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Key Terms

Autism, ASD, Autism Spectrum Disorder, yoga, self-stimulatory behaviors, time-on-task, self regulation, vocalization, verbalization, physical activity

Abstract

Autism Spectrum Disorder (ASD) is a complex developmental disorder that impacts social interactions, verbal and nonverbal communication and includes repetitive/stereotypical behaviors.[1] Approximately one in sixty-eight American children are diagnosed with ASD.[1] Stereotypical behaviors associated with Autism are categorized as self-stimulatory behaviors (object tapping, gazing at lights, scratching, neologisms, etc.). Therapy program goals for children with ASD include minimizing self-stimulatory behaviors and maximizing time spent on task. The participant of this case study was a 17 year old, non-Hispanic, Black male that presented with ASD at Cooperative Educational Services, a school for individuals with intellectual and developmental disabilities. He exhibited various self-stimulatory behaviors, including body rocking, hand flapping, and repetitive non-purposeful vocalization and echolalia. Using the Yogi-Breaks Yoga Curriculum, the goal was to track and maximize the time spent on task during the yoga program. The sessions occurred one to two times a week for 30 minutes at a time, in a calm and quiet space, for a total of six sessions. The participant was able to increase the time spent

on task and engage in yoga throughout the six sessions. In all six yoga sessions, time-on-task was recorded at 80% or higher. It was shown that yoga can be used as a positive therapeutic modality in decreasing the self-stimulatory behaviors associated with Autism Spectrum Disorder in this participant.

Introduction

Autism Spectrum Disorder (ASD) is a complex developmental disorder that can impact one's ability to think, feel, understand and coordinate language, and relate to others.[1] This neurological disorder impacts the functioning of the brain. There are more than 3.5 million Americans living with Autism.[1] Approximately one in 68 American children is diagnosed with ASD and it is three to four times more common in males than females.[1,2] Individuals diagnosed with ASD exhibit verbal and non-verbal communication issues, social interactions, and repetitive body movements and behaviors.[2] Symptoms begin to emerge between the ages of two and three.[3] Early intervention and treatment can help reduce the severity of symptoms.[4] There is no found cause associated with ASD, however, there may be a genetic connection. Parents who have one child with ASD have a two to eighteen percent chance of having a second child who may also be affected. ASD works to classify individuals within a range placing them somewhere on a low to high spectrum. The severity level of those classified range from requiring support (Level 1) and requiring very substantial support (Level 3), according to the DSM-5.[5] Different individuals will display different signs and symptoms. For individuals that classify as a Level 1, there can be difficulty in transitioning between activities, problems with organizations, as well as planning can cause impaired independence and poor self-regulation. Individuals with level 3 classification identify with inflexibility of behavior, extreme difficulty in coping with change in routine, behaviors that severely impair functioning, minimal to no self-regulation, and great distress changing focus or action.

An inclusion criteria specific to ASD, is self-stimulatory behaviors. This refers to stereotypical behaviors and repetitive body movements and behaviors. These movements can involve one or all

senses. Examples of self-stimulatory behaviors include, but are not limited to, hand-flapping, body rocking, scratching, gazing at lights, and object tapping.[1] Self-stimulatory behaviors can also play a role in communication and can include "overlearned scripts," echolalia, neologisms, verbalization of specific words or questions and oral fixations.[6] Professionals work to decrease these behaviors without minimizing other positive behaviors through exercise. Self-stimulatory behaviors can decrease time spent on task for an individual with ASD. During these events, a child is distracted from the proposed task and so it takes more time to bring the child back to the activity. When a child engages in self-stimulatory behaviors, they can also distract other people from their tasks. A primary goal for professionals in developing a course of treatment would be to decrease self-stimulatory behavior and consequently, increase time spent on task. Providing the proper exercise program may decrease self-stimulatory behaviors in certain children with ASD.[7]

Depending on the individual diagnosed with ASD, they may experience additional co-morbidities. ASD works on a spectrum ranging from low to high functioning. Individuals with low functioning Autism can have intellectual disabilities, poor motor coordination, lack of attention span, and sleeping complications. There is a higher incidence rate of epilepsy in individuals with ASD. Individuals are also at risk for gastrointestinal issues and obesity. Individuals on the higher end of the spectrum report having an above-average intelligence level. According to the CDC, 46% of children with ASD have above-average intelligence.[8] These children also have the capability to overlearn things in details and retain information for a long period of time. They tend to be strong visual and auditory learners. Individuals on the higher end of the spectrum may have one area of focus and excel in math, science, music, or art.

There are many physical, psychological and social benefits associated with engaging in physical activity (PA). Regular PA in children and adolescence improve strength and endurance, and the building of healthy bones and muscles.[9] General benefits of PA also include increased flexibility, and improved

cardiorespiratory endurance and functioning. PA also helps to control weight, reduce anxiety and stress, and improve self-esteem.[9] The Center for Disease Control recommends that each child gets 60minutes of PA daily. Children with ASD also benefit from moving and engaging in PA. Children with ASD are at an increased risk of childhood obesity due to limited PA when compared to their slimmer peers.[10] This can partially be attributed also to a lack of desire to engage in PA as well.[11] There are many benefits to engaging in PA for children with ASD including improved cognition, self-regulation, attention span and socio-emotional functioning.[12] Exercise has also been shown to increase non-verbal communication, self-esteem, and tolerance to touch. In addition to increasing positive behaviors, exercise also reduces irritability, feelings of withdrawal, hyperactivity, and asocial behaviors in individuals with ASD.[11]

Children with ASD need to be taught coping strategies in order to promote PA, reduce stress and compensate for sensory processing challenges.[13] Treatments for ASD consist of behavior and communication approaches, dietary approaches, medication, and complementary and alternative medicine.[14] Traditional therapy for children with ASD focus on sensory integration, with the goal to providing tactile, vestibular and proprioceptive stimulation.[15] Yoga is a favorable therapy because it is cost effective and attempts at accomplishing poses focus on a mind-body approach.[4,15] This yoga therapy increases a sense of control and teaches children to connect with their body, utilize and improve their personal strength, build connections with others, and work out life's issues. This approach has shown an improvement in concentration, relaxation and tolerance for activities in children with special needs.[16] Yoga has also been shown to increase positive emotional coping behaviors and decrease anxiety, aggression and self-stimulatory behaviors.[17] Contrary to other therapies, yoga assists in helping children calm themselves which promotes relaxation, independence, and gives the child a sense of control.

Methods

This research project examined the effect of a six-session yoga program while measuring time-on-task for an individual with ASD. The Yogi Breaks Yoga Curriculum was a project created by Tara Delago-Bridges as a research project entitled, "Yoga for Adolescents with Autism Spectrum Disorders: A Curriculum with a sensory approach that Incorporates Coping Strategies for Stress and Promotes Physical Fitness" (2012).[18] The purpose of Delago-Bridges' project was to use a multi-disciplinary approach and use yoga to teach coping strategies, alleviate stress, address sensory processing complications and to promote physical activity.[18] The Yogi Breaks Curriculum consisted of nine lessons, encompassing breathing, posture, physical movements, vocalization goals, emotion recognition, and relaxation techniques. The breaths and yoga postures are outlined in Table 1.

Table 1. Breathing Techniques and Yoga Poses from the Yogi Breaks Yoga Curriculum.

Breathing Technique[18]	• Ocean Breath • Rabbit Breath • Lion Breath
Yoga Poses[18]	• Sleep Pose • Rock Pose • Forward Bend • Table Top and Cat/Camel* (added to allow for students to be successful) • Downward Dog • Cobra Pose • Bridge Pose • Triangle Pose* (changed to Warrior 2 Pose) • Chair Pose • Tree Pose

The Yogi Breaks curriculum was modified to fit the needs and abilities of the participant. Sessions were taught at Cooperative Educational Services (CES) in Trumbull, Connecticut. CES is a school for individuals with intellectual and developmental disabilities. Yoga sessions took place one to two

times a week over a six sessions for 30 minutes. Yoga did not take place weeks three and four due to school closings. Yoga was also canceled on week five because the participant was absent from school. One undergraduate exercise science student led the yoga practice. One graduate speech-language student co-led the yoga practice, and directed the verbalization goals. A faculty member served as an outside observer, tracking start/stop time, time-on-task, and the participant's self-stimulatory behaviors. Time-on-task was recorded as the ratio of purposeful yoga practice and self-stimulatory behaviors. A stop watch was used to measure the total activity time and was stopped when the student engaged in self-stimulatory behavior. Percentages were determined through dividing the time spent on task by the entire yoga session time.

The participant in this case study was a 17 year old non-Hispanic Black male that presented with the primary diagnosis of Autism Spectrum Disorder. According to his teachers, he engages in self-stimulatory behaviors throughout the day thus distracting him from instructional time and time spent on task. Time-on-task in the school day consists of engaging in academic and social activities with his peers. It also consists of completing tasks instructed by his teachers. In the classroom, when the participant is engaging in self-stimulatory behaviors, his teacher or aide is able to help him refocus by giving him verbal cues as to what to do or where to focus. The participant struggles with self-regulating and requires verbal and visual prompting in order to reduce and/or cease the self-stimulatory behavior. The participant does not take any medicines nor had a past history of aggressive behaviors, injuries or co-morbidities. The participant was verbal and was able to ambulate in his environment. The participant in this study was well liked by his fellow classmates and is an overall happy 17 year old. However his diagnosis does present with several self-stimulatory behaviors including but not limited to: body rocking, non-purposeful verbalization, arm waving, and echolalia. The participant was very quick to answer questions and sometimes did not allow the full question to be asked before providing answer.

Results

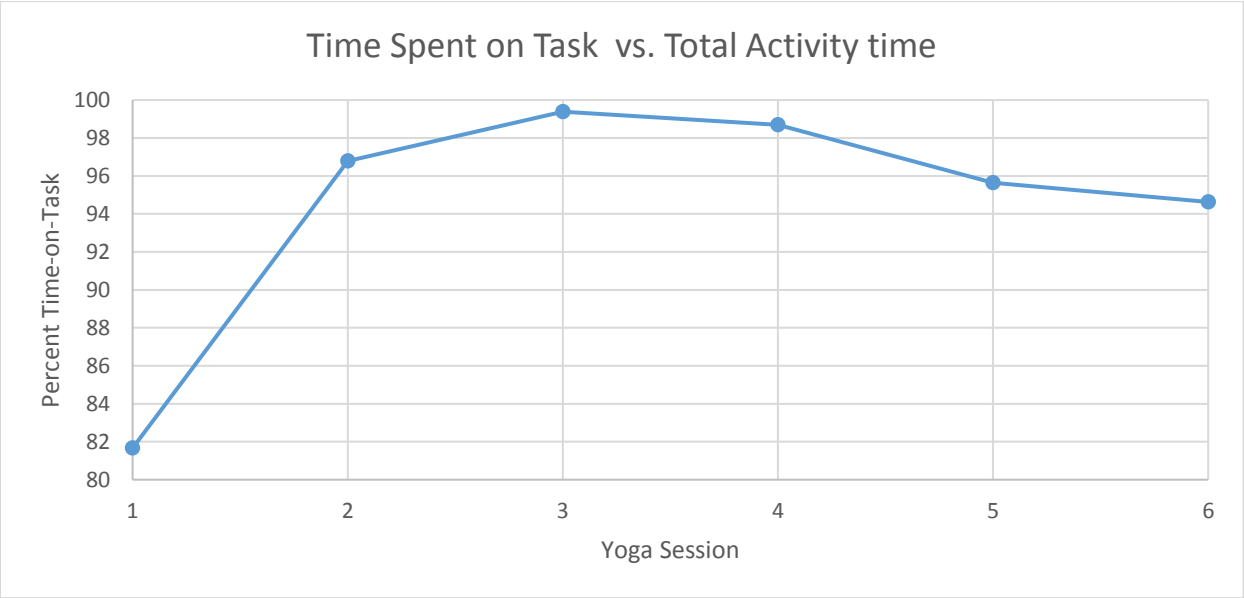

Figure 1. Time Spent on Task vs. Activity Time during Yoga Sessions over nine weeks for six sessions.

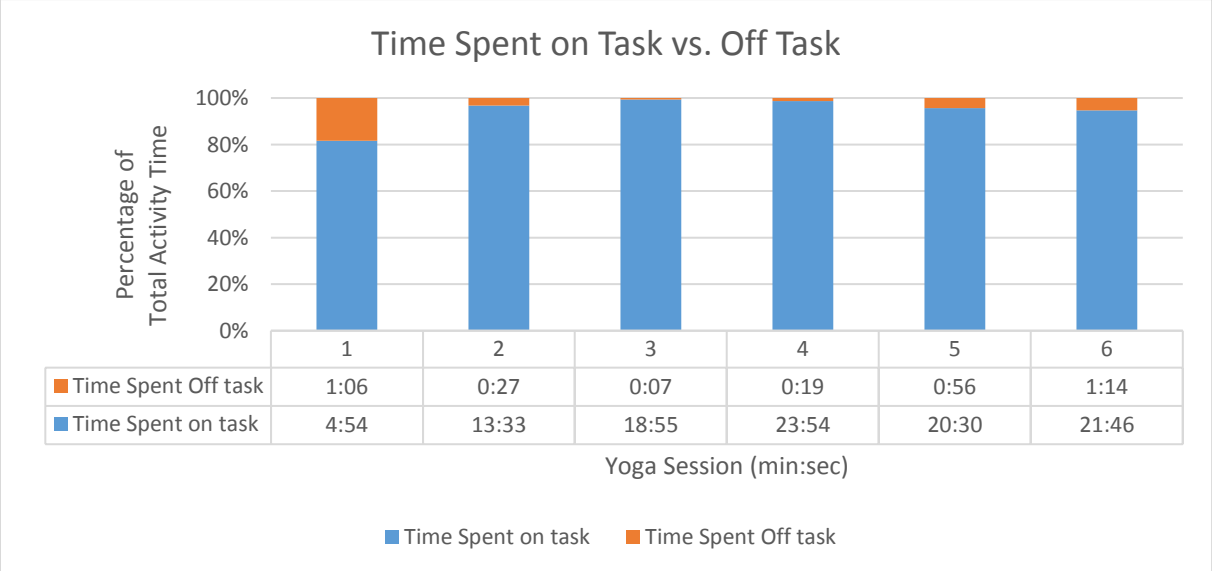

Figure 2. Time Spent on task compared to time spent off task.

Discussion

Time-on-task was measured through the use of a stopwatch and calculated through determining the time spent in purposeful yoga practice vs. the time spent in engaging in self-stimulatory behaviors.

According to the participant's classroom teacher, the participant constantly engages in self-stimulatory behaviors throughout the day. Throughout data collection, it is apparent that time-on-task increased as the yoga program progressed through the lessons. Time-on-task as compared to total activity time increased from session one to session three and then slightly plateaued and began to decrease as environmental distractions increased (Figure 1).

During the first session of the yoga program, a speech language pathology graduate student took pre-test data on the participant's ability to identify and display various emotions (happy, sleepy, confused, and angry) as well as reactions to certain scenarios (How would you feel if you lost your lunch box? How would you feel if you had to eat a frog?). The participant had never met the speech language pathology student prior to baseline testing. He proceeded to ask her various questions that he asks all new people (i.e. "what is your name?" and "when is your birthday?"). These questions were considered socially appropriate. Throughout baseline testing, the participant's eyes wandered and he required minimal cueing to bring him back to task. In the first week, the three breaths (ocean breath, rabbit breath, lion's breath) were identified and taught as well as the first set of three poses (sleep pose, rock, pose, forward bend). The participant was seen touching side of a nearby bench during rock pose, which contributed to his distraction time. He also required a demonstration although he said that he recalled rock pose and sleep pose. The participant looked behind him at his classroom teacher throughout the session, presumably to ensure that his teacher did not leave. The participant's eyes also wandered across the room occasionally. Week one also had the smallest amount of total activity time (6minutes) due to the required baseline testing. However, the participant was on task for 81.67% of the total activity time (Figure 2).

In the second session, the total activity time more than doubled and the participant's time-on-task increased to 96.79% throughout the session (Figure 2). He turned around four times throughout the session, contributing to his distraction time. It appeared as he was checking to see if his teacher was still

in the room. The timer was stopped when the participant started to move his arms, when he looked around, or when he engaged in any other self-stimulatory behaviors (echolalia, body rocking). Most vocalizations were on task although the timer was stopped during non-purposeful verbalizations ("Where is…" and "Who is…"). During this session, there was an environmental stimulus that contributed to the self-stimulatory behaviors, as another student was on the treadmill. The participant again was seen looking around during sleep pose. Although he did not recall the names of the poses from previous sessions, he did recall the names of the breaths which was the focus of week one. Week two focused on the introduction to poses. It was evident that the participant has limited range of motion in his torso and potentially has tight hamstrings as forward bend was difficult, and rock pose was more comfortable.

During the third scheduled yoga session, the total activity time increased to 19:02minutes. Of the total activity time, the participant was found to be on task during 99.39% of the time (Figure 2). When the participant walked down to the gym, he was seen engaging in several self-stimulatory behaviors including arm waving and body rocking. However, once yoga began, he only engaged in seven counts of self-stimulatory behaviors (looking around the room, answering questions that had not been asked yet). The participant verbalized "back" and "happy" many times throughout the session, particularly when asked "where do you feel this pose in your body?" and "how does this pose make you feel?" He tried to answer the question before they were finished being asked which caused some incorrect answers (i.e. saying "happy" to the location of the stretch, and "back" to how the stretch made him feel). The participant struggled with identifying the difference between the location of the stretch in the body and how the pose made him feel psychologically. The participant also preferred to be on his elbows as opposed to his hands which made the table top pose difficult. The participant also said he that he felt Cat/Camel pose in his back, but was unable to arch and round his back. This could possibly be contributed to his sedentary lifestyle. Throughout the day in class, the students are seated and the

participant has noticeably poor posture. In this session, the focus was on stretching the back and so due to these contributing factors, the poses could have put the participant's back in a stressed position.

In the fourth yoga session, the student was on task for 98.69% of the total activity time (24:13minutes) as seen in Figure 2. Two of the participant's classmates were walked in and out of the classroom several times throughout the session. However, the participant showed beginnings of self-regulation of his self-stimulatory behaviors. He was found to be very concerned about the other students and said "hi," "where is…" and "bye" to his teachers and peers as they walked in and out of the classroom. These distractions did not take away from the session, lasted less than a second, and were socially appropriate. The participant was successful in tree pose and was able to put together the following sentence by the end of the session: "When I feel mad, I can do tree pose to feel happy." There was significant knee valgus during chair pose and the participant had his feet turned slightly out, to allow for a greater base of support. When the toes were fixed and pointing forward, the knee valgus increased. Attention was brought to the participant's knees through cueing "watch your knees" and "push your knees out." This cueing helped to diminish the knee valgus slightly.

During the fifth session, the participant showed that he was able to self-regulate himself as he sat quietly and awaited the next direction for up to five seconds. This session also showed that behavior was dependent on environment. Much of the self-stimulatory behaviors (arm waving, non-purposeful verbalization) that the participant engaged in was due to an external stimulus. Moderate to maximal cueing (verbal direction and picture cards) was necessary for 50-75% of the distractions in order to redirect the participant's attention. There was another student in the room during the first 7:26minutes. Of that time, 0:46minutes (10.3%) was spent distracted or engaging in self-stimulatory behaviors. This included vocalization, turning of the head, and moving his fingers. During the remainder of the session (14minutes), the participant only engaged in self-stimulatory behaviors for 0:07mintues, during this time

he moved his hands and vocalized. The participant showed a recognizable improvement during transition periods where there was no task, yet minimal self-stimulatory behaviors.

During the sixth session, yoga took place again in the participant's classroom, where two students had the ability to walk in and out of the classroom. Although there were many environmental distractions (teachers and students walking in, background conversations), the student was on task for 94.64% of the 23:00minute session (Figure 2). The goal of this lesson was to put together a full yoga routine. Again the participant was able to self-regulate his behaviors. He did make socially appropriate comments to his peers as they left the room. The participant had more verbal stimulation (echolalia and non-purposeful verbalization) during this session than others previously but the stimulation did not distract him from completing the task or from the session as a whole. The participant was able to get through the complete yoga program with some self-stimulatory behaviors, including torso stimulation and moving fingers, in addition to non-purposeful verbalization. The participant was still unable to do the Cat/Camel Pose in Table Top pose yet was successful in completing the other poses and all of the breaths.

Conclusion

The Yogi Breaks Yoga Curriculum was a yoga program that was adapted for individuals on the Autism Spectrum.[18] Yoga is used as a therapeutic modality because it promotes physical activity and acts as a coping mechanism for individuals diagnosed with Autism Spectrum Disorder (ASD).[13] Stereotypical and self-stimulatory behaviors are common characteristics of ASD.[1] Due to these behaviors, time-on-task can be compromised because an individual is engaging in these behaviors. Increasing time spent on task and minimizing time engaging in self-stimulatory behaviors is a primary goal for professionals treating individuals with ASD. In a 17 year old, non-Hispanic, Black male with ASD, yoga was used to increase time-on-task from 81.67% to 99.39% by the end of the six session program across nine weeks.

As time-on-task increased, the participant's self-stimulatory behaviors decreased. This showed that he was able to better self-regulate his behaviors and actions. There was a marked improvement during transition periods where the individual was not instructed a specific task but did not engage in self-stimulatory behaviors. The student also engaged in smaller body movements when self-stimming at the end of the program when compared to the beginning. At the start of the program, the participant was seen self-stimming using fully body rocking and loud vocalizations. By the end of the program, the participant self-stimmed by moving his fingers and had fewer counts of non-purposeful verbalizations. The program took place over nine weeks in six yoga sessions. Yoga can be used as an effective treatment modality for adolescents with ASD in order to decrease self-stimulatory behaviors.

Limitations to this study include a small sample size and limited time available for testing. Since the participant was also a participant of the pilot study completed in May 2016, there could have been some recall from the prior exposure to the yoga program. Even though he successfully recalled breaths from fall with minimal visual prompting using picture cards, there could have been some residual learning from the pilot program in May. The study took place in two environments, the fitness room and the participant's classroom at CES. Yoga took place on Wednesday from 9:30 to 10:00am and some Fridays from 12:30 to 1:00pm. The change in location and time could have lead to some error. There were also various environmental stimuli that could not be controlled for (additional people in the room during the session, outside noise, noise over the walkie-talkies). Yoga was also canceled for three planned sessions due to school closings and the participant being absent. Yoga was not able to be conducted on those dates which lead to an uneven amount of time between each session. This lead to some undesirable inconsistency in the program implementation.

Further research would consist of looking at the effects of a longer exposure time to the yoga, including more participants with varying degrees of the disorder. More specific criteria would be needed to define self-stimulation as well as more outside observers to compare data. It would also be

interesting to see the effects of the yoga program on academic activities to see if there was any carry over past the yoga environment. Through this case study, yoga can be used to be an effective treatment modality in adolescents with Autism Spectrum Disorder.

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