cell of an interval column if the behavior occurs at least one time during the interval.
7. Return the completed data sheet to the section in the binder marked “Primary data”. For IOA scorers, return the data sheet to the section entitled “IOA”.

Thank you all so much for your assistance! Your hard work is truly appreciated!

Exercise Data Sheet

Date:_______ Observer: _________ Video Archive:_____________

	:00	:15	:30	:45	1:00	1:15	1:30	1:45	2:00	2:15	2:30	2:45	3:00	3:15	3:30	3:45	4:00	4:15	4:30	4:45	Total
VS																					/20
S																					/20
P																					/20
HF																					/20
V																					/20
E																					/20

	:00	:15	:30	:45	1:00	1:15	1:30	1:45	2:00	2:15	2:30	2:45	3:00	3:15	3:30	3:45	4:00	4:15	4:30	4:45	Total
VS																					/20
S																					/20
P																					/20
HF																					/20
V																					/20
E																					/20

	:00	:15	:30	:45	1:00	1:15	1:30	1:45	2:00	2:15	2:30	2:45	3:00	3:15	3:30	3:45	4:00	4:15	4:30	4:45	Total
VS																					/20
S																					/20
P																					/20
HF																					/20
V																					/20
E																					/20

	:00	:15	:30	:45	1:00	1:15	1:30	1:45	2:00	2:15	2:30	2:45	3:00	3:15	3:30	3:45	4:00	4:15	4:30	4:45	Total
VS																					/20
S																					/20
P																					/20
HF																					/20
V																					/20
E																					/20

VS	/80	=
S	/80	=
P	/80	=
HF	/80	=
V	/80	=
E	/80	=

REFERENCES

Allison, D. B., Basile, V. C., & MacDonald, R. B. (1991). Brief report: Comparative effects of antecedent exercise and lorazepam on the aggressive behavior of an autistic man. *Journal of Autism and Developmental Disorders, 21,* 89-94.

Allison, D. B., Faith, M. S., & Franklin, R. D. (1995). Antecedent exercise in the treatment of disruptive behavior: A meta-analytic review. *Clinical Psychology, 2,* 279-303.

American Psychological Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th Ed., text rev.*).* Washington, DC: Author.

Bachman, J. E., & Fuqua, R. W. (1983). Management of inappropriate behaviors of trainable mentally impaired students using antecedent exercise. *Journal of Applied Behavior Analysis, 16,* 477-484.

Bachman, J. E., & Sluyter, D. (1988). Reducing inappropriate behaviors of developmentally disabled adults using antecedent aerobic dance exercises. *Research in Developmental Disabilities, 9,* 73-83.

Bannerman, D. J., Sheldon, J. B., Sherman, J. A., & Harchik, A. E. (1990). Balancing the right to habilitation with the right to personal liberties: The rights of people with developmental disabilities to eat too many doughnuts and take a nap. *Journal of Applied Behavior Analysis, 23,* 79-89.

Bloom, S. E., Iwata, B. A., Fritz, J. N., Roscoe, E. M., & Carreau, A. B. (2011). Classroom application of a trial-based functional analysis. *Journal of Applied Behavior Analysis, 44,* 19-31.

Carr, E. G., & Durand, V. M. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis, 18,* 111-126.

Celiberti, D. A., Bobo, H. E., Kelly, K. S., Harris, S. L., & Handleman, J. S. (1997). The differential and temporal effects of antecedent exercise on the self-stimulatory behavior of a child with autism. *Research in Developmental Disabilities, 18,* 139-150.

Elliott, R. O., Jr., Dobbin, A. R., Rose, G. D., & Soper, H. V. (1994). Vigorous aerobic exercise versus general motor training activities: Effects on maladaptive and stereotypic behaviors of adults with both autism and mental retardation. *Journal of Autism and Developmental Disorders, 24,* 565-576.

Gabler-Halle, D., Halle, J. W., & Chung, Y. B. (1993). The effects of aerobic exercise on psychological and behavioral variables of individuals with developmental disabilities: A critical review. *Research in Developmental Disabilities, 14*, 359-386.

Hanley, G. P. (2010). Toward effective and preferred programming: A case for the objective measurement of social validity with recipients of behavior-change programs. *Behavior Analysis in Practice, 3*, 13-21.

Hanley, G. P., Iwata, B. A., & McCord, B. E. (2003). Functional analysis of problem behavior: A review. *Journal of Applied Behavior Analysis, 36*, 147-185.

Janssen, I., & LeBlanc, A. G. (2010). Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *International Journal of Behavioral Nutrition and Physical Activity, 7,* 1-16.

Kern, L., Koegel, R. L., & Dunlap, G. (1984). The influence of vigorous versus mild exercise on autistic stereotyped behaviors. *Journal of Autism and Developmental Disorders, 14,* 57-67.

Kern, L., Koegel, R. L., Dyer, K., Blew, P. A., & Fenton, L. R. (1982). The effects of physical exercise on self-stimulation and appropriate responding in autistic children. *Journal of Autism and Developmental Disorders, 12,* 399-419.

Larson, J. L., & Miltenberger, R. G. (1992). The influence of antecedent exercise on problem behaviors in persons with mental retardation: A failure to replicate. *Journal of the Association for Persons with Severe Handicaps, 17,* 40-46.

Levinson, L. J., & Reid, G. (1993). The effects of exercise intensity on the stereotypic behaviors of individuals with autism. *Adapted Physical Activity Quarterly, 10,* 255-268.

Lovaas, I., Newsom, C., & Hickman, C. (1987). Self-stimulatory behavior and perceptual reinforcement. *Journal of Applied Behavior Analysis, 20,* 45-68.

McGimsey, J. F., & Favell, J. E. (1988). The effects of increased physical exercise on disruptive behavior in retarded persons. *Journal of Autism and Developmental Disorders, 18,* 167-179.

Morrison, H., Roscoe, E. M., & Atwell, A. (2011). An evaluation of antecedent exercise on behavior maintained by automatic reinforcement using a three-component multiple schedule. *Journal of Applied Behavior Analysis, 44*, 523-541.

Morrissey, P. A., Franzini, L. R., & Karen, R. L. (1992). The salutary effects of light calisthenics and relation training on self-stimulation in the developmentally disabled. *Behavioral Residential Treatment, 7,* 373-389.

National Autism Center. (2009). *National standards report*. Randolph: MA.

Parks, S. (1988). *Help at home: Hawaii Early Learning Profile*. Palo Alto, CA. VORT Corporation.

Petrus, C., Adamson, S. R., Block, L., Einarson, S. J., Sharifnejad, M., & Harris, S. R. (2008). Effects of exercise interventions on stereotypic behaviours in children with autism spectrum disorders. *Physiotherapy Canada, 60,* 134-145.

Physical Activity Guidelines Advisory Committee. (2008). *Physical activity guidelines advisory committee report.* United States Department of Health and Human Services. Washington, DC.

Powell, D., Dunlap, G., & Fox, L. (2006). Prevention and intervention for the challenging behaviors of toddlers and preschoolers. *Infants and Young Children, 19*, 25-35.

Powers, S., Thibadeau, S., & Rose, K. (1992). Antecedent exercise and its effects on self-stimulation. *Behavioral Residential Treatment, 1,* 15-22.

Sigafoos, J., & Saggers, E. (1995). A discrete-trial approach to the functional analysis of aggressive behaviour in two boys with autism. *Australia and New Zealand Journal of Developmental Disabilities, 20,* 287-297.

Watters, R. G., & Watters, W. E. (1980). Decreasing self-stimulatory behavior with physical exercise in a group of autistic boys. *Journal of Autism and Developmental Disorders, 4,* 379-387.

Yell, M. L. (1988). The effects of jogging on the rates of selected targets behaviors of behaviorally disordered students. *Behavioral Disorders, 13,* 273-279.