Evaluating the Effects of Structured Physical Activity, Free Play Activity and Sedentary Activity on On-task Behavior with Children with Autism Spectrum Disorder

By Alexandra Mercado Baez

(Under the direction of Kevin Ayres)

ABSTRACT

Children with developmental disabilities tend to engage in less physical activity than neurotypical children. In this study, classroom staff implemented physical activities including a structured physical activity (SPA), a free play physical activity (FPA) and a sedentary activity (SA) in a self-contained classroom to increase on-task behavior among children with autism spectrum disorder (ASD) in the context of an alternative treatment design. On-task behavior and problem behavior were observed for three children with ASD. The students engaged in a 10-minute session of physical activity followed by 10 minutes of discrete trial training (DTT). Furthermore, the researcher collected problem behavior as a secondary variable to determine whether there was a relationship between physical activity and problem behavior. Results showed a functional relationship between higher levels of on-task behavior and lower levels of problem behavior in one of the students. These findings suggested that for some students engaging in physical activity before academic instruction might increase on-task behavior.

INDEX WORDS: physical activity, on-task behavior, problem behavior and autism

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TABLE OF CONTENTS

Page

CHAPTER

Chapter 1: Introduction

Physical activity assists with the maintenance of mental and physical health. Obesity among children in the United States has doubled in recent years (Culpepper & Killion, 2018). Children with developmental disabilities are 35% more likely to be obese and affected physically, socially, or emotionally (Polfuss et al., 2019). McCoy, Jakicic, and Gibbs (2016) found that children with developmental disabilities are 60% less likely to engage in physical activity than neurotypical children. Teachers can integrate physical activities into the student's daily schedule at school and increase physical activity among children who have developmental disabilities.

Researchers have evaluated whether physical activity affects on-task behavior during various activities (e.g Ledford et al., 2016, Luke et al., 2014, Mahar et al., 2006, Miramontez & Schwartz, 2016, Nakutin & Gutierrez, 2019). The researchers found that physical activity was beneficial and increased on-task behavior. Mahar et al., (2006), Luke et al., (2014), and Miramontez and Schwartx (2016) evaluated whether physical activity affects on-task behavior during teacher-directed activities and circle time. In addition to determining that physical activity increases on-task behavior, the researchers found that depending on how intense the physical activity was, the child engaged in higher or lower levels of on-task behavior. Further, the researchers found a functional relationship between intensity of the physical activity and the degree of subsequent on-task behavior (Miramontez and Schwartx, 2016). Also, Mahar et al., (2006) determined that the students engaged in lower levels of problem behavior after engaging in physical activity.

Ledford et al., (2016) conducted an experiment that evaluated the effect of low and high effort physical activity on social engagement, academic engagement, and proximal play. Low effort physical activity consisted of the students' playing with toys on the playground. The high effort physical activity consisted of structured exercise in which the teacher provided the students with six different choices of activities and toys, and the student chose the activity that he or she wanted to engage in. The researcher evaluated these data in the context of two alternative treatment designs with an initial baseline condition. The initial baseline condition consisted of the students' participating in recess at the playground as they normally did. Ledford et al., (2016) found that during the high effort (structured) physical activity engagement, proximal play and social interaction were higher than in the other conditions.

Another study by Nakutin and Gutierrez (2019) that evaluated the effect of physical activity on academic engagement in a school setting and analyzed whether physical activity improves executive function and whether teachers recognized physical activity to be a safe or effective intervention. The researchers evaluated these data in the context of multiple baseline designs across subjects. Nakutin and Gutierrez (2019) found that physical activity as a school-based intervention increased academic engagement, executive functioning, and desirable behaviors in students who had autism spectrum disorder.

Therefore, researchers should conduct more research on the effectiveness of classroom-based physical activity on on-task behavior and academic performance (Mahar et al., 2006). Luke et al., (2014) suggested that future researchers should vary the sessions that are conducted during the day and not just during one specific time or activity. Finally, future researchers should consider the amount and type of activity to determine whether physical activity affects the students' engagement in the classroom for on-task behavior (Miramontez &

Schwarz, 2016, Nakutin & Guiterrez, 2019). Therefore, the purpose of the current study was to evaluate the effect of structured physical activity, free play physical activity, and sedentary physical activity on on-task behavior among children who had autism spectrum disorder through an intervention that was implemented by classroom staff in a self-contained preschool classroom setting.

Chapter 2: Methods

Participants

The researcher included three 5 year-old African American students who had special education eligibility category of autism and speech language delay. The students attended a self-contained classroom in a public school that served children who had communication and academic delays and who engaged in problem behavior. The researcher collected permission from the students' parents before the study began. The inclusion criteria were that the students needed to have a special education eligibility category of autism, be in elementary school, have a history of problem behavior, have a history of transitioning between activities without engaging in challenging behavior; also, the researcher needed to report the low duration of on-task behavior in the classroom and the student's ability to complete moderate physical activity.

Sabrina communicated in two to three word sentences. Academically, her program consisted of instructional targets that related to identification of letters and shapes, expressive identification of letter sounds, and body parts. She exhibited generalized motor imitation in relation to the types of activities that were used in this study. On the playground, she engaged in a great deal of physical activity but rarely interacted with peers.

Jonathan showed delays in cognition, social, communication and physical domains. He communicated in three to four words. Jonathan's goal at school was to start using three or four words when verbally prompted. He was able to express his wants for "more", "help" and "my turn." Academically, his program consisted of instructional targets that consisted of receptive

identification of letters and letter sounds, identification of body parts, receptive identification of colors, receptive identification of common objects, and one-step direction.

Selena communicated by using PECS® (Frost & Bondy, 2002) and used one word to communicate. Academically, she worked on skills, such as imitation, receptive identification of common objects, one-step directions, and receptive identification of colors. She mastered goals, such as put in, come here, sit down, give me, and clean up. Selena's academic structure consisted of identifying one target at a time in an array of three, and whenever she mastered that target, she moved to the next target. During bathroom trips, Selena was independent by exchanging the picture to communicate when she needed to use the bathroom, walking to the bathroom, and engaging in all of the steps independently. On the playground, she engaged in dancing, running around the playground, and using the swings, but rarely interacted with other peers.

Settings and Materials

The study took place in a self-contained preschool classroom in the Southeastern region of the United States. The free play physical activity (FP) occurred on the school's playground which included a variety of recreational equipment such as swing sets, slides, and three playhouses. The structured physical (SPA) activity occurred in an empty enclosed courtyard, and only had materials for the structural physical activity. The sedentary physical activity (SA) occurred in the classroom in 6 by 9 ft space called indoor centers. These spaces contained a variety of toys, such as dolls, cars, trucks, dinosaurs, kitchen appliances, and Legos. For work sessions, the researcher randomized five mastered tasks for each student. The data collector used an iPad to record sessions and used an application named Countee to collect data (Peic & Hernández 2016).

Response Definitions

On-task behavior was defined as the student engaging in the activity by having his or her face and eyes oriented towards the teacher and/or materials and keeping their bottoms in the chair with a two second onset and offset. Each student had predefined problem behaviors (listed below) and when they occurred, the researcher immediately scored those behaviors as off-task behavior until on-task behavior criteria was met with a two second onset. The researcher measured on-task behavior by using total duration (Ledford & Gast, 2018). Total duration consisted of starting on-task behavior key each time the student engaged in on-task behavior with a two second onset and stopping the on-task behavior key when the student stopped engaging in on-task behavior with a two second off-set. The data collector recorded problem behavior as a secondary dependent variable to determine any relation between problem behavior and the type of physical activity during the work session. The data collector recorded the sessions and used Countee (Peic & Hernández, 2016) to record on-task behavior and problem behavior (Leford & Gast, 2018).

Sabrina engaged in problem behaviors including elopement, headbutting, disruption, and screaming and crying. Headbutting was defined as any instance or attempt in which the student charged her head 6 inches or more in the direction of another individual across a duration of no more than 3 seconds. Bitting was defined as any instance or attempt in which the students' teeth or lips came in contact with another individual where a piece of another individual's skin passed the plane of the student's mouth. Selena and Sabrina engaged in screaming/crying. Screaming/ crying was defined as any vocalization produced by words or sounds above conversation level with or without tears.

Selena and Jonathan engaged in problem behaviors including hitting, kicking, scratching, pushing, and elopement. Hitting and kicking were defined as any instance or attempt in which the student's hand (open or closed fist) or foot came into contact with another person from a distance of 3" or more (each hand/foot is one instance). Scratching was defined as any instance or attempt where the student's nail came into contact with another person. Pushing was defined as any instance or attempt where the student displaced another person with his or her body.

For all the students, elopement was defined as any instance or attempt where the student moved more than an arm's reach from his seat/area or more than an adult's arm's reach when away from the table or left her classroom when not instructed to do so. The researcher defined disruption as any instance or attempt in which the student held an item in one or both hands and released the object through the air for a distance of 3 inches or greater and/or swiping the materials from one side to another on the table and/or bites, ripes or otherwise damage the materials outside of appropriate toy play.

Reliability and Fidelity

The researcher collected inter-observer reliability data during 30% of sessions via recorded video. Before data collection began, the researcher explained the definitions for on-task behavior and discussed the different behavior definitions with the data collector. Data were collected individually by watching the students'' videos at different times. The researcher had the independent observer practice collection of data until the observer and researcher reached an IOA agreement of 90%. The researcher collected data from the recorded videos presented to the secondary data collector. Three data collectors recorded IOA data for the students. The data collector recorded an interobserver agreement of 33% for all sessions per student per condition. The researcher used gross reliability to calculate interobserver reliability. The researcher divided

small counts over large counts of IOA agreement for on-task behavior. Sabrina's average agreement for on-task behavior was 92% for SPA, 94% for SA, and 95% for FPA. As a secondary dependent variable, problem behavior average agreement was 100% for SPA, 83.5% for SA, and 89% for FPA. For screaming and crying, interobserver average agreement was 95% for SPA, 87.5% for SA, and 78.5% for FPA. Selena's interobserver average agreement for on-task behavior was 90% for SPA, 87% for SA, and 96% for FPA. For problem behavior interobserver average agreement consisted of 100% for SPA, 100% for SA, and 83% for FPA. Interobserver reliability for screaming and crying was 100% for SPA, 60% for SA, and 100% for FPA. Jonathan's average interobserver agreement was 83% for SPA, 82% for SA, and 91% for FPA. For problem behavior, reliability was 100% for SPA, 43% for SA, and 94% for FPA.

Procedural fidelity data were collected in a minimum of 20% of sessions per condition per student. The data collector recorded procedural fidelity data by using a checklist that included all the procedural steps in which the data collector scored commission and omission errors. The researcher calculated the percentage of steps correctly followed by the possible steps and multiplied by 100 (Ayres & Gast, 2010). Procedural fidelity for observed sessions was 99.6% due to the researcher's missing one step during the procedures. The independent observer collected commission errors when the implementer added a new step to the treatment that was not part of the protocol. Also, the independent observer collected omission when the implementer failed to implement a step of the protocol.

Experimental Design

An alternating treatment research design was used to compare the effect of structured physical activity, free play physical activity, and sedentary activity with students' on-task behavior during a discrete trial training session immediately following the treatment (as in

Miramontez & Schwartz, 2016). The researcher conducted three to four sessions with sedentary activity as a baseline condition before starting the intervention. During the intervention, the researcher alternated the three conditions (structure, free play and sedentary activity) across sessions and days (Ledford & Gast, 2018).

General Procedures

In each condition, the researcher took the student to the designated area (courtyard, recess, centers). The researcher stated the contingencies as specified in condition-specific procedures that are included below and then started a 10- minute timer. Then, she delivered praise every 10-20 seconds if the student was engaging in physical activity. If the student was not engaging in physical activity, which meant that the student was not moving or engaging in any available activities, the researcher waited five seconds and prompted the student to play with the toys using the prompting hierarchy (verbal, model, physical prompt). Once the activity session ended, the researcher prompted the student to go to the classroom. The verbal prompts were defined as encouragement for the student to engage in the activity by using phrases such as "let's go, you can jump on the trampoline", " you are doing a great job." The model prompts were defined as the researcher engaging in the physical activity and showing the student how to do the exercise. The researcher defined physical prompts as providing physical guidance or assistance that would help the students to engage the activity (Luke et al., 2014).

Antecedent Activity Conditions

Free Play Physical Activity

Researchers conducted the free play condition at the school's playground. The students had the opportunity to run around the playground and engage in an activity of their choice for 10 minutes. The researcher showed the timer to the students and stated the contingency: "When the

timer goes off, we are going back to the classroom to do some work.” When the timer went off, the researcher took the students to the classroom.

Structured Physical Activity Procedure

In the structured physical activity condition, the students spent 10 minutes outside in the courtyard, but the researcher prompted different types of exercises, such as jumping on the trampoline, hula hoop jumping, and chasing. The researcher provided the student with pictures of the various activities and asked the student to pick one. Jumping on the trampoline consisted of the researcher’ s placing the trampoline in the corner of the courtyard and stating the contingency:“ You can jump on the trampoline until the timer goes off.” Jumping in hula hoops consisted of the researcher placing hula hoops on the ground, with one cone on one end and another cone on the other end, and stating the contingency: “You can jump the hula hoops until the timer goes off.” Chasing consisted of the researcher stating the contingency: “ If you want me to chase you, you can say chase me.” The researcher set a 10- minute timer and stated the contingency: “When this timer goes off, we are going back to the classroom to do some work.” Then, the researcher will set a two- minute timer for each one of the activities that was selected. When the two- minute timer ended, the researcher showed the student the visuals and asked them to choose another activity. When the student made a selection, the researcher walked with them to the activity of their choice and stated the contingency: “I'm going to start the timer and when the timer goes off, you can choose another activity.” If the student engaged in problem behavior, the researcher responded using classroom specific procedures, and stated the contingency: whenever the timer goes off, you can choose another activity". When the 10-minute timer ended, the researcher took the student to the classroom.

Indoor Centers

Indoor centers served as sedentary physical activity contrast to the structure and free play times outside. During this condition, the student went to a space designed for them to interact with different toys. The researcher stated the contingency "I'm going to start the timer and when the timer goes off we can go do some work".

Work Sessions

Immediately after the antecedent conditions, the researcher took the child to the table and started working with the student in a discrete trial training session (DTT). The researcher worked with the students on their randomly selected mastered goals. The goals were considered mastered when the student independently identified the target for three non-consecutive days within five days. These goals were selected from their Individualized Educational Program (IEP). Once the student sat on the chair, the researcher started a 10 minutes timer. The researcher presented the tasks to the student every five seconds. If the student did not respond to the discriminative stimulus presented by the researcher, then she provided the three step prompting procedure (verbal, model, full physical) within five seconds between each prompt. If the student engaged in problem behavior, the researcher stated the contingency "when you have ready hands, you can work for fun things."Once the student was calm, the researcher continued the activity and proceeded to the next steps. If the student eloped from the table, the researcher responded by guiding the student back to the table. When problem behavior occurred, the researcher stated the contingency "when you sit in the chair, you can work for fun things". Once the student was seated, the researcher resumed the procedure. If the student was compliant, the researcher provided praise for being compliant. When the 10-minute timer went off, the researcher took the student to their designated area and praised the student for working.

Chapter 3: Results

Figure 1 shows Jonathan's responding to on-task behavior and problem behavior during baseline and the implementation of physical activity. In baseline, Jonathan's on task behavior was low (median = 50.67%) with a decelerating trend whereas problem behavior was high (median= 34) in an accelerating trend. During the alternating treatment conditions, Jonathan engaged in lower levels of on-task behavior during the SA (median= 22.5%) with a stable trend, and high levels of on-task behavior with an accelerating trend during the FPA (median =36.67%) and consistently higher levels of on-task behavior with an accelerating trend during the SPA sessions (median =61%). However, upon looking at the first two-minutes of the sessions, the data reveal that the transitions involved more concentrated problem behavior at the beginning of the session for the FPA (median= 12) and low levels of problem behavior during the SPA (median=2).

Figure 3 shows Selena's responding to on-task behavior and problem behavior during baseline and the alternating conditions. Selena engaged in higher levels of on-task behavior (median= 62.66%) and lower levels of problem behavior (median= 35.67) during the initial baseline condition than during the alternating conditions with some overlap between all conditions. During the alternating conditions, on-task behavior was the lowest during the SA (median= 50%) with a stable trend and the highest when compared to the whole session. However, Selena's on-task behavior was higher during the first two-minutes of FPA sessions (median= 68.33%) and the lowest during SPA sessions (median= 58.33%).

Figure 5 shows Sabrina's on-task behavior and problem behavior during baseline and the alternating conditions. In the baseline, Sabrina engaged in low levels of on-task behavior

(median =37.16%) and decelerating. During the alternating conditions, on-task behavior was the highest during the SPA (median= 23.5%) and the lowest during the SA (median= 21.17%) with some overlap in the data between baseline and the intervention phases. However, upon looking at the first two minutes of the sessions, Sabrina engaged in higher levels of screaming and crying during the first two minutes of the session for the SA (median= 37.5%) compared to the other sessions.

Chapter 4: Discussion

The purpose of this study was to evaluate the effects of structured physical activity, free play physical activity, and sedentary activity on on-task behavior and problem behavior among children with ASD in a self-contained classroom. The researcher used total duration to collect on-task behavior, and collected problem behavior by using frequency and duration. The students engaged in one of the physical activities for 10 minutes and immediately after the physical activities, the students engaged in a 10-minute work session. During alternating conditions, Jonathan engaged in higher levels of on-task behavior and lower levels of problem behavior during the structured physical activity. In contrast, physical activity did not have an effect on on-task behavior and problem behavior for Selena and Sabrina. The researcher collected data in the first 2 minutes of the session to observe if there was a relationship between the transition between physical activity to the work session, on-task behavior, and problem behavior. The researcher did not find a relationship between the first two minutes of the sessions and on-task behavior. However, Sabrina engaged in higher levels of screaming and crying during the transition from to center to work than during the other transitions. These results suggest that for some students engaging in a structured activity prior to engagement in academic instruction may increase their engagement in the activity; however future research would be needed to replicate these results.

The study faced limitations during the course of implementation that are important to address. The first limitation is that the dependent variable is difficult to observe and could easily be affected by observer bias and drift. Even though interobserver agreement for on-task behavior

ranged from 80% to 95%, future researchers should consider defining on-task behavior differently to obtain consistently higher levels of reliability. A second limitation was that the average interobserver agreement was low during problem behavior and screaming and crying because the student engaged in very low levels. The third limitation was that interobserver agreement was below 80% during the secondary dependent variable due to the frequency and duration having low level of occurrences. The fourth limitation was that the student engaged in the activity by themselves and did not have interaction with other students during the physical activities. The final limitation is that the researcher only provided neutral praise to the students for sitting in their chair and for engaging in the academic activity. The researcher wanted to determine whether physical activity was the only variable affecting on-task behavior.

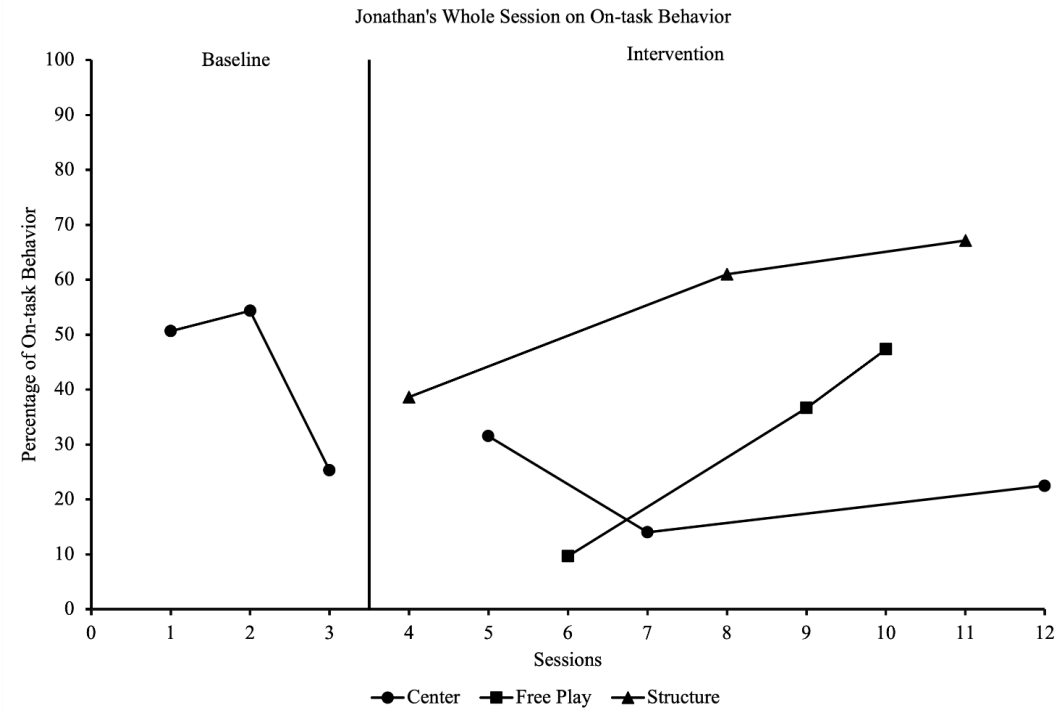
The current study adds to the existing literature by showing that for some students structured physical activity is an effective strategy that increases on-task behavior and reduces problem behavior. Researchers should conduct more research in physical activity and on-task behavior, and find the most effective intervention to implement in classrooms. Teachers should find a way to incorporate exercises where the students can choose and engage independently for a period of time. The teachers must educate him or herself in terms of the different advantages that physical activity holds for students with ASD and how physical activity can help the students become more engaged during group and one-on-one activities.

Future research in this area could include conducting physical activity and work sessions for a longer period of time and determining whether the student engages in higher levels of on-task behavior during shorter or longer sessions. Also, researchers should consider providing a preferred reinforcer to the student in a variable interval (VI) 20 schedule to the session, and observe if the levels of on-task behavior increase drastically or stay at the same levels as the

condition where no preference was provided. Lastly, researchers should examine conducting this intervention with several students at once and see if the inclusion of more students helps the student to increase their on-task behavior.

Figure 1:

Jonathan's percentage of on-task behavior and frequency of problem behavior during the whole session.



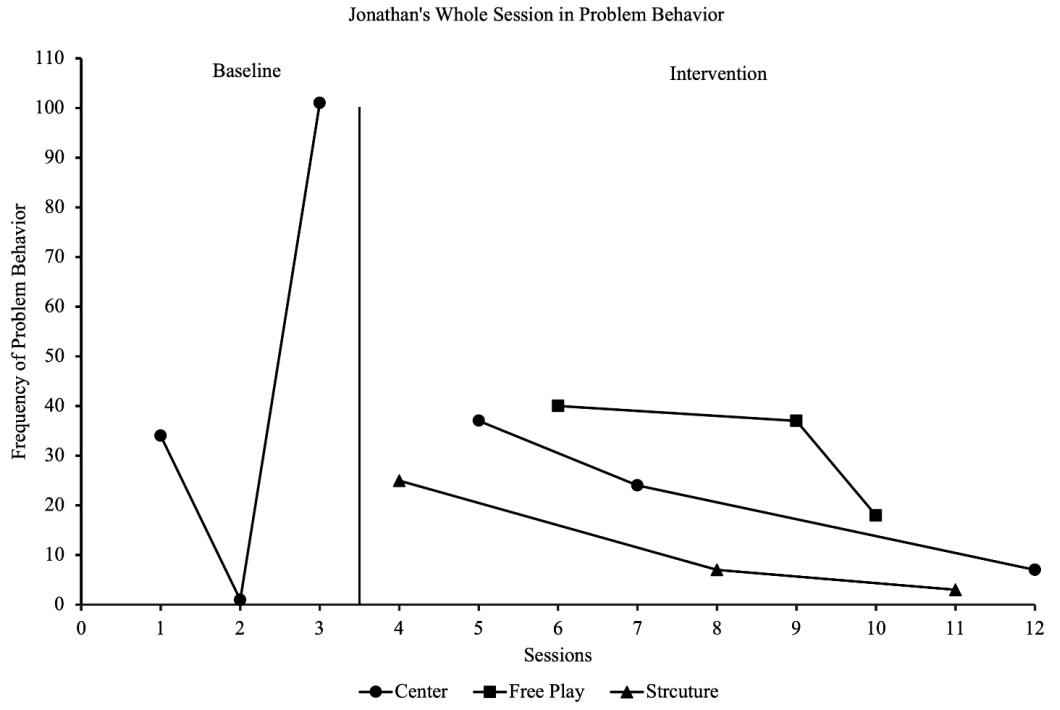


Figure 2

Jonathan's percentage of on-task behavior and frequency of problem behavior during the first two minutes of the sessions.

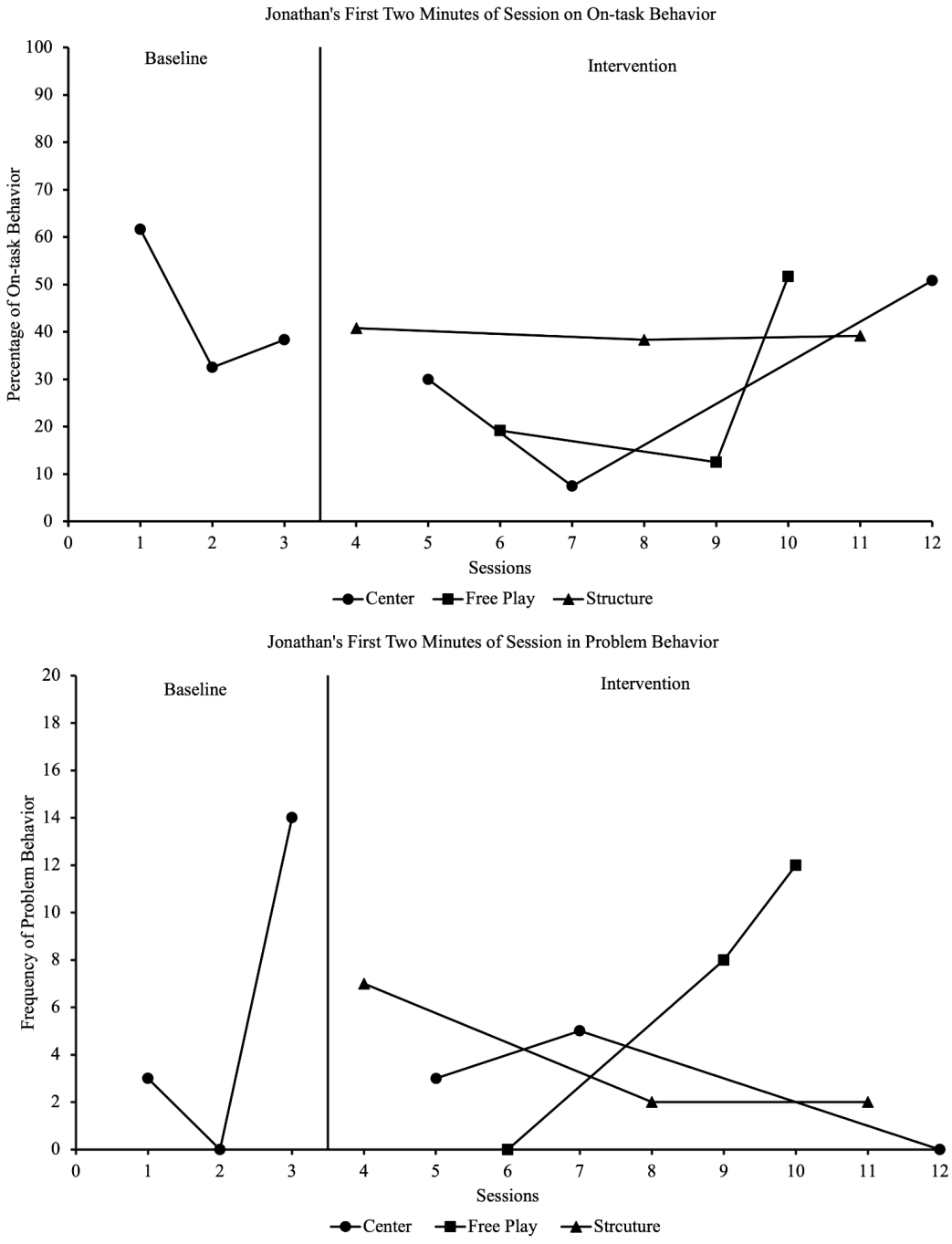


Figure 3

Selena's percentage of on-task behavior and screaming and crying and frequency of problem behavior during the whole session.

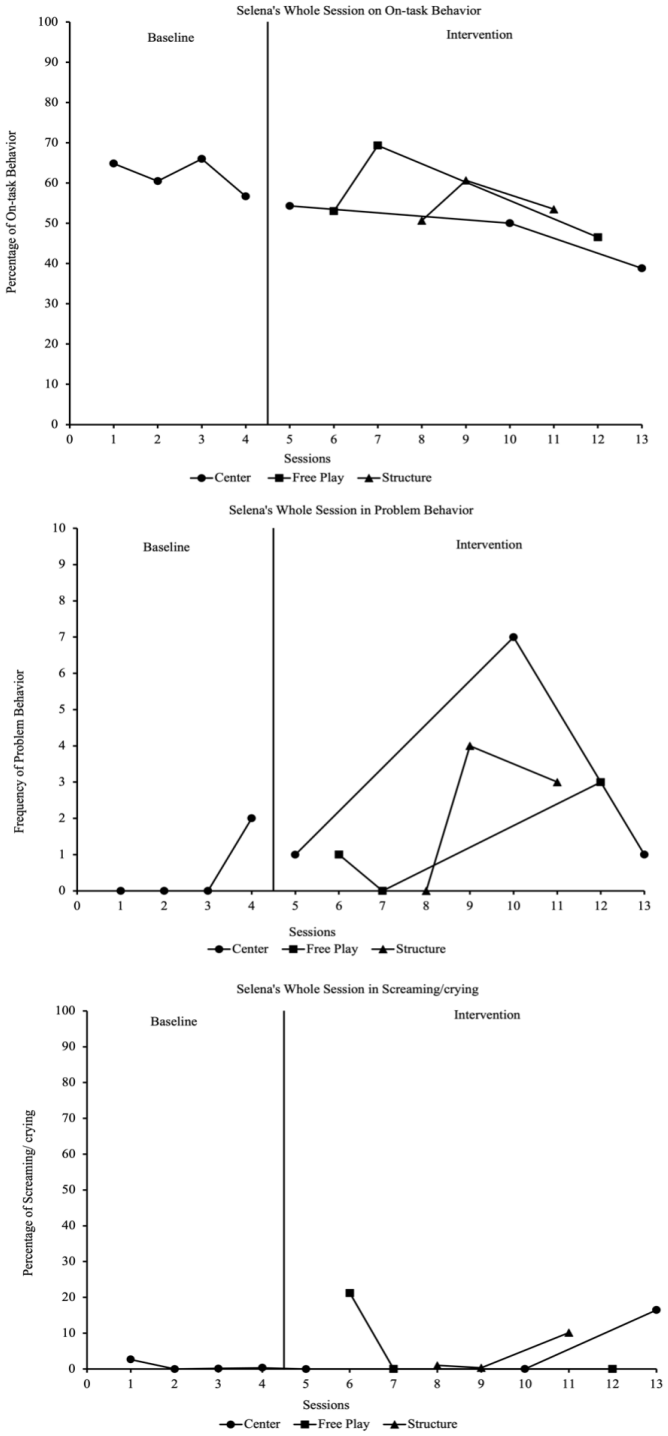


Figure 4

*Selena's percentage of on-task behavior and screaming and crying and frequency of problem behavior during the first two minutes of the sessi*ons.

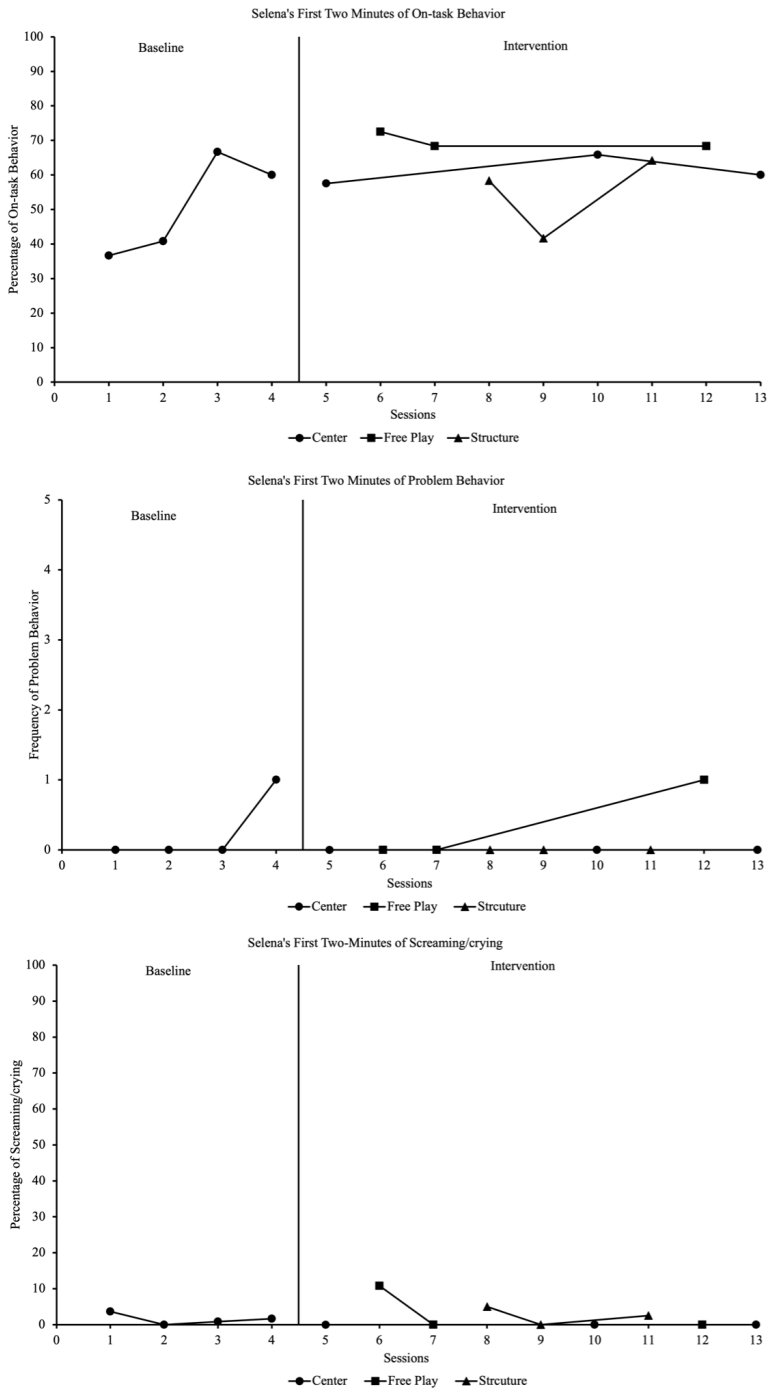


Figure 5

Sabrina's percentage of on-task behavior and screaming and crying and frequency of problem behavior during the whole sessions.

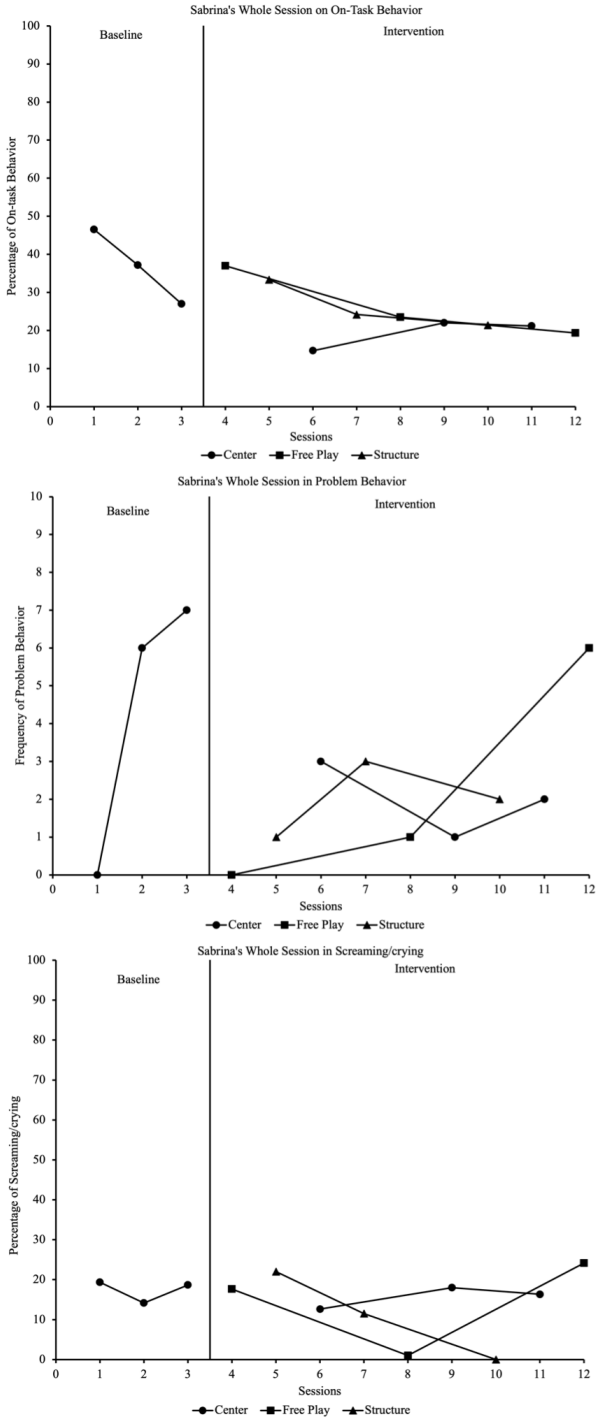
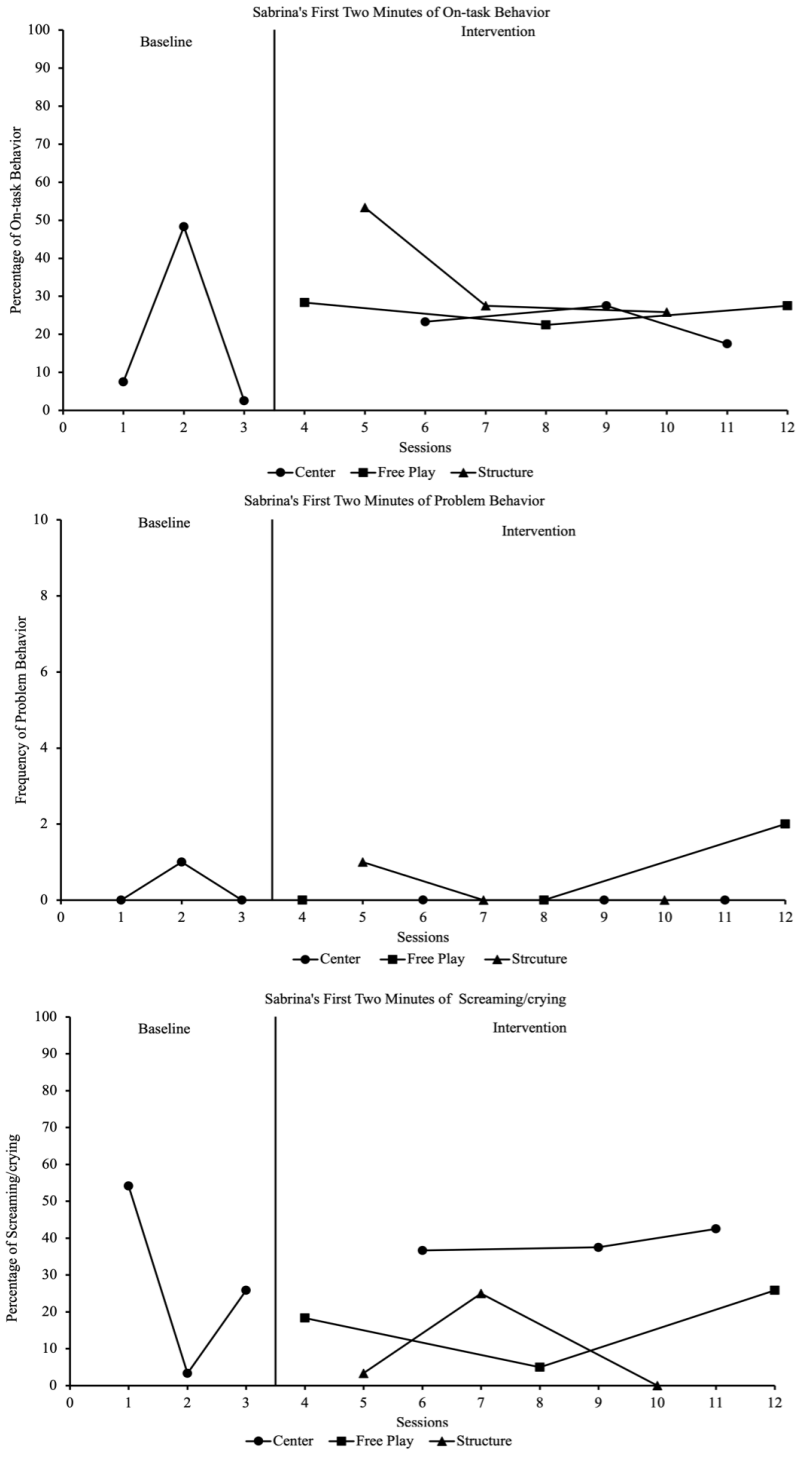


Figure 6*: Sabrina's percentage of on-task behavior and screaming/crying and frequency of problem behavior during the first two minutes of the sessions.*



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