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## A Comparison of Accumulated and Distributed Reinforcer Arrangements in a Classroom

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A Comparison of Accumulated and Distributed Reinforcer Arrangements in a Classroom

by

Alexandra Gingras

A thesis submitted in partial fulfillment  
of the requirements for the degree of  
Master of Science in Applied Behavior Analysis  
Department of Child and Family Studies  
College of Behavioral and Community Sciences  
University of South Florida

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reinforcers, off-task behavior

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## **DEDICATION**

This thesis work is dedicated to my son, Wyatt, who is truly my source of inspiration; you are my sunshine every day. With a warm heart and incredible sense of joy, I dedicate this thesis to my loving parents Scott and Susan Knoepfel, and my grandmother Dolores Knoepfel, your words of wisdom and encouragement have pushed me to pursue and achieve my goals. Last and foremost, I dedicate this thesis to my husband, Christopher, whose love and support gave me the strength to complete this work. With immense gratitude, I thank you all for being on this adventure with me.

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## **ABSTRACT**

Though effective classroom management can increase student academic achievement and decrease disruptive behavior (e.g., Beaman & Wheldall, 2000; Marzano et al., 2003), many classroom teachers receive inadequate training on effective classroom management strategies (Reinke et al., 2011; U.S. Department of education 2000).| Reinforcement-based interventions using differing reinforcer arrangements (e.g., accumulated, distributed) have been shown to be effective at reducing disruptive behavior (Fulton et al., 2019; Robinson & St. Peter, 2019); however, previous studies have not evaluated the relative efficacy of different reinforcer arrangements as teacher implemented classroom management strategies. Therefore, the purpose of this study was to assess the efficacy of accumulated and distributed reinforcer arrangements, used within a classroom setting, on decreasing disruptive and increasing on-task behavior. Results indicated that the accumulated arrangement led to a greater reduction in off-task behavior for both participants.



## **CHAPTER ONE:**

### **INTRODUCTION**

The U.S. Department of Education (2000) reported that teachers spend up to 50% of their time managing classroom behavior (e.g., keeping students on-task while keeping disruptive behavior minimal) (e.g., Emmer & Stout, 2001; Kounin & Obradovic, 1968). Classroom management is generally defined as the actions a teacher takes to create and maintain order within the classroom to occasion student engagement and cooperation (Emmer & Stout 2001; Kounin, 1970). According to teacher self-report, classroom management is one of the most challenging aspects of teaching and training on the topic is inadequate (Reinke et al., 2011). Training on effective classroom management strategies is necessary; these strategies can increase student achievement, on-task behavior, and instructional time for teachers (i.e., teaching) (Marzano et al., 2003; Marzano & Marzano, 2003; Wang et al., 1993). Furthermore, disruptive behavior within the classroom can lead to teacher burnout (Fernet et al., 2012), decreased instructional time, and distracts other students (Emmer & Stout, 2001). It is imperative to student outcomes that effective classroom management strategies to decrease disruptive behavior and are feasible for teachers to implement are identified and evaluated.

One evidence-based intervention that has been used as a classroom management strategy is token economies. An abundance of research has shown token reinforcement to be a successful reinforcement procedure in many settings and with many behaviors. For example, tokens were used as reinforcement to increase academic success in children of the Wolf et al. (1968) study. Reinforcer arrangements play a vital role in the success of token economies. Research has compared two work-reinforcer arrangements (i.e., accumulated and distributed) to evaluate their

impact on skill acquisition efficiency and efficacy (e.g., Frank-Crawford et al., 2018), increasing compliance, and reducing problem behavior (e.g., Fulton et al., 2019; Robinson & Peter, 2019).

In the accumulated reinforcer arrangement, a participant will accumulate an amount (i.e., number, duration) of a reinforcer each time they meet the specific reinforcement contingency. At the end of the work period, the participant will have access to the accumulated amount of reinforcer (DeLeon et al., 2014). In some cases, a token is used to indicate that a contingency has been met in order to mediate the delay to reinforcer consumption (Frank-Crawford et al., 2018). For example, a token worth 30s of time on the iPad is delivered to the participant for each math problem completed correctly. After a set of trials, the participant can consume the accumulated amount of time earned. The distributed arrangement differs because it allows the participant to consume the reinforcer immediately after the specific contingency is met (e.g., emitting a target response or responses) (DeLeon et al., 2014; Frank-Crawford et al., 2018). For example, the researcher delivers 30s of time on the iPad contingent on the participant completing one math problem correctly. After reinforcer consumption, the iPad would be removed from the participant, and the individual would have the opportunity to meet the reinforcement contingency once again.

Research has compared the effects of distributed and accumulated reinforcers on many responses, including compliance and problem behavior (e.g., Fulton et al., 2020; Robinson & St. Peter, 2019). For example, Fulton et al. compared the efficacy of accumulated and distributed arrangements on compliance and level of disruptive behavior with three participants who engaged in escape-maintained disruptive behavior. The accumulated arrangement resulted in the greatest compliance and least amount of problem behavior for two out of three participants.

Similarly, Robinson and St. Peter (2019) compared the effects of accumulated and distributed reinforcer arrangements on compliance and disruptive behavior with three students diagnosed with attention-deficit hyperactivity disorder (ADHD). All participants had higher compliance rates and lower rates of problem behavior during the accumulated arrangement than the distributed arrangement. Additionally, Frank-Crawford et al. (2021) compared the efficacy of positive (i.e., food) and negative reinforcers (i.e., breaks) delivered in accumulated and distributed reinforcer arrangements with eight participants that engaged in escape-maintained problem behavior. Similar to some other studies (e.g., DeLeon et al., 2014; Falligant et al., 2020; Weston et al., 2019), the accumulated arrangements included tokens. This study found that accumulated and distributed arrangements with a break as the reinforcer were similarly effective at decreasing disruptive behavior for four of the five participants who experienced these conditions; accumulated was as effective as distributed when food items were used as reinforcers for all participants. There were no cases in which accumulated with a break as the reinforcer was more effective than the distributed condition. Additionally, during schedule thinning results were mixed across participants. Results of these three studies indicated that the accumulated reinforcer arrangement was similar or more effective at reducing disruptive behavior.

Although some studies have evaluated the impact of distributed and accumulated reinforcer arrangements without using tokens (e.g., Fulton et al., 2020; Robinson & St. Peter, 2019), others have included tokens within these arrangements (DeLeon et al., 2014; Falligant et al., 2019; Falligant & Kornman 2019; Kocher et al., 2015; Weston et al., 2019). Only five studies have delivered tokens within both accumulated and distributed reinforcer arrangements (DeLeon et al., 2014; Falligant et al., 2020; Falligant & Kornman 2019; Kocher et al., 2015; Weston et al., 2019), and of these, two have

targeted compliance (Falligant et al., 2020; Falligant & Kornman 2019). Of the two studies looking at compliance, the distributed arrangement with tokens was less effective than the accumulated arrangement across all participants. In these previous studies, tokens have been represented in different forms, such as checkmarks (Kocher et al., 2015), tally marks (Falligant et al., 2020), different colored poker chips that symbolized different values (e.g., black-FR 1, blue FR-2, green FR-5) (Falligant and Kornman, 2019), and plastic poker chips with Velcro secured to the back to be placed on a token board (DeLeon et al., 2014).

Given the need for effective classroom management and that differing reinforcer arrangements have been associated with different levels of efficacy (e.g., Frank Crawford et al., 2021; Fulton et al., 2020), it seems imperative these two reinforcer arrangements be assessed in a classroom setting. Therefore, the purpose of this study was to compare the impact of accumulated and distributed reinforcer arrangements within a classroom setting. Specifically, this study sought to determine which reinforcer arrangement was most effective in reducing disruptive behavior.

## **CHAPTER TWO:**

### **METHOD**

#### **Participants, Setting, and Materials**

This study included two dyads that consisted of one student and their teacher. To recruit participants, the principal investigator (P.I.) emailed recruitment flyers to school principals who shared these flyers with teachers in their schools. Before beginning the study procedures, the P.I. obtained approval from the institutional review board (IRB), parent consent, and teacher consent. Student assent was waived for participant one (i.e., Dean) but was obtained for participant two (i.e., Jess) because he was over the age of seven. Participant eligibility consisted of students enrolled in a public school who engaged in disruptive behavior (i.e., off-task behavior) for a minimum of 30% of instructional time as determined during initial observations and had a classification of emotional and behavior disorders (EBD) or were identified by their teachers to be at risk for EBD. Exclusionary criteria consisted of students who emitted behaviors that posed a risk of injury to themselves or the people around them (e.g., exhibiting self-injurious behavior) and students who are frequently absent. Additionally, each participant's teacher participated in the study. Teacher participation criteria consisted of willingness to implement the study's procedures with their students.

The P.I. recruited teacher participants by emailing and distributing a recruitment flyer to the school administration and teachers. Once teachers were recruited and signed consent was obtained, the teacher then completed a student screening form (see Appendix A) that identified potential student participants. This form was adapted from Andreu (2016) to determine the student's eligibility to participate in the study. For students nominated as potential participants,

an information package was sent home for their caregivers to review and sign parental consent to participate. Information packets included a description of the study and consent forms. After the parent's consent forms were signed, the P.I. observed the student to determine if they met participation criteria.

Sessions were conducted within the student's classroom during typical school hours. Data collection materials included a datasheet (see Appendix B), pen, smartphone, timer, and the Countee © application. In addition, the teacher utilized a vibrating interval timer (i.e., motivator). Tokens were also used, and examples of tokens included laminated pictures with Velcro adhesive on the back (see Appendix C). Additional materials included the preferred stimuli which were used as backup reinforcers (e.g., fidgets, books, toys, videos, music).

Dean was a 5-year-old male in a kindergarten classroom at a public school in a general education classroom. The teacher and parents reported that Dean did not have any formal diagnosis or classification and that he was not taking medication, but he was identified by the teacher to be at risk for an EBD classification due to high levels of disruptive behavior, hyperactivity, and lack of coping skills. His teacher also indicated that Dean had difficulty with impulse control and staying focused during instructional time. Before starting the study, the teacher used an individualized sticker chart to increase on-task behavior, but the teacher indicated that the sticker chart was ineffective in decreasing Dean's off-task behavior during math class. Teacher 1 was Dean's kindergarten teacher, and she had 10 years of teaching experience.

Jess was an 8-year-old male in a second-grade classroom at a public school in a general education classroom. Caregiver consent forms indicated that Jess had a diagnosis of ADHD, operational defiant disorder (ODD), post-traumatic stress disorder (PTSD), autism spectrum

disorder (ASD), mixed expressive-receptive language disorder, adjustment disorder with mixed disturbance of emotional conduct, and was not taking any medication. Jess was identified by the teacher to be at risk for an EBD classification due to high levels of disruptive behavior, high need for direct intensive social skills, and low levels of independent functioning. Additionally, the teacher reported that Jess was hyperactive and struggled to stay on task. To address Jess's off-task behavior, which the teacher hypothesized to be escape maintained, the teacher and intervention specialist previously utilized an individualized token system, check-in/check-out, non-contingent breaks from demands (i.e., the teacher would send the student to run errand such as bring a letter to the front office), and they also taught Jess a functional communication response for asking for a break. The teacher reported that Jess's off-task behavior was high during math despite these interventions being in place. Teacher 2 was Jess's second-grade teacher, and she had 26 years of experience teaching. She had worked at the school for 16 years and she had taught Kindergarten to 5<sup>th</sup> grade.

### **Dependent Variables and Data Collection**

Sessions lasted 30 mins and were conducted 2-5 times per week during the same time/academic subject and in the same location. Based on the P.I.'s observations of the students and teacher input, the dependent variables included on-task and off-task behavior, which consisted of the same definition for both students. Off-task behavior consisted of any time the student left their designated area, played with instructional materials or toys, talked to peers without permission, engaged in vocal protests (e.g., "I am not doing my work," "I don't want to do this," etc.), drawing without permission, and/or looked away from instructional materials or teacher for more than 3s. On-task behavior consisted of anytime the student a) continuously looked at the teacher or teacher presentation for at least 5 continuous seconds, b) raised their hand to answer a

question given by the teacher, and/or c) intentionally engaged in teacher instruction for at least 5 continuous seconds (e.g., writing notes, reading aloud or silently, using a calculator, taking out a textbook and turning to a requested page) in the absence of off-task behavior.

Given that the dependent variables of off-task and on-task behavior were mutually exclusive, data were recorded by the P.I. and the teacher on only one of these responses. The P.I. measured off-task behavior using 10s partial interval recording (PIR; 180 intervals per 30-min session), which was recorded using the Countee application (i.e., an interval was scored if off-task behavior occurred at any point during a 10-s interval by using a frequency key instead of a duration key). These data were summarized as the percentage of intervals with off-task behavior. The teacher recorded data for on-task behavior for the participating student using a 5-min momentary time sampling recording method (i.e., six intervals per 30-min session). At the end of each interval, the teacher observed the participant for 10 s and recorded if the student engaged in on-task behavior. Intervals were scored with a (+) if on-task behavior was occurring and were left blank if on-task behavior was not occurring. The data collected by the teacher was summarized as a percentage of intervals with on-task behavior; the number of intervals with on-task behavior was divided by the total number of intervals in the session, multiplied by 100.

### **Interobserver Agreement**

Interobserver agreement (IOA) was collected by trained research assistant (R.A.). The P.I. used behavior skills training (BST; Miltenberger et al., 2004) to train the R.A. on data collection. BST included instructions, modeling, rehearsal, and feedback on the correct data collection method. The R.A. scored at least 90% agreement with the P.I. across one session prior to starting data collection. The R.A. independently observed and recorded data on the dependent variables for 26.32% for dean and 25% for Jess across sessions and conditions. IOA was



calculated for the data collected by the PI using PIR on off-task behavior using the proportional agreement method. The calculations were completed using the Countee website. This method entailed dividing sessions into 10-s bins, calculating a proportion for each interval by dividing the smallest duration by the largest duration, adding the proportions for all of the intervals, dividing by the number of intervals, and multiplying by 100. For the data collected by the teacher on the occurrence of on-task behavior using MTS, interval-by-interval IOA was calculated by dividing the total number of intervals with agreements by the total number of intervals with agreements plus disagreements and multiplying by 100 (Cooper et al., 2020). Interobserver agreement for Dean's off-task and on-task behavior was assessed for 26.32% and 37% of sessions, respectively, and the mean agreement score for off-task behavior was 89.84% (range, 85.85-97.78%) and for on-task behavior (100%). Interobserver agreement for Jess' off-task and on-task behavior was assessed for 25% and 38% of sessions, respectively, and the mean IOA scores for his off-task was 89% (range, 86.11-96.11%) and on-task was 100%.

### **Treatment Integrity**

The P.I. collected treatment integrity (T.I.) using a checklist for 32% session with teacher 1 and 38% of session for teacher 2. The T.I. checklist (Appendices D and E) included the steps the teacher needs to complete for each condition, and data were recorded on whether the teacher implemented each step correctly using a "yes" or "no" coding system. T.I. scores were calculated by dividing the correct steps by the total number of steps in the checklist and multiplying that number by 100. The mean TI score for Teacher 1 and Teacher 2 was 100%.

## **Experimental Design**

This study utilized a multiple-baseline-across-participants with an embedded alternating treatments design (Kazdin et al., 1982) to evaluate the impact of the two reinforcer arrangements on off-task behavior.

## **Initial Assessments**

Prior to the start of the reinforcer arrangement evaluation, we conducted a functional behavior assessment (FBA) and a preference assessment.

### ***Functional Behavior Assessment***

The FBA was used to identify the hypothetical function of the participants' off-task behavior and consisted of an interview with the teacher using the Functional Analysis Screening Tool (FAST; Iwata et al., 1995) and descriptive assessment (i.e., Antecedent, behavior, consequence [ABC] narrative recording). The purpose of this interview is to identify the antecedent events and consequences that follow off-task behavior. Interviews lasted approximately 5-10 min and were completed at the teacher's earliest convenience. Data on the antecedent and consequences for the participants off-task behavior was collected by the P.I. using ABC narrative recording during the baseline phase of reinforcer arrangement evaluation. For each participant ABC data were recorded for two of the baseline sessions.

### ***Preference Assessment***

The preference assessment included two components, an interview with the teacher and a rank order assessment completed by the student. The P.I. used a structured interview similar to the Reinforcer Assessment for Individuals with Severe Disabilities (RAISD; Fisher et al., 1996) to interview the teacher and identify a list of preferred stimuli that were feasible and easy to deliver to the student (see appendix H). Once the teacher identified potential reinforcers, we

presented three items to the student and asked the student to rank order the items from most-to-least preferred.

### **Reinforcer Arrangement Evaluation**

The reinforcer arrangement evaluation included two phases, baseline and differential reinforcement. Furthermore, during the differential reinforcement phase, we alternated between two reinforcer arrangements, distributed and accumulated.

#### ***Baseline***

During baseline, the teacher conducted the class as usual. At least three baseline sessions were completed per participant. The data were then evaluated to determine if it is appropriate to introduce the differential reinforcement phase. Implementation of the differential reinforcement phase was staggered across participants (e.g., the intervention phase for the second participant began once the data for the first participant showed a treatment effect). Prior to the onset of the differential reinforcement phase, teacher training was completed.

#### **Teacher Training**

The P.I. used BST (Miltenberger et al., 2004) to train teachers on each of the differential reinforcement procedures (i.e., accumulated and distributed reinforcer arrangements). This training included instructions, modeling the intervention, brief rehearsal of the intervention, and feedback on the implementation of the procedures. The mastery criteria for training consisted of reaching 100% fidelity for one rehearsal session. Specific training steps included a) asking the student to vote on a work reinforcer, b) placing the picture of the reinforcer on the token board via Velcro adhesive, c) providing a condition-specific contingency statement, d) setting a 5 min interval timer, d) observing the student at the end of the interval for at least 10 s, and e) providing a correct consequence based on student's behavior and condition. Teachers were

provided with a treatment integrity checklist (see Appendices D and E) that lists the steps needed to correctly complete the procedures.

### ***Differential Reinforcement***

The differential reinforcement arrangements (i.e., accumulated and distributed) differed in regard to when the students could exchange their tokens for backup reinforcers (i.e., different token exchange schedules). For both conditions, at the onset of the session, the teacher asked the student to select a preferred stimulus as the backup reinforcer. The teacher held up two laminated pictures of preferred items and prompted the student to choose one (e.g., "Do you want to work for a video? or do you want to work for teacher Storytime?"), The teacher then placed the laminated picture of the stimulus selected onto the token board that was placed on the student desk or table. The item the student selected was delivered as a consequence for that session. Then the teacher began the session by describing to the student the contingency specific to the condition. After stating the contingency, the teacher set a 5 min silent interval timer, and then the teacher conducted her class per usual (e.g., present academic instruction to the class such as writing notes on the board, reading aloud, or passing out worksheets). At the end of the interval the teacher observed the student for 10 s. If the student was on-task, the teacher placed a token on the token board. Each token was worth 1 min with a preferred stimulus delivered to the participating student. When the token was delivered, the teacher delivered praise to the student (e.g., "you were on-task and earned a token") and then placed the token on the board. If the student did not meet the reinforcement contingency (i.e., was not on task during the 10-s observation interval), the teacher stated, "I checked, and you were not on-task," and restated the original contingency to the student. This process was repeated until the end of the session. Across both conditions, the teacher and the P.I. did not interact with students during the

reinforcer consumption time unless the activity selected involved the teacher (e.g., teacher reading a book to the student) and students had a total of six opportunities to earn tokens. Furthermore, sessions continued until off-task behavior decreased to clinically acceptable levels, as determined based on baseline levels and discussions with the teacher, for three consecutive sessions.

***Distributed Reinforcer Arrangement.*** In this condition, at the beginning of the session, the teacher provided a verbal description of the contingency in effect, including the token exchange schedule and reinforcer (e.g., "if you are doing your work when I check, you will get a token and right away you can watch a video for 1 min"). Then, throughout the session, the student was provided 1 min of access with the backup reinforcer immediately after earning a token. Specifically, after delivering the token, the teacher provided the student with access to the backup reinforcer. Then the token was left on the board, and another 5-min interval began.

***Accumulated Reinforcer Arrangement.*** In this condition, at the beginning of the session, the teacher verbally stated the contingency in effect, including the specific token exchange and reinforcer (e.g., "if you are on-task when I check, you will earn a token worth 1 min. At the end of the session, you can play Legos for the total amount of time you earned. More tokens mean more time with Legos"). In this condition, at the end of the session the teacher showed the student all the tokens they earned and explained the corresponding duration of the access to the chosen reinforcer (e.g., you have 5 tokens, so earn 5 min with the iPad).

### **Social Validity**

At the end of the study, social validity questionnaires were given to the participating teachers and students. An adapted version of the Intervention Rating Profile was used in this study for both teachers and students (e.g., see Appendices F and G) (IRP-15; Andreu, 2016;

Martens et al., 1985). The teacher questionnaire included nine questions that were scored using a 5-point Likert scale ranging from 1 (disagree) to 5 (agree). The teacher questionnaire also included one open-ended question to allow for any additional information the participants could share. The student questionnaire included five yes/no questions and one multiple choice question.

## **CHAPTER THREE:**

### **RESULTS**

The results from FAST are displayed in Table 1. For Dean, the FAST results identified social negative and social positive reinforcement as plausible functions for disruptive behavior. More specifically, out of 4 total possible points, Dean scored all possible points (i.e., 4) (range, 0-4) in the social negative and social positive category and scored zero points (range, 0-4) in the remaining automatic categories. Jess's results indicated social negative and social positive reinforcement as the most plausible function for disruptive behavior. Jess scored all possible points (i.e., 4) in the social negative reinforcement category, 3 points (range 0-4) in the social positive reinforcement category, and zero points in all remaining automatic categories. Additionally, the ABC narrative recording indicated that possible function of off-task behavior was escape from math work (i.e., demands) for both participants (Table 2 and Figure 1). The results of the preference assessments are displayed in Figure 2. The rank order preference assessment completed with Dean indicated that the iPad was most preferred, followed by drawing, and then Legos. The rank order preference assessment completed with Jess indicated that the most preferred to least preferred stimuli were magnetic blocks, Legos, and drawing. Although the plan was to use only the two most preferred stimuli during the reinforcer arrangement evaluation, all three items were used because it was not possible to use only the top two consistently (e.g., iPad was not available; student requested drawing).

The results of the reinforcer arrangement comparison for all participants are displayed in Figures 2-3. Figure 3 depicts the percentage of intervals with off-task (data collected by researchers), whereas Figure 4 shows the percentage of intervals with on-task behavior (data

collected by teachers). During baseline, Dean (top panel) engaged in high levels of off-task behavior. More specifically, Dean engaged in off-task for a mean of 48.90% (range, 23.89%-82.22%) of the sessions (Figure 3) and on-task behavior for a mean of 38.89% (range, 16.67%-50%) of the intervals per session (Figure 4). When the reinforcer arrangements were introduced, Dean engaged in less off-task behavior during both arrangements. More specifically, for the accumulated arrangement, Dean engaged in off-task behavior for a mean of 19.45% (range, 10-30.56%) of the intervals (Figure 3) and off-task behavior for a mean of 54.16% (range, 33.33-83.33%) of the intervals per session (Figure 4). During the distributed arrangement, Dean engaged in off-task behavior for a mean of 34.51% (range, 25.56%-39.44%) of the sessions (Figure 3) and on-task behavior for a mean of 47.92% (range, 33.33-66.67%) of the intervals per session (Figure 4). For Dean, both reinforcer arrangements were efficacious at reducing off-task behavior; however, the accumulated arrangement was the most effective arrangement as, during that arrangement, off-task behavior decreased by a mean of 15.06% more than in the distributed arrangement.

During baseline, Jess (second panels of Figures 2-3) engaged in high levels of off-task. Jess engaged in off-task for a mean of 64.56% (range, 27.78%-88.33%) of the sessions (Figure 3) and in on-task for a mean of 23.33% (range, 0%-50%) of intervals per session (Figure 4). During the accumulated arrangement, Jess showed a gradually decreasing trend in off-task behavior. During the accumulated arrangement, Jess engaged in off-task behavior for a mean of 26% (range, 10.56%-63.89%) of the sessions (Figure 3) and on-task behavior for a mean of 56.66% (range, 16.67%-83.33%) of intervals per session (Figure 4). During the distributed arrangement, Jess showed a slight decrease in off-task compared to baseline data. During this arrangement Jess engaged in off-task for a mean of 51.56% (range, 40.56%-65%) of the sessions



and on-task for a mean of 36.68% (range, 16.67%-66.67%) of the intervals per session (Figure 4). For Jess, both reinforcer arrangements were efficacious at reducing off-task behavior; however, the accumulated arrangement was the most effective arrangement as during that arrangement off-task decreased a mean of 8.81% more than the distributed arrangement. The results of the social validity questionnaire completed by the teachers are displayed in Table 2. Teacher 1 indicated that overall, they found the intervention to be successful at reducing off-task behavior. The mean score for Teacher 1's social validity questionnaire was 4.11 (range, 3-5). From the results, teacher one indicated that they believed reinforcer arrangements were appropriate for various children and classrooms. Furthermore, in the open-ended question, Teacher 1 believed that the accumulated arrangement was the most effective at increasing on-task behavior in the classroom. Teacher 1 indicated that overall, she found the accumulated/distributed arrangement to be successful at increasing on-task behavior. The mean score for Teacher 2's social validity questionnaire was 3.44 (range, 2-4). From the results, Furthermore, in the open-ended question, Teacher 2 believed that the accumulated arrangement was the most effective at increasing on-task behavior in the classroom.

Results of the social validity assessment completed with the students are displayed in (Table 3). Both students selected the accumulated arrangement as their most preferred in the multiple-choice question. Additionally, both students indicated “yes” a) like using tokens, b) wanted to keep using tokens, and c) wanted to use tokens other classes. Dean indicated “yes” it was easy to use the tokens and that he would recommend this to his friends. Jess indicated “no” it was not easy to use the tokens and that he would not recommend this to his friends. Overall, both students preferred the accumulated arrangement over the distributed arrangement.

**Table 1***Results of the FAST for Participant 1 and 2*

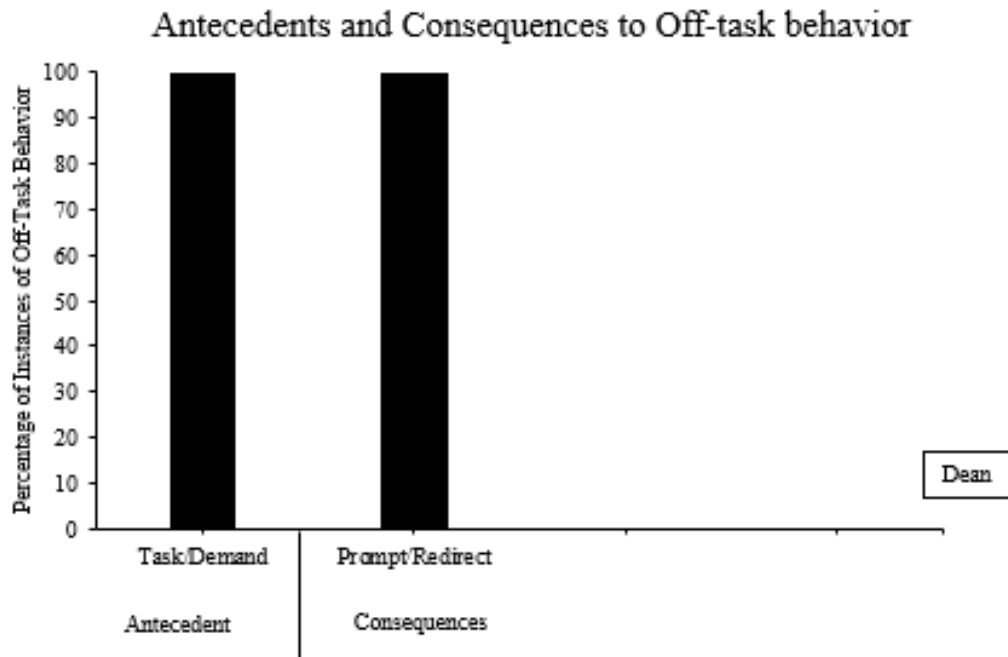
<b>Participant</b>	<b>Social Positive</b>	<b>Social Negative</b>	<b>Automatic Positive</b>	<b>Automatic Negative</b>
Dean	4	4	0	0
Jess	3	4	0	0

*Note. The maximum score for each category is 4 points***Table 2***Results of the ABC Narrative Recording for Participants 1 and 2*

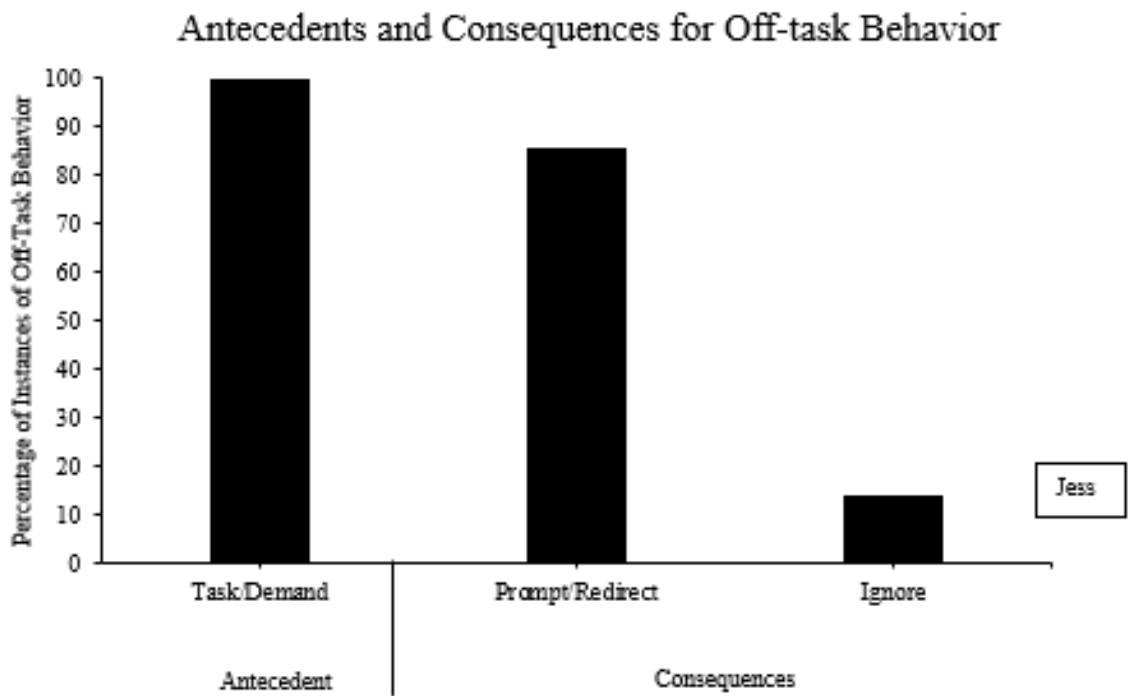
<b>Dean</b>		
<b>Antecedent</b>	<b>Behavior</b>	<b>Consequence</b>
The teacher is playing a math video lesson displayed on the whiteboard	Off-task: looking around the room and at peers	The teacher stops the video and redirects back to the lesson
The teacher prompted the student to complete a math task	Off-task: drawing pictures on his whiteboard	The teacher prompts him to finish his work
The teacher provides directions for a math task	Off-task: walking around the room without permission, drawing on himself, talking to peers	The teacher prompts him to finish his work
The teacher asks the class to take math materials out	Off-task: playing with car toy brought from home	The teacher prompts him to complete his worksheet
The teacher provides directions	Off-task: student gets out of the seat and runs around the classroom, talks to peers without permission	Teacher prompts back to the seat
<b>Jess</b>		
<b>Antecedent</b>	<b>Behavior</b>	<b>Consequence</b>
Teacher provides directions to the class in the front of the room	Off-task: building with manipulatives by stacking counters to make a tower without permission	Teacher provides prompt and then ignores behavior
Independent math work	Off-task: left his area and walked around the room	The Teacher prompted him back to them seat to complete his work
The teacher provides directions given to complete independent math worksheet	Off-task: talking to peers, giving pencils to peers without	Ignored by Teacher and students

	permission or being asked to by the peer	
The Teacher is teaching in the front of the classroom	Off-task: laying down on the ground, rolling around on the ground	The Teacher ignores this behavior at first and then prompts him back to his seat to complete his work
Teacher asks student to turn to a specific page in the math book	Off-task: student takes out his headphones and puts them on	Teacher comes to his desk and turns to the page for him
The teacher provides a math worksheet	Off-task: student gets out of his seat to get hand sanitizer, stapler, and markers without permission (These materials were not needed to complete the worksheet)	Prompted to go back to a seat and complete his work
Teacher provides math flashing in the front of the classroom	Off-task: student is out of seat rolling around on the floor	Teacher prompts back to seat and complete work

**Table 2** (Continued)



**Figure 1.** Results ABC narrative recording for participant 1 and 2



**Figure 1.** (Continued)

**Table 3***Results of Social Validity Assessment Completed by Teachers*

Questions	Teacher 1	Teacher 2
This was an acceptable intervention given the target student's disruptive behavior	4	4
This intervention led to a decrease in the target student's disruptive behavior	3	2
Most teachers would find this intervention appropriate for disruptive behavior	4	3
I would recommend this intervention to other teachers	4	4
I would be willing to use this intervention in the classroom setting with other students	5	4
This intervention would be appropriate for a variety of children and classrooms	5	4
This intervention was a fair way to handle the problem behavior in my classroom	4	3
I liked the procedures used in this intervention	4	4
Overall, this intervention was beneficial for the students in my classroom	4	3
Which arrangement was more effective at increasing on-task behavior? And which arrangement do you prefer?	Accumulated seemed to work better for reward redemption and for teacher to continue teaching without stopping for student	The student preferred the accumulated model as transitioning back after one minute was a challenge. Earning a break at the end.
Mean	4.11	3.44

*Note. Likert-scale where 5 = Strongly agree and 1= Strongly disagree*

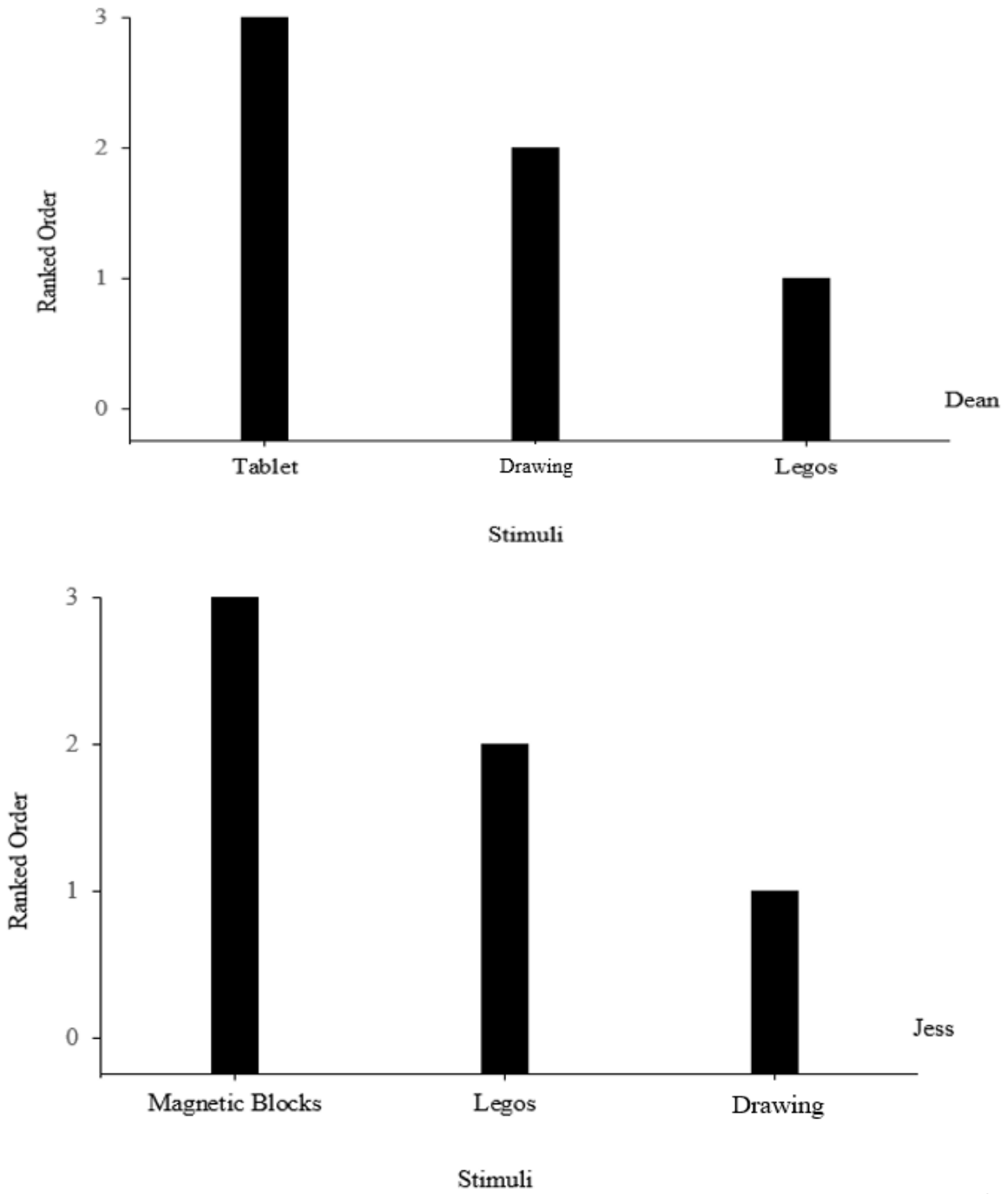
**Table 4***Results of Social Validity Assessment Completed by Students*

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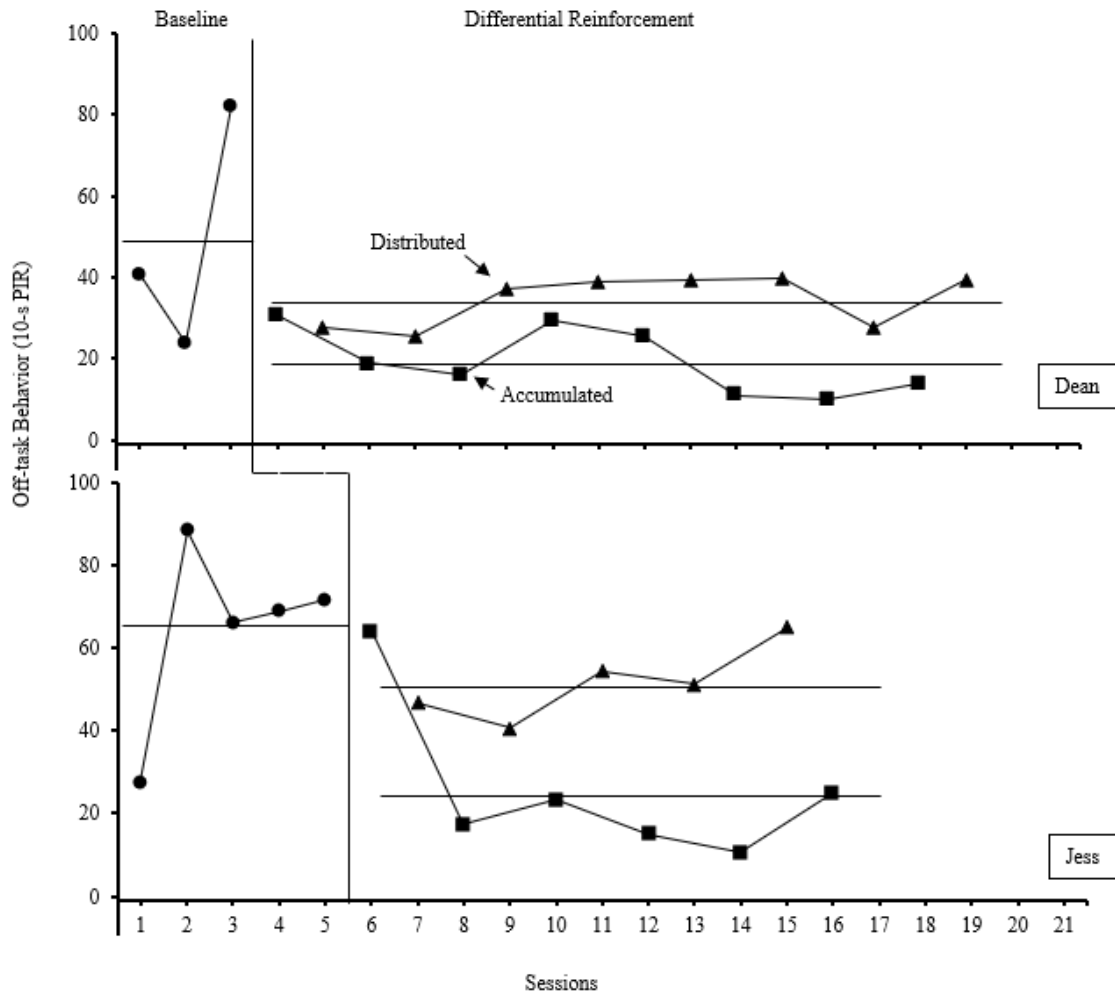
Questions	Dean	Jess
I liked using the tokens.	Yes	Yes
It was easy to use the token system.	Yes	No
I want to keep using tokens.	Yes	Yes
I want to use the token system in other classes.	Yes	Yes
I would recommend this to my friends.	Yes	No
Which token system did you like?	b	b
a) Rewards throughout the class		
b) Rewards at the end of class		
c) None of these		

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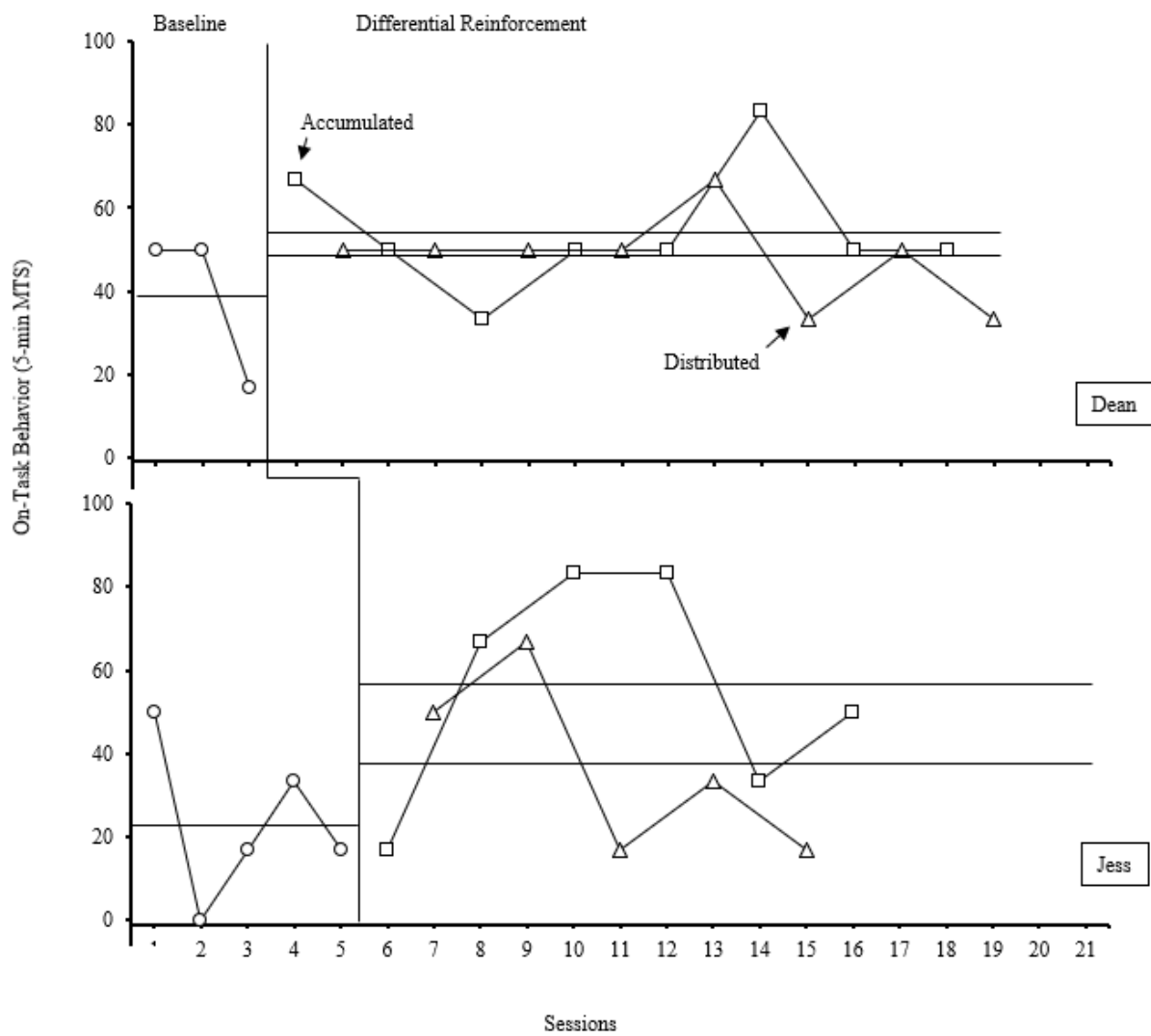


**Figure 2.** Results of the Ranked Order Preference Assessment for Participant 1 and Participant 2



**Figure 3.** Results of the Reinforcer Arrangement Comparison Based on Data Collected by PI Using PIR





**Figure 4.** Results of the Reinforcer Arrangement Comparison Based on Data Collected by Teacher using MTS

## **CHAPTER FOUR:**

### **DISCUSSION**

This study compared the effects of accumulated and distributed reinforcer arrangements on the off-task behavior of two young children at risk of EBD, one of which had several formal diagnoses (ADHD, ASD, PTSD, ODD, mixed expressive-receptive language disorder, adjustment disorder with mixed disturbance of emotional conduct). In this study, both reinforcer arrangements decreased off-task behavior for both students when compared to baseline. Results indicated that the accumulated arrangement led to a greater reduction in off-task than the distributed condition for both participants. These results are similar to those of previous research (e.g., Fulton et al., 2020; Robinson & St. Peter, 2019) in which the accumulated arrangement was more effective across all participants (Robinson & St. Peter, 2019) or as effective as the distributed arrangement for almost all participants (i.e., 3 out of 5 and 4 out of 5) (Frank-Crawford et al., 2021) in decreasing problem behavior (e.g., disruptive behavior).

Although results of this study are similar to those of previous research, this study's procedures differed from previous studies that have compared reinforcer arrangements on problem behavior (e.g., disruptive behavior) in several ways. In the current study teachers implemented the intervention (i.e., differential reinforcement with accumulated or distributed reinforcers) during ongoing instructional time (i.e., math period/lesson) while the researcher observed and collected data on disruptive behavior for a target student. In comparison, although the study by Robinson and St. Peter (2019) was conducted in a classroom setting, researchers implemented the intervention with the target student at the back of the classroom. That is, Robinson and St. Peter removed their participants from the regularly scheduled classroom

activities whereas in our study the target participation in the regularly scheduled lesson was not disrupted and the participant was not moved to separated location. Additionally, in the current study teachers implemented procedures for a target student while providing typical instruction for the entire general educational classroom (i.e., 20-25 students) whereas in previous research the study was conducted in a public alternative education center (Robinson & St. Peter 2019), in home (Fulton et al., 2020), and inpatient hospital unit or education center for children with autism spectrum disorder (ASD) (Frank-Crawford et al., 2021). This study also differed from previous studies in that in the current study teachers provided a token in both reinforcer arrangements (i.e., accumulated and distributed). Frank-Crawford et al. (2021) included tokens only in the accumulated arrangement and no tokens were provided in Fulton et al. (2020) and Robinson & St. Peter (2019) in either arrangement.

Moreover, the amount of reinforcement available differed across studies. In the current study in both arrangements each token was worth 1-min of access to back-up reinforcers, tokens were delivered at the end of 5-min intervals in both arrangement, and participants could access up to 6-min of reinforcement during the session. In previous studies such as Robinson and St. Peter (2019) 15-s of access to back up reinforcers was available at the end of a 3-min work period and the maximum amount of reinforcement available during the session was 12.5-min. Similarly, in Fulton et al. (2020) participants could access 30-s of reinforcement at the end of each 10-min work period and a maximum of 7.5-min of reinforcement per session. Additionally, in the current study teachers delivered tokens every 5-min if the student was on-task at the end of the interval (i.e., momentary time sampling). In the previous studies access to reinforcers or breaks were delivered for instances of compliance or correct responding. For example, in Robinson and St. Peter (2019) 15-s of access was either accumulated or distributed (i.e.,

delivered immediately) following a correct response. Therefore, the current study extends previous research by a) training a teacher to implement the procedures, b) evaluating the impact of differential reinforcement with different reinforcer arrangements in a general education classroom setting, and c) the delivery of tokens in both reinforcer arrangements.

There are various limitations to the current study that should not be overlooked. First, given sessions were conducted in a general education classroom researchers could not control for potential confounding variables. Some examples include inconsistency of additional staff support for the classroom (i.e. teacher assistants were not there every session), technical difficulties (i.e. project wasn't working or the student login wasn't working), schedule changes (i.e., math was moved to a different time so the session was conducted in the afternoon instead of the morning), peers in the classroom (i.e., peer in the classroom would talk/ distract the participating student resulting in the student being off-task). Second, due to the current pandemic COVID-19 participant recruitment was difficult because schools did not want additional people on campus; as a result, only two students participated in this study thus far. Third, MTS data collected by the teacher did not accurately represent the increase on-task behavior while reduction in disruptive behavior were accurately represented in the data collected by the P.I. using PIR 10-s interval recording. Given these limitations future research should evaluate alternative data collection procedures that are not only feasible for teachers but also accurately represent the occurrence of the target behavior. For instance, future research could consider using an Individualize Behavior Rating Scale Tool (IBRST; Iovannone et al., 2009). The IBRST is a data collection system in which teachers rate behavior on a scale of 1 to 5 (e.g., 5 = a terrible day; 1 = a terrific day). Results of previous studies comparing the IBRST to direct data collected by researchers found high correspondence between the IBRST score and the direct data (Barnes et al., 2020).

In summary, results of this study indicate that the accumulated arrangement was more effective in decreasing disruptive behavior for both participants. The social validity assessment that both teacher and students preferred the accumulated arrangement when compared to the distributed arrangement. Thus, it appears that differential reinforcement with accumulated reinforcers may be a feasible and effective intervention for disruptive behavior of students in general education classroom.

Author Note: Due to the COVID-19 pandemic the thesis requirements for students graduating from the USF ABA program in 2022 have been modified and may include fewer participants or case studies.

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## **APPENDICES**

## Appendix A: Teacher Nomination Form

Adapted from (Andreu, 2016; Zuniga & Cividini-Motta, 2021)

Teacher: \_\_\_\_\_

Date: \_\_\_\_\_

Grade(s): \_\_\_\_\_

The first step is to identify students in your class or across your day who are of concern to you on behaviors.

Examples of Disruptive behaviors:

- Aggression to others or things
- Out of seat behavior
- Stealing
- Off-Task
- Arguing with teachers
- Arguing with peers
- Defiance
- Stealing
- Non- Compliance/ Not following directions
- Inappropriate vocalizations (e.g. Calling out when he/she is not called on; yelling; vocal threats)

Step 1) Do not use student names or identifiers

Step 2) Select the time of day that you see these behaviors

Step 3) List behaviors that the student engages in and circle the one of most concern to you. You do not have to list them in order.

Nomination	Period/Class or Time	List all types of disruptive behavior (circle most concerning)
Student A		
Student B		
Student C		

**Appendix B: Interval Recording Sheet (Momentary time sampling)**

**Participant One and Two**

Teacher Name \_\_\_\_\_

Date \_\_\_\_\_

Arrangement:             Accumulated       Distributed       Baseline

Set a timer for 5 min. At the end of the interval, observe the student for 10 sec and record a + if the target student is on task.

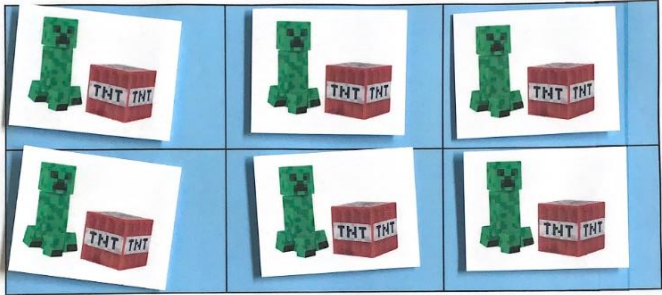
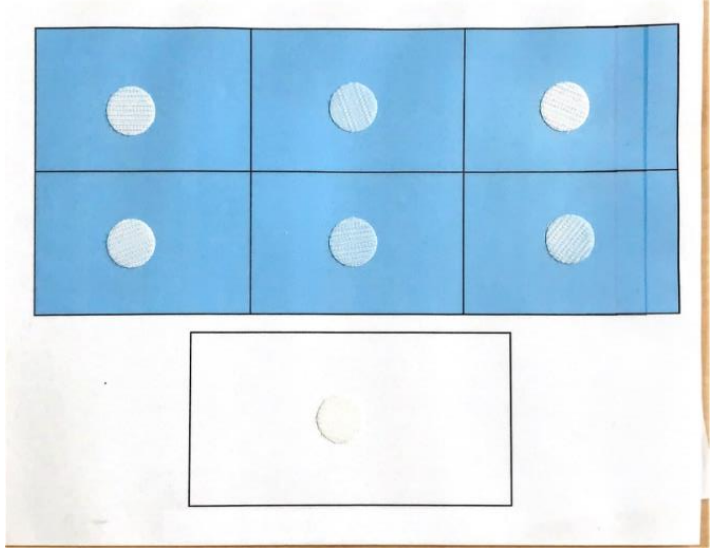
**On-task behavior definition:** any time the student engages in a teacher-directed task for at least 5 seconds. Examples include continuously looking at the Teacher or materials, opening a book and turning to an assigned page, reading aloud or silently when instructed by the Teacher, completing worksheets while seated in a designated area.

At the end of the interval, if the student is on task for **5 seconds** mark +

Interval	Time	On-task (+)	Comments
1			
2			
3.			
4.			
5.			
6.			

## Appendix C: Token Board Accumulated and Distributed





Accumulated Token Board

**Appendix D: Differential Reinforcement Evaluation Treatment Integrity Checklist**

<b>Treatment Integrity Checklist for Accumulated Arrangement</b>							
<b>Task</b>	<b>Yes/No/N.A.</b>						
1. Prior to starting class, teacher presents the student with two preferred items and asks the student to select the item they want to access at the end of class (i.e., backup reinforcer).							
2. Teacher places laminated pictures of reinforcer on the token board							
3. Teacher states the correct contingency for arrangement. ("If you are working when I check, you will get a token and at the end you will get Legos. Each token is worth 1 min of time with _____, so the more tokens you earn the more time you get with _____")							
4. Teacher/P.I. starts silent timer for 5-min.							
5. Teacher conducts class in the usual way							
6. When the timer vibrates the Teacher observes student for 10 seconds							
7. If the student is on-task for 5" the Teacher provides praise to the student ("great job working; you earned a token") and places a token in the accumulated arrangement board	Check is continency met_____						
	Praise_____						
	Token Placement____						
8. Teacher then states the contingency ("if you are working when I check you will earn another token") and continues with class	Contingency _____						
	Continues w/ class_____						
9. If the student is NOT ON-TASK teacher states "When I checked you were not working"							
10. Then the Teacher will restate the contingency (IF you are working when I check you will earn a token)							

Percentage of step completed correctly	
Assessor Name	
Date	
Session Number	
Participant Name	

## Appendix E: Differential Reinforcement Evaluation Treatment Integrity Checklist

Treatment Integrity Checklist for Distributed Arrangement							
Task	Yes/No/N.A.						
1. Prior to starting class, teacher presents the student with two preferred items and asks the student to select the item they want to access at the end of class (i.e., backup reinforcer).							
2. Teachers places the laminated pictures of the reinforcer on the token board.							
3. Teacher states the correct contingency for arrangement. ("If you are working when I check you will earn a token and right away you will earn 1 min with ____")							
4. Teacher/P.I. starts silent timer for 5-min.							
5. Teacher conducts class in the usual way.							
6. When the timer vibrates the Teacher observes student behavior for 10 s.							
7. If the student is on-task for 5" the Teacher provides praise to the student ("Great job working; you earned a token. Now you can __ for 1 min") and places a token on the board.	Check is continency met__						
	Praise__						
	Token Placement__						
8. Teacher provides student with access to reinforcer right away for 1 min.							
9. If student is not on-task teacher states "I checked and you were not on-task."							
10. Then the Teacher will restate the contingency ("If you are working when I check you will earn a token and right away you will get 1 min with ____").							
11. Teacher restarts the timer for 5 mins when the 1 min reinforcer time is over.							

Percentage of step completed correctly	
Assessor Name	
Date	
Session Number	
Participant Name	



## Appendix F: Social Validity Questionnaire for Teachers

(IRP-15; Andreu, 2016; Martens, Witt, Elliot, & Darveaux, 1985; Zuniga & Cividini-Motta, 2021)

Please circle the number that best describes your agreement or disagreement with each statement using the scale below.

1= Slightly Disagree 2= Disagree 3= Neutral 4= Slightly Agree 5= Agree

1. This was an acceptable intervention given the target student's disruptive behavior  
1      2      3      4      5
2. This intervention led to a decrease in the target student's disruptive behavior  
1      2      3      4      5
3. Most teachers would find this intervention appropriate for disruptive behavior.  
1      2      3      4      5
4. I would recommend this intervention to other teachers.  
1      2      3      4      5
5. I would be willing to use this intervention in the classroom setting with other students.  
1      2      3      4      5
6. This intervention would be appropriate for a variety of children and classrooms.  
1      2      3      4      5
7. This intervention was a fair way to handle the problem behavior in my classroom.  
1      2      3      4      5
8. I liked the procedures used in this intervention.  
1      2      3      4      5
9. Overall, this intervention was beneficial for the students in my classroom.  
1      2      3      4      5
10. Which arrangement was more effective at increasing on-task behavior? And which arrangement do you prefer?

**Appendix G: Social Validity Questionnaire for Students**  
(Adapted from Andreu. 2016; Zuniga & Cividini-Motta, 2021)

Please answer yes or no to each statement.

1. I liked using the token system
2. It was easy to use the token system.
3. I want to keep using the token system.
4. I want to use the token system in other classes.
5. I would recommend this to my friends
6. Which token system did you like best?
  - a. Rewards throughout the class
  - b. Rewards at the end of the class only
  - c. None of these

**Appendix H: Preference Assessment**

Teacher Name \_\_\_\_\_ Date \_\_\_\_\_

1. Create a list of preferred items/activities that are feasible and easy for you to deliver to \_\_\_\_\_ (Student's name). This may include toys and/or activities that you have observed the student frequently engages with.

1. _____	9. _____
2. _____	10. _____
3. _____	11. _____
4. _____	12. _____
5. _____	13. _____
6. _____	14. _____
7. _____	15. _____
8. _____	16. _____

**Additional**  
**Comments/Notes:** \_\_\_\_\_  
\_\_\_\_\_