Effects of Activity Schedules on Challenging Behavior for Children with Autism

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Abstract

This study examined activity schedules as an intervention to decrease challenging behavior and increase academic engagement during work tasks scheduled after free play activities in three boys diagnosed with autism spectrum disorder (ASD). Functional analysis results indicated all participants' challenging behavior was maintained, at least in part, by access to tangibles. No differences were noted in challenging behavior nor in academic engagement between baseline and activity schedule conditions. Results suggest that activity schedules are not effective as a stand-alone intervention for children with ASD with tangibly maintained challenging behavior.

***Keywords*:** activity schedules, challenging behavior, autism spectrum disorder

Effects of Activity Schedules on Challenging Behavior in Children with Autism

Autism spectrum disorder (ASD) is a developmental disability marked by impairments in social communication as well as restricted or repetitive patterns of behavior, interests, or activities (American Psychiatric Association, 2013). While not a part of the diagnostic criteria for autism, challenging behavior is common in this population, often evoked by a number of factors such as deficits in expressive language (Carr & Durand, 1985) or interruption of stereotypic behaviors (Green & Striefel, 1988). Individuals diagnosed with ASD often display challenging behavior when transitioning between activities, faced with unpredictable events, or changes to routines (Sterling-Turner & Jordan, 2007). For this reason, interventions have been developed in an effort to decrease challenging behaviors associated with transitions from one task to the next, one of which is the use of activity schedules (e.g., Dettmer, Simpson, Myles, & Ganz, 2000; Dooley, Wilczenski, & Torem, 2001).

Activity schedules are used as an antecedent intervention to provide information, organize a daily schedule, or as a way of signaling upcoming activities (McClannahan & Kratz, 1999). Furthermore, these are used to increase an individuals' independence

within a particular setting (Hume & Odom, 2007). Typically, activity schedules are comprised of written directives, pictures, or a combination of the two detailing the number of activities and the order in which these are to be completed (McClannahan & Kratz, 1999). It is hypothesized that the presentation of this information in advance will increase predictability, which may serve to increase compliance across activities (Flannery & Horner, 1994; Flannery, O'Neill, & Horner, 1995). However, the exact operant mechanism impacting behavior when activity schedules are in place has yet to be thoroughly ascertained. Regardless of this, activity schedules are a popular intervention with high social validity among teachers and clinicians given the minimal cost and training needed to implement it (Lequia, Machalicek, & Rispoli, 2012).

Another reason for the intervention's popularity for children with ASD is the effectiveness of activity schedules across various response classes and settings. In a review (Lequia, Machalicek, & Rispoli, 2012) examining activity schedules for children with ASD most participants were reported as demonstrating a decrease in challenging behavior (e.g., Schmit, Alper, Raschke, & Ryndak, 2000), while some participants also displayed an increase in adaptive, functional behaviors, such as on-task engagement (e.g., Hall, McClannahan, & Krantz, 1995). In addition, several studies have noted increases in compliance during activities across environments children with ASD regularly encounter with the use of activity schedules (Dettmer et al., 2000; Waters, Lerman, & Hovanetz, 2009).

Although the aforementioned review found activity schedules to have a positive influence on both challenging and adaptive behavior during transitions, Lequia and colleagues (2012) found that activity schedules were often utilized as one component of a multi-component treatment. Additional treatment components such as differential reinforcement, extinction, and prompting were used in combination with activity schedules. Interestingly, the degree to which these additional components contributed to the success of activity schedules is unknown as there is limited research examining the effectiveness of activity schedules as a stand-alone intervention. Even the National Standards Project published by the National Autism Center (2015) indicates activity schedules are an established, evidence-based intervention for self-regulation purposes. Yet this information is supplemented by a clause noting that activity schedules are often used in conjunction with additional interventions, like reinforcement (National Autism Center, 2015).

Though largely demonstrated as effective, it has been suggested that activity schedules may in fact evoke challenging behaviors in some situations. For example, McCord, Thomson, and Iwata (2001) found that providing a 2 min advance notice of transitions via visual supports (i.e., activity schedules) and vocal instructions (i.e., countdowns) had little effect on escape maintained self-injurious behavior (SIB). On the other hand, differential reinforcement of alternative behavior when combined with extinction and response blocking (i.e., physically preventing SIB) produced a long-term decrease in SIB during transitions for both participants rather than the advance notice of transitions (McCord, Thomson, & Iwata, 2001). In this case challenging behavior was maintained by escape, but the literature in relation to activity schedules for individuals with ASD is

limited concerning both escape and tangibly maintained challenging behavior (Lequia, Machalicek, & Rispoli, 2012)

From the available research there appears to be a lack of information on the utility of activity schedules for children with ASD, specifically as a stand-alone intervention. Furthermore, there is minimal evidence on the effectiveness of activity schedules for children with ASD needing substantial academic and behavior support with escape and tangibly maintained challenging behaviors, specifically during typical classroom transitions between activities. Therefore, the purpose of this research was to examine the effects of an activity schedule for children diagnosed with ASD who engaged in tangibly maintained challenging behavior. This study addressed two questions: (a) does an activity schedule influence challenging behavior during work tasks after playing with a high preference item and (b) does an activity schedule alter academic engagement during work sessions that follow play with high a high preference item?

Method

Participants

Three children diagnosed with ASD who engaged in challenging behavior participated in this research. All participants were previously diagnosed by an outside qualified physician, received special education services in public schools, and had 1 hr of applied behavior analysis (ABA) therapy at a university-based clinic twice weekly. Pertinent characteristics of the participants, operational definitions of challenging behavior and academic engagement, as well as activities used throughout the study are available in Table 1. (*see* Table 1 after References section)

Tito was a 12-year-old male who spoke using three- and four-word phrases; however, these words were often not clearly articulated. In addition, he frequently engaged in vocal stereotypy and repetitive body rocking. Tito engaged in SIB (i.e., head hitting) as well as disrobing, hitting others, and hitting objects (i.e., table, wall). During the play session Tito would play a game or watch videos on the iPad®. In the work session, he was required to read a Grade 3 reading level book out loud as this was one of his ABA therapy goals that had not reached the mastery criterion.

Rocco was a 10-year-old male who spoke using three- to four-word phrases, which typically included previously heard phrases. Rocco engaged in multiple topographies of challenging behavior that often occurred together including aggression (i.e., hitting others) and SIB (i.e., hitting head and chest) as well as noncompliance (i.e., falling to the floor, saying "no"). During the play session Rocco would draw pictures using a whiteboard and dry erase marker. In the work session, he was required to complete two digit addition and subtraction math problems using a pencil as this was one of his ABA therapy goals that had not reached the mastery criterion.

Luca was a 5-year-old male with an additional diagnosis of a speech delay and a vision impairment in one eye. He used three- to four-word phrases and word approximations to communicate. Luca's challenging behaviors included screaming and, at times, falling to the floor. During the play session Luca would watch videos on the iPad®. In the work

session, he was required to color a page in a coloring book using crayons as this was one of his ABA therapy goals that had not reached the mastery criterion.

Setting and Materials

All sessions were conducted at a university-based ABA clinic in therapy rooms that consisted of a child-sized table and chair. Additionally, experiment-specific materials were available, including work tasks and preferred items for use during sessions. One highly preferred item for each participant was identified via a paired choice preference assessment (Fisher et al., 1992). One work activity was seleted for each participant via therapist interview. Specifically, a task in which the participant had demonstrated some independence, but had not reached mastery criterion was selected. If multiple tasks were available, the therapists was asked to select the task most frequently associated with challenging behavior.

One to four sessions were conducted per day and each were recorded using a videocamera, which was placed in an inconspicous location in the room. One to three experimenters were present in the room to implement the procedures and collect data during each session.

Activity schedules were individualized for each participant based on preferred items and work tasks and laminated for re-use. At the top of the page the activity schedule was labeled with the participant's name (i.e., "Luca's Activity Schedule"). Photographs of the preferred items and work tasks were taken prior to procedures being implemented. The picture of the preferred item was placed at the top of the page with the name of it directly to the right. Beside the name was a square outlined in black, the exact size of the picture, used to check off activities on the schedule with a black dry erase marker at the completion of a task. For example, Luca had a picture of the iPad® with the word "iPad" written next to it, followed by the outlined square. Beneath the preferred item was the picture of the work task, the name of the work task, and the same outlined square. The size of these items were identical to the preferred item line. For Luca's schedule this was a picture of crayons and a page from a coloring book followed by the word "Color" and the outlined square. Nothing else was included on the schedules.

Experimental Design

An ABABAC reversal design was implemented in this study. The following conditions were evaluated across participants including (a) Baseline, (b) Activity Schedule, and (c) Activity Schedule with Reinforcement.

Measurement and Interobserver Agreement

Data were collected on challenging behavior and academic engagement using a 10 s partial interval procedure across all phases of the study by graduate students specializing in ABA. Data collectors were trained regarding the operational definitions of challenging behavior and academic engagement for each participant. Target behaviors were only collected during work tasks as neither challenging behavior nor academic engagement occurred during play.

Interobserver agreement (IOA) was calculated using an interval-by-interval method. The number of intervals in which both observers agreed (occurrence plus nonoccurrence) was divided by the total number of intervals (agreements plus disagreements) and multiplied by 100%. IOA was conducted on 100% of functional analyses across participants. Mean IOA was 99.9% (range: 99-100%). IOA was measured on 100% of all baseline and intervention conditions across participants. Mean IOA was 94% (range: 70-100%) for challenging behavior and 96% (range: 77-100%) for academic engagement.

Treatment Fidelity

Treatment fidelity data were collected for at least 30% of sessions for each participant. A procedural task analysis was developed for each phase of the study with the experimenter behaviors operationally defined. Treatment fidelity was calculated by dividing the number of procedural steps completed correctly by the total number of procedural steps for the condition and then multiplying by 100%. The mean treatment fidelity in baseline conditions was 100%. In intervention conditions of this study treatment fidelity was 98% (range: 96-100%).

Procedure

Gilliam Autism Rating Scale – 3. The *Gilliam Autism Rating Scale–3* (GARS–3; Gilliam, 2014) was completed by the participants' ABA therapist to provide additional evidence for an ASD diagnosis as well as a descriptor for the level of support required in order to provide more information related to each participants' functioning. The Autism Index score notes the probability of an individual being diagnosed with autism. Scores less than 54 indicate an unlikely diagnosis of ASD, scores ranging from 55 to 70 indicate a probable diagnosis, and scores ranging from 71 to greater than 101 indicate a very likely diagnosis.

Severity level estimates the level of support needed, which corresponds to the *Diagnostic and Statistical Manual of Mental Disorders 5* (DSM 5; American Psychiatric Association, 2013) criteria for ASD diagnoses including Level One – Minimal Support Required (Autism Index between 55 and 70), Level Two – Requiring Substantial Support (Autism Index between 71-100), and Level Three – Requiring Very Substantial Support (Autism Index greater than 101). The greater the Autism Index score, the more support an individual will need in addressing social communication and restricted or repetitive behaviors. Tito received a score of 114 and Rocco received a score of 106 on the Autism Index, indicating a need for Level Three support. Luca received a score of 94 on the Autism Index, indicating a need for Level Two support.

Functional analysis. In order to identify the function of challenging behavior, an analogue functional analysis was completed with each participant using procedures similar to that of Iwata, Dorsey, Slifer, Bauman, and Richman (1994). A multielement research design was used with sessions lasting 5 min in duration including attention, demand, play, and tangible conditions. An alone condition was not evaluated given the descriptive data indicated target behaviors were mediated by social reinforcement.

Baseline. Baseline consisted of two conditions, play and work. No activity schedule was used. During the play session the participant was told "You can play with [the preferred activity]." The researcher was within 2 ft of the participant at all times and provided verbal attention every 10 s. At the end of 5 min the participant was told, "Play time is over. It's time to work." If the preferred activity was not handed to the researcher (i.e., the iPad® or dry erase marker), it was removed from the reach of the participant and placed out of view.

The work session was then immediately implemented, which consisted of the participant given the instruction specific to his academic task. For example, Tito was presented a story book and told, "It's time to read out loud." The experimenter was within 2 ft of the participant at all times and provided least-to-most prompting when necessary for task completion or error correction (Duker, Didden, & Sigafoos, 2004). For example, this prompting included pointing to a word Tito pronounced incorrectly. If he did not say it correctly the experimenter would say the first letter of the word aloud. If he still did not correctly pronounce the word, the experimenter would say the entire word aloud. No reinforcement was provided for correct responding with the task. Additionally, all challenging behavior was ignored.

Activity schedule. The intervention was identical to the baseline phase except for the use of the activity schedule. At the beginning of the play session the participant was presented the schedule and told "First you can play with [the preferred activity] and then it will be time to work." The schedule was left on the table and visible to the participant at all times. The play condition then proceeded as in baseline. At the end of 5 min the participant was told, "Play time is over. Let's check it off the schedule." and a checkmark was placed on the activity schedule in view of the participant. The experimenter then directed the participant's attention to the next task on the activity schedule and said, "Now it's time to work." The work session then proceeded as in baseline. At the conclusion of 5 min in the work session the participant was told, "Work time is over. Let's check it off the schedule." A check mark was placed in the box next to the activity on the schedule in view of the participant and the session was ended.

Activity schedule with reinforcement. The procedures for this phase were identical to the Activity Schedule phase with one exception. Reinforcement in the form of verbal praise related to work task completion was provided on a variable interval (VI) schedule. The schedule of reinforcement was determined based on the average occurrence of challenging behavior displayed per minute during both Baseline and Activity Schedule phases. The average was then divided by two to determine the reinforcement schedule. This was done in order to provide a rich schedule of reinforcement. For example, Rocco engaged in challenging behavior on average every 30 s; therefore he was reinforced on a VI 15 s schedule for work task completion (i.e., about every 15 s Rocco was provided verbal praise for completing a math problem). The purpose of the activity schedule with reinforcement phase was to determine the possibility of low levels of challenging behavior and high levels of academic engagement. In other words, to determine if the

behaviors were subject to change given the availability of simple verbal praise as reinforcement.

Results

Functional Analysis

The results of Tito's functional analysis are available in the top panel of Figure 1. Aggression was displayed only in the tangible conditions of the functional analysis. The mean percent of intervals with challenging behavior was 0%, 0%, 0%, and 43% across attention, demand, play, and tangible conditions, respectively. The level of challenging behavior exhibited in the tangible conditions led to the conclusion that aggression was maintained by access to a preferred item.

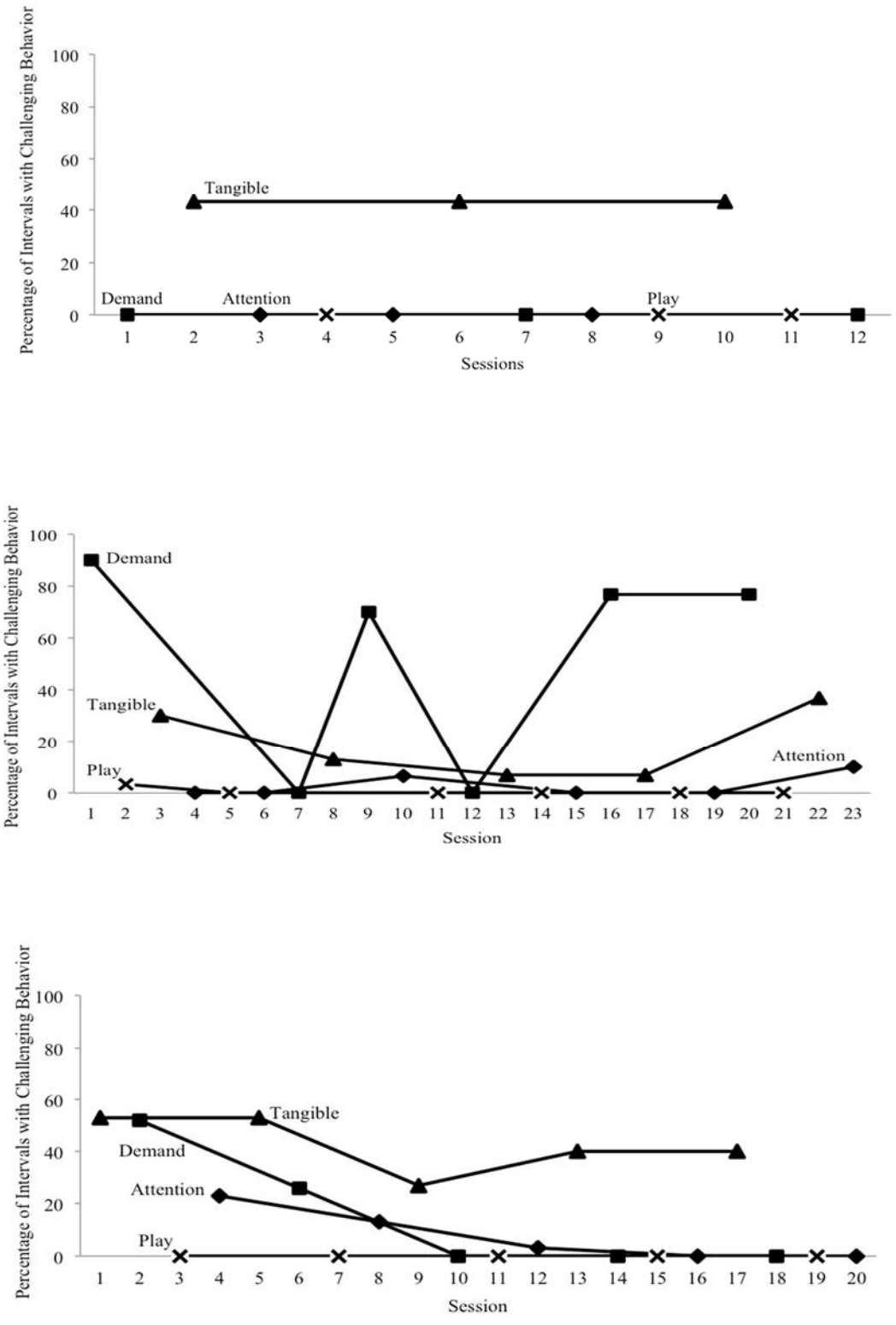

Figure 1. Functional analysis results of Tito, Rocco, and Luca respectively.

The results of Rocco's functional analysis are available in the middle panel of Figure 1. For Rocco aggression and noncompliance were highest in demand and tangible conditions. The mean percent of intervals with challenging behavior was 2% (range: 0-10%), 47% (range: 0-77%), 0%, and 17% (range: 7-30%) across attention, demand, play, and tangible conditions, respectively. The variability of challenging behavior exhibited in the demand condition as well as elevated rates of challenging behavior in the tangible condition led to the conclusion that aggression and noncompliance were multiply-maintained, serving both to escape a demand and to gain access to a preferred item.

The results of Luca's functional analysis are available in the bottom panel of Figure 1. For Luca screaming was highest in the tangible condition of the functional analysis, followed by demand. The mean percent of intervals with challenging behavior was 10% (range: 0-23%), 20% (range: 0-53%), 0%, and 43% (range: 27-53%) across attention, demand, play, and tangible conditions, respectively. The level of challenging behavior exhibited in the tangible condition led to the conclusion that screaming was maintained, at least in part, by access to a preferred item.

Intervention

Challenging behavior. The top panel of Figure 2 shows Tito's challenging behavior across phases, which occurred exclusively after the play session ended and the work task was presented. Tito engaged in moderate and consistent levels of aggression in Baseline (M = 21.3%; range: 7-43%). Challenging behavior was nearly identical during the Activity Schedule conditions (M = 20.6%; range: 13-30%). Finally, in the Activity Schedule with Reinforcement condition challenging behavior decreased (M = 3.2%; range: 0-13%) in relation to both Baseline and Activity Schedule phases.

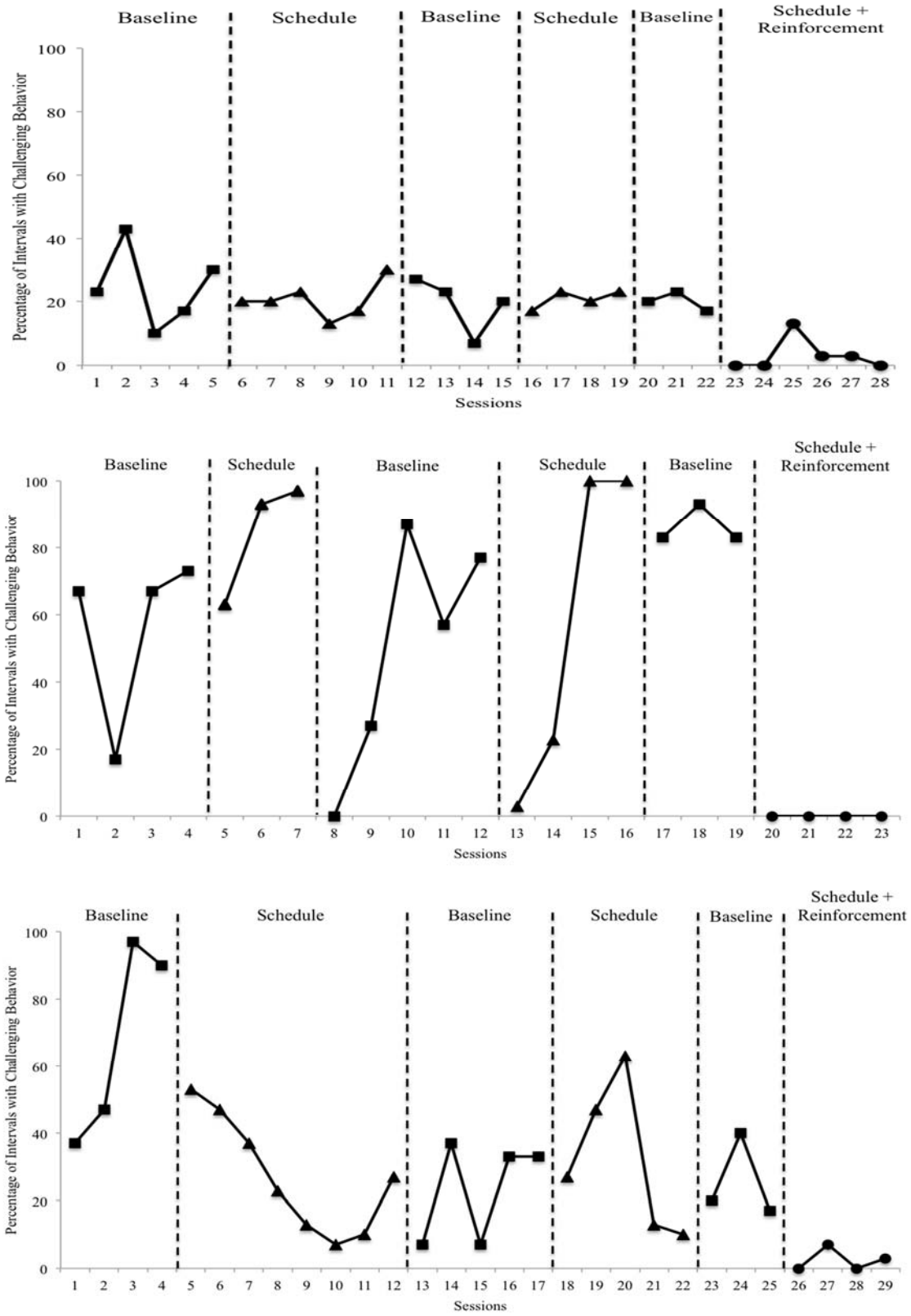

Figure 2. Tito, Rocco, and Luca's challenging behavior across study phases respectively.

The middle panel of Figure 2 shows Rocco's challenging behavior across phases, which occurred exclusively after the play session ended and the work task was presented. Rocco engaged in high and variable levels of aggression and noncompliance in Baseline (*M* = 64%; range: 0-93%). Challenging behavior was slightly higher during the Activity Schedule conditions (*M* = 70.4%; range: 3-100%). Finally, in the Activity Schedule with Reinforcement phase challenging behavior decreased significantly (*M* = 0%) in relation to both Baseline and Activity Schedule conditions.

The bottom panel of figure 2 shows Luca's challenging behavior across phases, which occurred exclusively after the play session ended and the work task was presented. Luca engaged in high and variable levels of screaming in Baseline (*M* = 39%; range: 7-97%). Challenging behavior decreased slightly during the Activity Schedule conditions, however there was not as much variability in responding (*M* = 29.6%; range: 7-63%). Finally, in the Activity Schedule with Reinforcement phase challenging behavior decreased (*M* = 2.5%; range: 0-7%) in relation to both Baseline and Activity Schedule conditions.

Academic engagement. The top panel of Figure 3 shows Tito's academic engagement across phases during work tasks. Tito displayed consistently high levels of academic engagement in Baseline (*M* = 93.9%; range: 67-100%). Academic engagement was nearly identical during the Activity Schedule phases (*M* = 94.5%; range: 73-100%). Finally, in the Activity Schedule with Reinforcement phase academic engagement remained high and consistent across sessions (*M* = 100%).

The middle panel of Figure 3 shows Rocco's academic engagement across phases during work tasks. Rocco displayed variable levels of academic engagement in Baseline (*M* = 32.4%; range: 0-83%). Engagement was considerably lower than Baseline during the Activity Schedule phases (*M* = 1.9%; range: 0-7%). Finally, in the Activity Schedule with Reinforcement phase academic engagement increased in relation to both Baseline and Activity Schedule conditions (*M* = 94.3%; range: 90-100%).

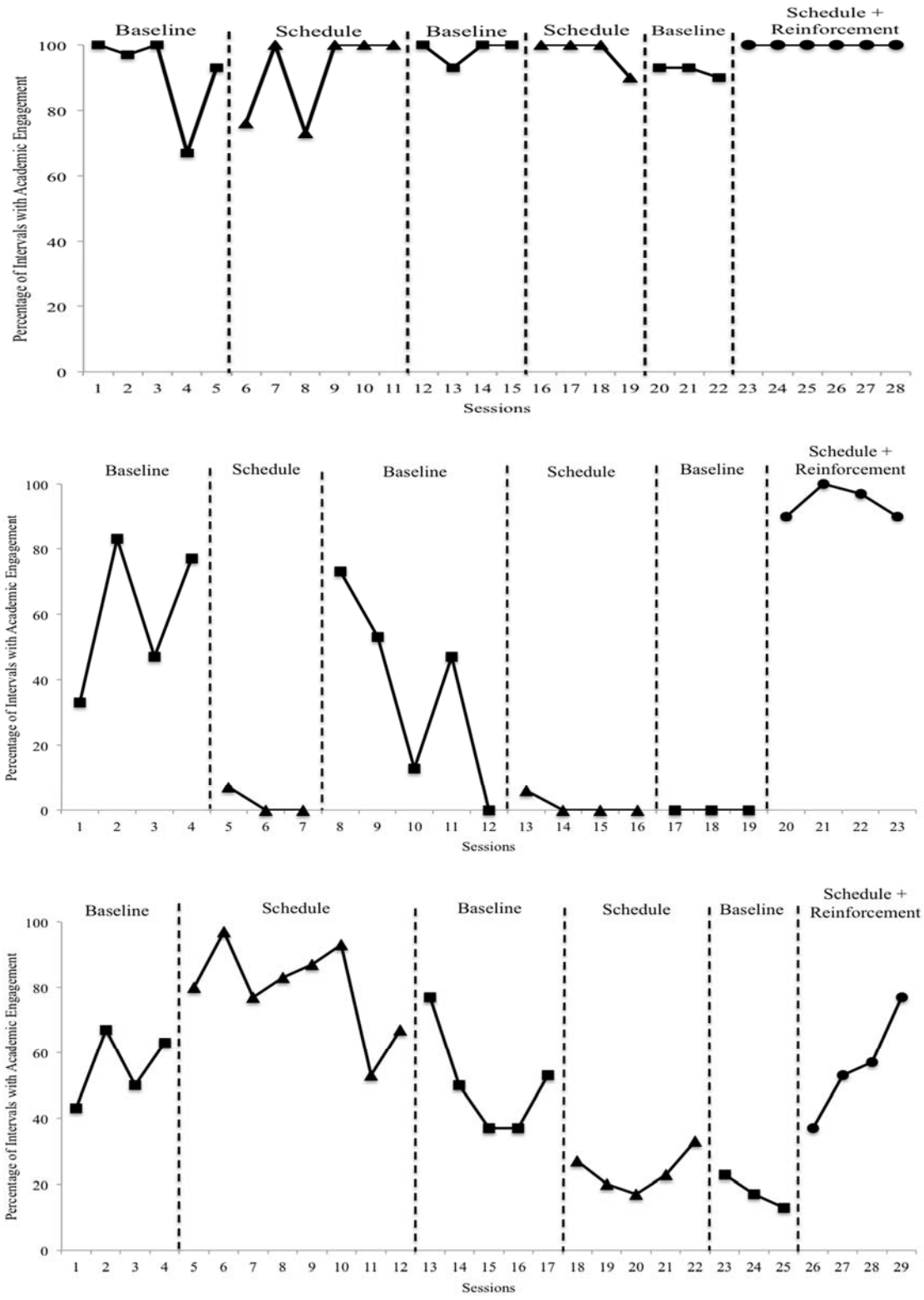

Figure 3. Tito, Rocco, and Luca's academic engagement across study phases respectively.

The bottom panel of Figure 3 shows Luca's academic engagement across phases during work tasks. Luca engaged in moderate and variable levels of academic engagement in Baseline (*M* = 41.4%; range: 13-67%). Academic engagement increased slightly during the Activity Schedule phases, however there was considerably more variability in responding across sessions (*M* = 51.8%; range: 17-97%). Finally, in the Activity Schedule with Reinforcement phase academic engagement increased in relation to both Baseline and Activity Schedule conditions and was less variable than in previous conditions (*M* = 56%; range: 37-77%).

Discussion

The present study found no effect of activity schedules on challenging behavior nor academic engagement during work tasks following preferred free play activities. This research filled a gap in the literature by (a) investigating activity schedules as a stand-alone intervention, rather than as one component of a multi-component treatment and (b) examining activity schedules for children diagnosed with ASD who engaged in challenging behavior maintained by access to tangibles, at least in part.

Based on the results of this study, activity schedules appear to be ineffective as a stand-alone intervention to decrease challenging behaviors associated with typical classroom transitions between play and work activities. These findings are consistent with McCord, Thomson, and Iwata (2001) who found providing individuals with advance notice produced no changes in SIB. Consequently, advance notice of a task may even increase challenging behavior, as it signals that an undesirable event is forthcoming. This suggests that, in some cases, activity schedules could function as a reflexive conditioned motivating operation, which could help to explain inconsistencies in the literature regarding the effectiveness of activity schedules. Rocco's results from the current study might reflect this, as challenging behavior, although undifferentiated between baseline and activity schedule phases, does show an increase the longer he is exposed to the schedule.

In order to ensure that the challenging behavior and academic engagement measured in this study were sensitive to environmental changes, a final condition in which reinforcement was provided for task completion was implemented. All three participants engaged in low levels of challenging behavior and high levels of academic engagement throughout this condition. While the activity schedule plus reinforcement intervention was not experimentally-controlled, it verified that the participants were capable of demonstrating appropriate on-task behavior when engaging in academic work.

As mentioned, the National Standards Project lists schedules as an effective intervention with a strong evidence backing in the literature, specifically as a tool to increase self-regulation skills for individuals with ASD (National Autism Center, 2015). However, activity schedules have not been demonstrated as an effective stand-alone intervention (e.g., McCord, Thompson, & Iwata, 2001) nor is there evidence to support the reduction of challenging behaviors with the use of schedules. Since schedules have a high level of

social validity, are cost effective, require minimal training to implement, and are easy to use (Lequia, Machalicek, & Rispoli, 2012) there is an increased liklihood that practitioners will use this specific intervention to target a variety of behaviors regardless of its effectiveness. Therefore, careful consideration should be made before implementing an activity schedule, especially as a stand-alone intervention for children with ASD who engage in tangibly maintained challenging behavior.

Limitations

Some limitations of the current study should be taken into consideration. First, though Tito and Luca's behaviors are clearly tangibly maintained, as evidenced by the functional analysis, Rocco's results are less clear. Rocco's functional analysis indicates that his aggression and noncompliance are multiply-maintained serving both an escape and tangible function. However, the activity schedule literature indicated that research on challenging behavior maintained by escape was needed as well. Additionally, variation in Rocco's functional analysis may have resulted from collapsing several topographies of challenging behavior (i.e., aggression and noncompliance) into one operational definition.

Second, a photograph-based paper activity schedule with words was used, whereas alternative schedules associated with known preferences may prove more effective. Given two participants' preference for the iPad®, an electronic schedule may have been a preferable alternative. For example, picture schedules could be displayed using an additional iPad® and application showing the upcoming activities. Though there may not be any difference in challenging behavior and academic engagement with an alternative form, certainly participant preferences should be considered in the development of interventions (Wolf, 1978). Furthermore, the participants could have had more direct interaction with activity schedules either in their creation, indicating a task was completed, or both.

Third, this study did not measure challenging behavior during a physical transition from one activity to the next. Both the play and work tasks occurred in the same location. Transition from one activity to the next involved the removal of activity-specific materials and the presentation of activity-specific materials, which was less than 1 min in duration. Previous activity schedule research has measured the effects of the transition period specifically, but transitions typically involved moving from one setting to another (McCord, Thomson, & Iwata, 2001). While this study did not measure trasnsition given it was short in nature, this may actually be a strength of the study in that many transitions in school activities do not involve physically transitioning from one setting to the next. For example, a school transition may involve transition from reading to math, both of which are conducted at the same desk, but with different materials. In other words, this study reflects common transitions from one activity to another that occur within one setting.

Fourth, participants were only exposed to an activity schedule during transitions from play to work sessions. This may have become predictable to some extent across the

duration of the study and unduly influenced findings related to challenging behavior and academic engagement. However, this sequence of activities was chosen given the limited information available in the literature on the effectiveness of activity schedules for challenging behavior and academic engagement associated with work tasks after free play activities among children with ASD.

Finally, the activity schedule plus reinforcement condition was not experimentally-controlled. The purpose of this condition was to evaluate the possibility of behavior improvement, rather than identify and experimentally-control a successful intervention. In other wrods, because the activity schedule alone was ineffective, it was important to determine if this was in part because the targeted behavior was simply incapable of change. The activity schedule plus reinforcement condition confirmed the ability of the measured behaviors to decrease based on environmental manipulations.

Future Research

Based on the results of this study, several areas of investigation remain regarding the use of activity schedules. All participants in this research received "very likely" scores on the Autism Index and required either Level Two or Level Three support on the GARS – 3 (Gilliam, 2014). Future research might investigate the effectiveness of activity schedules with participants with ASD who have lower Autism Index scores and require Level One support to determine the effectiveness of activity schedules on challenging behavior based on pertinent participant characteristics. Another consideration for future research would be replication of the procedures outlined in this study with participants whose challenging behavior is multiply-maintained, especially those maintained by escape and tangible functions, as this specific area is currently lacking in the literature.

Additionally, future investigations should consider the characteristics and construction of the activity schedules. For example, tailoring activity schedules to meet individuals' preferences, such as electronic-based schedules for individuals who prefer the iPad®. Furthermore, it may be relevant to consider the order of activities on the schedule, such as the influence of a work activity followed by a play activity. Given participants' challenging behavior was maintained by access to a tangible, reordering conditions on the activity schedule may assess for additional operant mechanisms that were not a component of this study, leveraging the use of the Premack Principle.

Conclusion

The current study demonstrates that activity schedules produce no effect on tangibly maintained challenging behaviors nor on academic engagement when used as a stand-alone intervention during common classroom transitions from play to work. Additional investigation is warranted on activity schedules given the high social validity of the intervention, either highlighting its effectiveness or narrowing the scope in which it can be successfully utilized. The acceptance and use of activity schedules as an intervention for children diagnosed with ASD whose challenging behavior is tangibly maintained

creates a need to identify components which increase the efficacy of activity schedules if they are to continue to be used in the future.

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Table 1
Characteristics, activities, and operational definitions across participants

Participant	Age	GARS – 3	Play activity	Work task	Challenging behavior	Academic engagement
Tito	12	114 Level 3	Playing a game or watching videos on the iPad®	Reading aloud Grade 3 reading level books	Aggression: using an open palm or fist to hit self, others, or objects	Sitting in the chair, holding the book open, clearly articulating each word, and turning pages at appropriate times
Rocco	10	106 Level 3	Drawing on a whiteboard with a dry erase marker	Math worksheet with 20 two-digit addition and subtraction problems	Aggression: using an open palm or fist to hit self, others, or objects; Noncompliance: sitting or lying on floor, saying "no"	Sitting in the chair, holding the pencil, looking at the worksheet, and counting aloud or writing the answers
Luca	5	94 Level 2	Watching videos on the iPad®	Coloring using crayons and coloring book pages	Screaming: any non-word vocalizations above typical speaking volume or pitch	Sitting in the chair, holding the crayon in his right hand, holding the page down with his left hand, and moving the crayon across the page