Behavioral Supports to Increase Skill Learning, On-Task Behavior, and Enjoyment of an Adapted Tennis Program (ACEing Autism) for Children and Adolescents with Autism Spectrum Disorder

ABSTRACT

ACEing Autism is a national non-profit organization that uses tennis as a vehicle to enhance the lives of children and families with ASD. To enable all participants across the spectrum to access the ACEing Autism curriculum, additional behavioral supports were developed and implemented for the ACEing Autism program at Auburn University. These behavioral supports included: 1. Social story; 2. Checklist schedule; 3. Modeling; 4. Token system; and, 5. iPad-based feedback. This paper will describe the ACEing Autism program, the behavioral supports developed to promote skill learning, on-task behaviors, and enjoyment, and specific examples of participants in the ACEing Autism program.

KEYWORDS Tennis, Social Story, Video Modeling, Picture Schedule, Token System

With the growing prevalence of children diagnosed with Autism Spectrum Disorder (ASD) (Christensen et al., 2016), interventions are necessary to increase participation in activities of daily living including physical activity and sports. Although ASD is defined as a social communication disorder (DSM-5, (American Psychiatric Association, 2013)), movement difficulties have been well-documented in this population (Fournier, Hass, Naik, Lodha, & Cauraugh, 2010). In addition to movement problems, children with ASD face additional barriers to participating in physical activities and sports (for a recent review see (Nichols, Block, Bishop, & McIntire, 2019)). Compared to typically developing peers, fewer adolescents with ASD report enjoying team sports, physical education, or physical activities; while more adolescents with ASD perceived that physical activities were too difficult to learn (Stanish et al., 2015).

Adapted physical educators employ equipment modifications (e.g., different size of balls, racquets, and nets), rule modifications, and various types of instructions (e.g., verbal, modeling, or pictures) to increase participation of children with ASD (Liberman & Houston-Wilson, 2018 (Block, 2016; Grenier, 2014; Lavay, French, & Henderson, 2016; Lieberman & Houston-Wilson, 2018). Yet, a primary concern for adapted physical educators is the need for additional behavioral strategies to reduce behavioral difficulties, particularly for individuals requiring substantial support (Healy et al., 2016). The present paper describes the development and implementation of supplemental behavioral strategies used during an after-school adapted tennis program for children and adolescents with ASD (ACEing Autism). The goal of the paper is to describe the ACEing Autism program and to provide concrete examples of how these behavioral strategies supplement the standard curriculum to increase motor skill learning, on-task behaviors, and enjoyment.

INSERT FIGURE 1.

ACEing Autism

ACEing Autism (www.aceingautism.org) is a national non-profit organization whose mission is to use tennis as a vehicle to enhance the lives of children and families with ASD. The program enables children with ASD to be physically active and socially-engaged during adapted tennis lessons. Since its inception in 2008, the program has grown to 70 sites throughout the US and serves over 1,300 children. Tennis coaches, parents, ABA therapists, high school or college students, and physical educators currently serve as local program (site) directors and oversee program management and logistics (e.g., training and managing volunteers, recruitment, providing lessons, etc.). In addition, this program could be easily implemented by parks and recreation, therapeutic recreation, or adapted sports programs. There are two standard delivery methods employed. In the traditional model, weekly clinics (once a week) are offered at a tennis facility for a total of 6 weeks (1 session). In the school-based model, clinics are offered during the physical education class or recreation time and the schedule of clinics is based on the school's programming (e.g., during twice weekly physical education classes during the semester).

ACEing Autism provides a standard adapted tennis curriculum, visual supports (e.g., visual schedule), equipment (mini nets, racquets, different balls, hoppers, poly spots, place markers, tennis tees), t-shirts for participants and all staff members, and training materials for coaches and volunteers. The standard curriculum includes a group warm-up, hand-eye coordination, racquet skills, volleys, groundstrokes (forehands/backhands), games, and a group cheer. The curriculum was developed to build confidence using a progression from the easiest

skills to the more difficult skills. The curriculum enables local program directors to cater the lesson plan to the abilities of each child. A manual and videos are provided to train local program staff with examples for each task. The manual also includes set-up diagrams and descriptions of each task. A volunteer manual is provided to train volunteers to work with individuals with ASD (e.g., information about ASD, engaging/interacting with participants, etc.). During the sessions, the coaches use the visual schedule to orient the participants to each task (Figure 2); coaches also have a simplified version on a lanyard. The national program staff provides 1.5-hour in-person training prior to the first session. To ensure program quality and consistency across the local programs the ACEing Autism national program has an ABA therapist that evaluates each program based on a rubric (program management, training, professionalism, interaction with participants/parents, implementation of the curriculum, etc.). In the traditional delivery model, the participant costs average around $10 per clinic, which covers the rental of equipment and fee for the local program director. Local fundraising and grants aimed at increasing adapted programming for individuals with disabilities (e.g., Autism Speaks) could be used to defray the costs for facilities and additional staff (coaches or ABA therapists).

A recent program evaluation was completed by parents of ACEing Autism participants. These results were disseminated to local program directors and suggest that children with ASD show broad improvements in confidence, social skills, and motor skills (including tennis-specific skills) after participation in the program. Parents also reported positive changes in language, behavioral regulation, sleep, diet, and fitness.

INSERT FIGURE 2.

Additional Behavioral Supports

Auburn University launched an ACEing Autism program during summer 2018 with a total of 22 participants ages 8- to 18-years. Here, we discuss some of the modifications made to the standard ACEing Autism program. First, the delivery model was a variation of the school-based program; participants completed twice weekly clinics for four weeks (8 clinics total) over the summer. Make-up sessions were available to ensure all participants completed 8 clinics. Second, each participant also completed a pre-test skill assessment for the volley, forehand, and backhand to determine the participant's skill level. The pre-test assessment was used for ability grouping (i.e., courts were assigned based on similar skill levels) and was provided to the participant's volunteer in preparation for the first clinic. Third, the volunteers were undergraduate students in Exercise Science, who completed a two-week training on professionalism, details about the ACEing Autism program (volunteer manual), information about ASD, facilitating on-task behaviors, and how to provide cues and feedback for each tennis skill. Each volunteer was matched to each program participant and worked with that participant for all 8 clinics. During training they were provided with information about their participant and how to specifically motivate their participant to be successful during the program. Each volunteer completed the "Protecting Children: Identifying and Reporting Sexual Misconduct" offered online through United Educators; background checks are required for all ACEing Autism volunteers and staff over the age of 18.

In addition to the materials provided by ACEing Autism, additional behavioral supports were developed as a supplement to increase motor skill learning, on-task behaviors, and enjoyment for participants across the spectrum. These behavioral supports were based on best practices for inclusive physical education (Block, 2016; Grenier, Miller, & Black, 2017;

Lieberman & Houston-Wilson, 2018) and recommendations specific to children with ASD (Grenier, 2014; Healy, Judge, Block, & Kwon, 2016; Houston-Wilson & Lieberman, 2003; Lee & Haegele, 2016; Menear & Neumeier, 2015). The behavioral supports used to supplement the ACEing Autism program included: 1) a social story; 2) a checklist schedule for task completion; 3) video and picture models for each skill; 4) token system; and, 5) feedback about task completion using an iPad application. Table 1 provides a breakdown of the tasks completed during the session and the implementation of the supports. The use of each behavioral support was based on the needs of each participant, but the checklist, picture models, and feedback about task completion from the iPads were consistently used for all participants for all sessions. The social story, video models, and token system were added or removed based on the participant during the course of the program but were commonly used for those with more substantial behavioral needs. All parents attended an orientation session that provided additional program information, details about logistics, information about the behavioral supports, and recommendations for facilitating tennis skills between sessions.

INSERT TABLE 1.

Social stories use a specific story format and provide children with ASD information about situations they may be involved in and the appropriate way to respond in those situations (Gray, 2015). A social story should be written in first-person language and include a description of the behaviors participants are asked to perform throughout the lesson (Gray, 2015). Grenier (2014) provides recommendations on the development and implementation of social stories in physical education. Social stories increase skill learning (Mowling, Menear, Dennen, & Fittipaldi-Wert, 2018) and may decrease anxiety experienced by children with ASD (Grenier &

Yeaton, 2011). A social story was developed to provide participants with information about the setting, schedule, goals, and tasks specific to the program at Auburn University (an excerpt is provide in Figure 3). The social story was reviewed by parents/instructors before the first lesson and was available for students if they needed to review the story at the beginning of and during each lesson. Access to the full social story is available at: https://figshare.com/articles/ACEing_Autism_Social_Story/7836962.

INSERT FIGURE 3.

A checklist schedule was used to augment the visual schedule provided by ACEing Autism. Consistent with the recommendations for best practices, the checklist schedule was used to orient students to the order of tasks, encourage task completion, and provide a preview of all tasks (Block, 2016; Fittipaldi-Wert & Mowling, 2009; Houston-Wilson & Lieberman, 2003). Each student had a checklist schedule and examined the schedule at the beginning of the lesson (Figure 4). After the completion of each task/skill, a check mark was placed on the schedule to illustrate that the activity was completed, and the lesson moved to the next skill. The volunteers working with each participant were encouraged to ask questions to check for understanding (e.g., "What skill did you complete? What skill are you doing next?"). This process enabled the successful transition from one task to the next.

INSERT FIGURE 4.

Modeling in the form of picture- and video-based systems allows students to view the correct behaviors in sequence in a standardized format and may be useful when teaching motor skills (Block, 2016; Grenier, 2014; Mechling & Swindle, 2012). Video modeling has been used to increase physical activity participation (Bassette, Kulwicki, Dieringer, Zoder-Martell, &

Heneisen, 2018) and motor skill learning (Gies & Porretta, 2015; Mechling & Swindle, 2012; Obrusnikova & Rattigan, 2016). Video modeling of each tennis skill was provided via an iPad application (CopyMe, IKKOS™) that showed the instructor performing the skill (third-person perspective). The video models for each skill showed a tennis instructor (Loriane Favoretto) performing the skill in real time, a breakdown of the skill into its parts with simple verbal cues (prompts), and the tennis instructor performing the skill again in slow motion with repeated presentation. The verbal cues were based on a task analysis of key components of the skill (e.g., for the forehand: "ready position", "turn sideways with arms open", "palm faces net", "contact the ball in front of the body", "follow-through to opposite shoulder"). Figure 5 shows a screenshot of one of the video models with the tennis instructor performing the forehand from two different angles. The participant can watch the skill videos during the clinics and in between clinics to focus on the relevant task parameters. Access to all video models is available through CopyMe (ACEing Autism).

INSERT FIGURE 5.

In addition to iPad-based video models, pictures from the videos with simple cues were provided on the courts next to the checklist schedules (Figure 6). The participant was able to examine each task and with the assistance of a volunteer or coach would identify the next component of the skill to practice (e.g., "follow-through to opposite shoulder"). This sequential process, consistent with forward-chaining, enabled participants to focus on one cue at a time and eventually put all cues together to complete the skill (Block, 2016). All picture models are available at: https://figshare.com/articles/ACEing_Autism_Visual_Supports/7854992.

INSERT FIGURE 6.

A token system is a form of extrinsic motivation where the child receives a reward in exchange for performing the correct behavior and is an effective management strategy when working with children with ASD (Block, 2016; Lavay et al., 2016; Lieberman & Houston-Wilson, 2018; Matson & Boisjoli, 2009). This system should be simple, age-appropriate, used consistently, and provided after the student successfully demonstrates the appropriate behavior or completes a task correctly (Block, 2016; Lavay et al., 2016; Matson & Boisjoli, 2009). For the ACEing Autism program, a token system was created using pool noodles cut into disks that were attached to the top of the net (Figure 7). The tokens were moved across the net to encourage the participants to hit a specified number of shots (e.g., 1 token = 10 shots). Once participants achieved the specified number of tokens (e.g., 5 tokens), they were permitted to take a break or move on to the next task. Participants were encouraged to count the tokens as a marker for the total number of shots and encouraged to acquire the same number of tokens (or more) for the following skill.

INSERT FIGURE 7.

Lastly, feedback regarding the number and velocity of shots was provided by the Head tennis sensor attached to the bottom of the participant's racquet, which streamed data to the Head tennis sensor iPad app (Head™ tennis sensor powered by ZEPP, Phoenix, Arizona, USA; Figure 8). After completing each task, the participants could look at their data on the app. Participants could also look at data from the previous session and set goals for the number and velocity of shots for the practice. This feedback is a form of extrinsic positive reinforcement that could be used in conjunction with or in substitution of the token system. The incorporation of this form of

feedback was based on studies suggesting that "gamification" can lead to increased motivation and engagement during skill learning in children with ASD (Malinverni et al., 2017).

INSERT FIGURE 8.

Example of Implementation – Requiring Very Substantial Support

INSERT FIGURE 9.

Participant 1 was a 17-year-old male with ASD. He had minimal expressive communication (few words of intelligible speech), displayed signs of anxiety or distress before and during lessons, exhibited repetitive behaviors that increased with stress or frustration, had difficulty transitioning between tasks, and had trouble focusing during tasks. For this participant, all of the behavioral supports described above were implemented. The social story was read to Participant 1 by his parents before the start of the program and repeated before each clinic if Participant 1 exhibited anxiety. An iPad with the video models was provided to preview each skill. At the beginning of each practice, the visual schedule, checklist schedule, and picture models were reviewed. Before initiating each task, Participant 1 was shown the pictures of each skill and provided with the relevant cue. The volunteer and ABA therapist working with Participant 1 would reiterate the target cue for each skill (e.g., "racquet back") during the practice and would provide congruent positive feedback to reinforce the cue (e.g., "great job bringing your racquet back"). The tokens were used to represent ten shots; completion of 50 shots indicated successful completion. As the participant became more successful in performing the skills and staying on-task, the tokens represented only the shots that went over the net and within the court boundary. In addition, the total number of shots represented by each token

increased over clinics (i.e., 10 shots to 15 shots). After completing each task, Participant 1 viewed his data (number and velocity of shots) on the iPad, checked off the task on the schedule, and took a short break before transitioning to the next task. His parents were asked to view the video models with Participant 1 between clinics to reinforce skills.

Example of Implementation – Requiring Minimal Support

INSERT FIGURE 10.

Participant 2 was a 12-year-old male with ASD. He had good expressive and receptive communication (e.g., was able to engage in conversation), but had difficulty initiating social interactions with peers, exhibited frustration when unsuccessful, and had trouble switching between activities. For this participant, his parents reviewed the social story and video models before the first clinic. At the beginning of each practice, the visual schedule, checklist schedule, and picture models with cues were reviewed to reduce his anxiety and help him transition between tasks. After the first few sessions, the visual schedule was no longer needed. The picture models and cues were useful in helping Participant 2 focus on the next component (cue) to be practiced (e.g., "follow-through to the opposite shoulder") and promote skill acquisition. The video models were not needed during the session, as this participant was able to perform the skills correctly after an in-person demonstration by his volunteer or coach. Congruent positive feedback was provided to reinforce the cues (i.e., "Your follow-through went to the opposite shoulder! Great job!"). At the end of the program, Participant 2 could articulate all cues for each of the tennis skills in order. The use of tokens during the session and iPad-based feedback (number and velocity of shots) upon completion of each task were important motivating factors

for Participant 2. But, the token system was faded out for later clinics, as the number of shots executed became difficult to track. Participant 2 became competitive with other participants regarding the total shots completed during practice and would state goals of increasing the number of shots to "beat his last score".

Summary

INSERT FIGURE 11.

The materials provided by ACEing Autism (i.e., standard curriculum, visual schedule, equipment, and training materials) can be implemented as an after-school program or during adapted physical education during the school day (i.e., school-based delivery model) and as a weekly program at a tennis facility (i.e., traditional delivery model). The additional behavioral supports described here (1. Social story; 2. Checklist schedule ; 3. Picture and Video modeling; 4. Token system; and, 5. Technology-enhanced feedback), facilitated motor skill development, on-task behaviors, and enjoyment in individuals with ASD across the full spectrum of abilities, thus maximizing the impact of participation in ACEing Autism. A combination of multiple behavioral supports was implemented at the same time for all participants. As participants improved, fewer supports were required. For successful implementation, program staff (i.e., local program director, coaches), volunteers, and parents may need additional training to understand the importance of these supports, how to identify which supports may be useful for each participant, how to implement each support, and when it is appropriate to add or remove supports. It is important to note that every child with or without a disability learns in different ways. An important goal for teachers and coaches is to appropriately assess the child's needs and

skill levels before implementing any behavioral intervention. Continued evaluations throughout the intervention are useful to identify successful strategies and individual progress.

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References

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders: DSM-5* (5th ed.). Arlington, VA, US: American Psychiatric Publishing, Inc.

Bassette, L., Kulwicki, J., Dieringer, S. T., Zoder-Martell, K. A., & Heneisen, R. (2018). The use of a multicomponent behavioral intervention to promote physical activity in adolescents with Autism Spectrum Disorders across inclusive community settings. *Behavioral Analysis in Practice, 11*(4), 358-369. doi:10.1007/s40617-018-00285-7

Block, M. E. (2016). *A Teacher's Guide to Adapted Physical Education: Including Students with Disabilities in Sports and Recreation* (4th ed.). Baltimore, MD: Paul H. Brookes Publishing Co., Inc.

Christensen, D. L., Braun, K. V. N., Baio, J., Bilder, D., Charles, J., Constantino, J. N., . . . Yeargin-Allsopp, M. (2016). Prevalence and characteristics of Autism Spectrum Disorder among children aged 8 years - Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States, 2012. *Morbidity and Mortality Weekly Report Surveillance Summaries, 65*(3), 1-23.

Fittipaldi-Wert, J., & Mowling, C. M. (2009). Using visual supports for students with Autism in physical education. *Journal of Physical Education, Recreation & Dance, 80*(2), 39-43. doi:10.1080/07303084.2009.10598281

Fournier, K. A., Hass, C. J., Naik, S. K., Lodha, N., & Cauraugh, J. H. (2010). Motor coordination in autism spectrum disorders: a synthesis and meta-analysis. *Journal of Autism and Developmental Disorders, 40*(10), 1227-1240. doi:10.1007/s10803-010-0981-3

Gies, M., & Porretta, D. (2015). Video prompting and its application to physical activity settings for individuals with developmental disabilities. *Palaestra, 29*(4), 31-35.

Gray, C. (2015). *The New Social Story Book: Revised and Expanded*. Arlington, TX: Future Horizons.

Grenier, M. (2014). *Physical Education for Students with Autism Spectrum Disorders: A Comprehensive Approach* (M. Grenier Ed.). Champaign, IL: Human Kinetics.

Grenier, M., Miller, N., & Black, K. (2017). Applying Universal Design for Learning and the inclusion spectrum for students with severe disabilities in general physical education. *Journal of Physical Education, Recreation & Dance, 88*(6), 51-56. doi:10.1080/07303084.2017.1330167

Grenier, M., & Yeaton, P. (2011). Previewing: A successful strategy for students with Autism. *Journal of Physical Education, Recreation & Dance, 82*(1), 28-43. doi:10.1080/07303084.2011.10598558

Healy, S., Judge, J. P., Block, M. E., & Kwon, E. H. (2016). Preparing adapted physical educators to teach students with Autism: Current practices and future directions. *The Physical Educator, 73*(1). doi:10.18666/tpe-2016-v73-i1-6082

Houston-Wilson, C., & Lieberman, L. J. (2003). Strategies for teaching students with Autism in physical education. *Journal of Physical Education, Recreation & Dance, 74*(6), 40-44. doi:10.1080/07303084.2003.10609218

Lavay, B. W., French, R., & Henderson, H. L. (2016). *Positive Behavior Management in Physical Activity Settings* (3rd ed.). Champaign, IL: Human Kinetics.

Lee, J., & Haegele, J. A. (2016). Understanding challenging behaviors of students with Autism Spectrum Disorder in physical education. *Journal of Physical Education, Recreation & Dance, 87*(7), 27-30. doi:10.1080/07303084.2016.1202802

Lieberman, L. J., & Houston-Wilson, C. (2018). *Strategies for Inclusion: Physical Education for Everyone* (3rd ed.). Champaign, IL: Human Kinetics.

Malinverni, L., Mora-Guiard, J., Padillo, V., Valero, L., Hervás, A., & Pares, N. (2017). An inclusive design approach for developing video games for children with Autism Spectrum Disorder. *Computers in Human Behavior, 71*, 535-549. doi:10.1016/j.chb.2016.01.018

Matson, J. L., & Boisjoli, J. A. (2009). The token economy for children with intellectual disability and/or autism: A review. *Research in Developmental Disabilities, 30*(2), 240-248. doi:10.1016/j.ridd.2008.04.001

Mechling, L. C., & Swindle, C. O. (2012). Fine and gross motor task performance when using computer-based video models by students with autism and moderate intellectual disability. *The Journal of Special Education, 47*(3), 135-147. doi:10.1177/0022466911433859

Menear, K. S., & Neumeier, W. H. (2015). Promoting physical activity for students with Autism Spectrum Disorder: Barriers, benefits, and strategies for success. *Journal of Physical Education, Recreation & Dance, 86*(3), 43-48. doi:10.1080/07303084.2014.998395

Mowling, C. M., Menear, K., Dennen, A., & Fittipaldi-Wert, J. (2018). Using technology and the ecological model of constraints to develop story-based interventions for children with Autism Spectrum Disorder. *Strategies, 31*(3), 5-12. doi:10.1080/08924562.2018.1442274

Nichols, C., Block, M. E., Bishop, J. C., & McIntire, B. (2019). Physical activity for young adults with ASD: Barriers and solutions for caregivers. *Palaestra, 33*(1), 52-57.

Obrusnikova, I., & Rattigan, P. J. (2016). Using video-based modeling to promote acquisition of fundamental motor skills. *Journal of Physical Education, Recreation & Dance, 87*(4), 24-29. doi:10.1080/07303084.2016.1141728

Stanish, H., Curtin, C., Must, A., Phillips, S., Maslin, M., & Bandini, L. (2015). Enjoyment, barriers, and beliefs about physical activity in adolescents with and without Autism Spectrum Disorder. *Adapted Physical Activity Quarterly, 32*(4), 302-317. doi:10.1123/APAQ.2015-0038