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ORIGINAL PAPER

Using a Daily Report Card to Reduce Off-Task Behaviors for a Student with Autism Spectrum Disorder

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Abstract

Daily behavior report cards (DBRCs) have shown promise in reducing problematic classroom behaviors. The effectiveness of DBRCs has been used widely examined with respect to students with attention deficit hyperactivity disorder, specific learning disabilities, and other high incidence disabilities. Past research has primarily focused on students in primary grades, with a limited number of studies examining students in secondary grades, in particular students in high school. Even fewer studies have examined the effectiveness of DBRCs implemented by novice special educators. The purpose of the current study was twofold: (1) to examine the effectiveness of a DBRC in reducing off-task classroom behavior for a high school student with autism spectrum disorder (ASD) and (2) to evaluate the delivery of an intensive intervention by a novice special education teacher. A preservice special education teacher implemented the intervention. A changing criterion design was used to examine the effectiveness of the intervention. We analyzed the data using visual analysis and calculated effect sizes using Tau-U. The results suggested that DBRCs are an acceptable and effective treatment for reducing off-task behavior with a student with ASD when implemented by a novice special education teacher. Data were collected to measure the novice teacher's implementation fidelity. Additionally, the results showed that a novice special education teacher can be trained to implement a behavior management program for a student presenting inappropriate classroom behaviors with high fidelity.

Keywords Daily behavior reports cards · Preservice teacher · Autism spectrum disorder · Off-task · Behavior

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Introduction

Problematic and disruptive academic and social classroom behaviors can have a dire impact on students with disabilities and their teachers, especially novice teachers (Gunter et al. 1994). These impacts can include removal from inclusive settings (Butler and Monda-Amaya 2016), interfering with the learning process (Sutherland et al. 2002, 2003) and loss of teaching efficacy (Klassen and Chiu 2010; Perrachione et al. 2008). Along with students with emotional behavioral disorders (EBD), learning disabilities (LD), and attention deficit hyper activity disorder (ADHD), students with autism spectrum disorder (ASD) can present unique challenges in the classroom. Specifically, students with ASD can present problem behaviors (e.g., repetitive behaviors, intellectual disabilities, and symptoms of attention deficit hyperactivity disorder; Mayes et al. 2012; White et al. 2011). These behaviors can become barriers to effective educational and social development (Horner et al. 1992, 2002). For students who engage in chronic problem behaviors, the outcomes can be negative (Butler and Monda-Amaya 2016). Problem behaviors often threaten continued placement in general education settings, interfere with academic and social skill acquisition, generalize to other classrooms or settings, create toxic teacher–student relationships, and may follow students into adulthood (Butler and Monda-Amaya 2016; Neitzel 2010; Sutherland and Morgan 2003; Walker et al. 2004; Wehby et al. 1998).

Improving outcomes for students with problem behaviors is essential. Traditional approaches to behavior management include an assortment of approaches ranging from student-centered approaches (e.g., differential reinforcement, time-out), classroom and teacher-centered tactics (e.g., rules and routine, clear expectations), teacher–student relationship-focused (e.g., developing positive discourse with students), and school-wide initiatives (e.g., school-wide positive behavior interventions and supports; Horner and Sugai 2000; Korpershoek et al. 2016; Sugai and Horner 2002). One intervention that has been shown to be particularly effective is the daily behavior report card (DBRCs; Lebel et al. 2013; Owens et al. 2012; Taylor and Hill 2017). DBRCs have been used to reduce problem behavior in the classroom and are effective, efficient, and economical for special education teachers to implement.

Results of research on DBRCs suggest positive impacts on academic and social behaviors for students with disabilities (Atkeson and Forehand 1979; Barth 1979; Burke and Vannest 2008; Chafouleas et al. 2002; Riden et al. 2018; Smith et al. 1983; Vannest et al. 2010). Vannest et al. (2010) conducted a meta-analysis of single-case research analyzing 17 single-case research design studies, from 1970 to 2007, involving 107 participants. They reported a broad range in effect sizes for interventions (range = −0.14 to 0.97) using improved rate difference (IRD) as the meta-analytic measure.

Updating the work of Vannest et al. (2010) and Riden et al. (2018) conducted an examination and analysis of single-case and group design DBRC research from 2007 to 2017. Their review included 390 participants identified as at-risk, eligible for 504 services, or as having a disability (e.g., ADHD, specific LD, EBD).

Single-case DBRC research had an aggregated Tau-U effect size of 0.66 that can be interpreted as a medium effect (range = 0.51–0.81). Further they reported a broad effect size range for group research designs (range = 0.03–0.72) which is interpreted as low to medium effect.

Ultimately, past research has suggested that DBRCs can be viable tool for teachers to use for classroom/behavior management. Yet, with the range of effects of this intervention in the past, additional research is needed to determine their effectiveness when working with students in academic settings. DBRCs have been consistently shown to have a low-to-high range of effectiveness for increasing desired academic and social behaviors of students considered to have disruptive behaviors including those with disabilities (Atkeson and Forehand 1979; Barth 1979; Burke and Vannest 2008; Chafouleas et al. 2002; Smith et al. 1983; Vannest et al. 2010). Further, the research base on using DBRCs in high school is minimal.

Daily behavior report cards are individualized rating forms used to appraise target behaviors of students on a daily basis, provide feedback to the students on his or her performance, increase home-school communication, and deliver reinforcement contingent on student behavior (Atkenson and Forehand 1979; Barth 1979; Riden et al. 2018; Vannest et al. 2010). The flexibility, adaptability, and economical nature of DBRCs make them an efficient way to provide direct feedback about students' academic and social behaviors (Chafouleas et al. 2002). Throughout the research on DBRCs, five components have been shown to be necessary when creating the DBRC: (a) operationally defining the target behavior or constellation of behaviors; (b) rating of behaviors using simple numbers or symbols on a behavior scale; (c) daily monitoring of behaviors; (d) providing feedback to students on their behavior(s); and (e) communicating performance of DBRCs between the student's teacher and home (Chafouleas et al. 2002, 2007; Long and Edwards 1994; Riley-Tillman et al. 2007).

The inclusion of feedback and regular check-ins with the student about their behavior have the potential to create predictable schedules of reinforcement for some students. By utilizing instruments such as the function assessment screening tool (FAST), teachers are able to identify potential functions of target behavior that may be an effective means for deciding which students DBRCs are most likely to be effective. In our study, the results of the FAST suggest attention is maintaining the target behavior. In this instance using a DBRC was appropriate as the intervention is designed to provide students with attention via feedback on exhibited behaviors.

DBRCs are highly flexible in nature pertaining to settings and behaviors. We conducted our study in a high school setting where there is a need for highly flexible interventions that can travel from setting to setting with students. In comparison to elementary school where students receive the majority of their instruction in one setting, high school students receive instruction in various settings from several teachers throughout the day. A DBRC can be completed and behaviors reinforced by different teachers in different settings which can also promote the generalization of the target behavior. The factors mentioned above suggest DBRCs can be used efficiently by different teachers with multiple students in varying settings.

For example, Schumaker et al. (1977) implemented a daily report card system for use with problem behavior displayed by students in a secondary setting. In their

study, the authors recruited three male students, each displaying disruptive behavior, truancy, tardiness, and limited completion of academic tasks, to participate in the DBRC intervention. The authors developed the DBRC which included sections for rules, classwork, grades, and teacher satisfaction with corresponding boxes the teacher could check to indicate whether the student had met a particular expectation. Reinforcement was provided to the participants at home by their parents/caregivers that included praise and additional privileges (e.g., snacks, TV time, bowling) contingent on their performance at school. Specifically, parents were taught about basic rules of exchange regarding points for privileges. If a student received all "yes" checks in a particular class for following classroom rules, the student earned two points. If the student broke only one rule in that class the student earned one point. Any more than that zero points were awarded. A similar scale was used for classwork, grades, and teacher satisfaction. Parent-interventionist communication occurred via home visit once a week with the goal of collecting previous week's DBRC and troubleshooting any problems that may have occurred. Results suggest behavior trending in a therapeutic direction across all participants for all target behaviors.

The purpose of the current study was to extend the literature base and examine the effects of a DBRC treatment package on off-task classroom behavior exhibited by a high school student with ASD implemented by a preservice special education teacher. Previous reviews (i.e., Vannest et al. 2010; Riden et al. 2018) found that only five of 26 studies were conducted in secondary school settings leaving a gap in the literature. As such this study focuses on a student in high school implemented by a preservice special education teacher. Specifically, the purpose of the current study was to evaluate whether a DBRCs would be a viable behavior management tool for a preservice special education teacher working with a student with ASD and a history of problem behavior. Additional purposes included the evaluation of (a) the effects of a DBRC on off-task behaviors of a student with ASD; (b) the extent to which a preservice teacher would implement a DBRC with fidelity in the classroom setting; and (c) the acceptability of the DBRC intervention by stakeholders.

Methods

Participants and Setting

One female preservice special education teacher acted as the interventionist and one female high school student with ASD was the participant. Inclusion criteria for the interventionist consisted of (a) entering the culminating special education student teaching practicum, (a) working with students with disabilities, and (c) being placed in a K-12 academic setting. The interventionist was selected from a large public university in the northeast from an eligible pool of 15 that also met the inclusion criteria. The interventionist was a 21-year old, white female entering her student teaching placement.

The inclusion criteria for the participant consisted of (a) attending a public K-12 school, (b) receiving services as an eligible student with a disability, and (c)

engaging in high rates of behavior that result in being off-task during instructional classroom time. The participant was a 15-year-old white female in 9th grade diagnosed with ASD with a history of problem behavior and chronic absenteeism resulting in several ineffective interventions. The participant spent the majority of her time in special education settings throughout the day where she received services for mathematics, English language arts, and writing. She regularly attended history, science, and specials (e.g., physical education) in an inclusive setting always with the support of a paraprofessional. The participant had age appropriate expressive and receptive language skills.

The study was conducted in a public high school serving students in 8th–12th grade (total high school population = 2301) in the central Pennsylvania. Further, the intervention was implemented in both an autism support classroom during the System 44™ period (a reading and writing program) and an inclusive science classroom. During System 44™, the classroom consisted of 10 students including the participant. Instruction during this time was delivered with the student participant sitting at a table with three peers facing the teacher. During this time, the interventionist implemented the intervention as the classroom teacher led the class. The science class consisted of 12 students facing the science teacher. The participant sat at a table with her paraprofessional in the back of the classroom. The interventionist implemented the intervention as the science teacher instructed the class. The interventionist sat at a table behind the participant during instruction and approached her only after the 10-min interval expired to provide feedback and review goals in both settings.

Independent Variable

The DBRC form was adapted from Vannest et al. (2011). A DBRC package consisting of operational definitions of target behaviors, a simple number rating system, daily monitoring of behaviors, feedback provided to student on her behaviors, and communication of performance between the student's teacher and home was developed. The DBRC included the following: (a) a brief welcome note to the mother of the participant; (b) two questions in which the interventionist had to circle *yes* or *no* [i.e., (a) today we did a "check-in" with yesterday's card and (b) today we did a "check-out" with today's card]; (c) space for the participant's name, the date, and who the DBRC should be returned to (i.e., the interventionist); (d) the behavior rating scales, which described how many points could be earned contingent on student performance; (e) a section for the target behavior to be reduced; (f) a section for the class period to be named and three subsequent boxes that labeled the target behaviors; (g) space for the interventionist to provide the rating for each behavior; (h) a space for the interventionist's signature and a space describing how many points were earned during that class; (i) a section for how many points had to have been earned to earn the reward (i.e., reinforcer); (j) two boxes at the bottom of the DBRC for teacher comments; the other for parent comments; (k) a space for the parent to sign the form prior to sending the DBRC back to school with the student the next day.

Dependent Variables

The first author and interventionist operationally defined each target behavior prior to data collection. Target behaviors included *talking out*, *looking at others*, and *picking fingers*. *Talking out* was defined as any instance the participant made an unauthorized or unsolicited verbal statement during whole group instruction, independent work, or silent reading. Verbal statements included academic or non-academic utterances (e.g., answering without raising hand) but did not include non-contextual vocalizations (i.e., stereotypy) or group work interactions. Verbal statements do not include talking to her paraprofessional (e.g., asking her paraprofessional a question, asking a paraprofessional for help). *Looking at others* was defined as any instance the participant looked at another student's work during independent work time, looking at others in the classroom during whole class instruction, or during silent reading. *Picking fingers* was defined as any instance in which the participant picked her fingernails with her hand or mouth during whole group instruction, independent work, or during silent reading which led to her being further off-task.

Experimental Design

The effects of the DBRC were evaluated using a changing criterion design (CCD) across three behaviors. Changing criterion designs require initial baseline data on a single target behavior followed by implementation of a treatment in a series of phases in a stepwise change in criterion rate for the target behavior each prior phase acting as baseline (Hartmann and Hall 1976).

Pre-experimental Procedures

Training

The author provided three 1-h trainings to the interventionist. After the training, the first author and interventionist met with the mother of the participant to define her responsibilities during intervention (e.g., daily review of the DBRC, contingent reinforcement, signing and returning DBRC). The final training was conducted by the interventionist and was delivered to the participant as the first author monitored the meeting. PowerPoint presentations were developed to aid the interventionist in training the parent and student so no pertinent information was left uncovered during the trainings.

Interventionist Training

Three days of training were provided prior to pre-baseline data collection. On the first day of training, the rationale for the DBRC intervention was presented along with the essential components of the intervention, implementation procedures, operational definitions, and a question-and-answer period. Day two of consisted

of a review of day one materials, instruction on conducting the functional assessment screening), the multiple stimulus without replacement preference assessment (Deleon and Iwata 1996), practice on data collection procedures, as well as baseline and intervention procedures. During training, the interventionist was required to meet a mastery criterion of 100% on data collection procedures. The interventionist recorded the first author engaging in *talking out*, *looking at others*, and *picking fingers* to gain reliability of behavior data collection procedures. A third day of training was conducted prior to intervention phase entailing a review of behavior definitions, intervention training, parent training materials introduced, and weekly intervention meetings scheduled.

Parent Training

The first author and interventionist met with the mother in the autism support classroom. A PowerPoint presentation was conducted to explain the benefits of DBRCs, a review of the target behaviors, introduction of the DBRC, and her role in the intervention. During the parent training reinforcers at home were discussed and extra phone time and watching a television show with the mother was agreed upon. Time was allotted at the end of the presentation to answer any questions the mother had about the intervention.

Student Training

Following the baseline phase, a participant training session was conducted. The interventionist delivered a PowerPoint presentation to the participant. The presentation included why we were providing this support, how the support would be delivered, what the DBRC would look like, and instruction on replacement behavior. Replacement behaviors included: (a) raising her hand to speak as opposed to talking out, (b) focusing on her own work and area rather than looking at others work or other distractions in the classroom, and (c) lacing her fingers and placing them on the desk or on her lap instead of picking at her cuticles. While replacement behaviors are not required for a DBRC intervention, best practice suggests identifying functionally equivalent replacement behaviors that achieve the same outcome as a less desirable problem behavior. When the replacement behaviors were introduced and modeled for the participant by the interventionist, the interventionist prompted the participant to practice the replacement behaviors until the behaviors were demonstrated correctly. During participant and parent training sessions positive language was emphasized at all times by the researcher and interventionist (e.g., "we are doing this to help you have better days at school," "we are not doing this because you are in trouble we are doing this to help you become a successful young woman").

Pre-baseline Observation and Interviews

Two weeks prior to baseline, we determined the appropriateness of a behavior change program. Next, behavior pinpoints were defined according to Hawkins

and Dobes (1977) that stated behavior definitions have to be objective, clear, and describe what the behavior is and what the behavior is not. Interviews were conducted with the interventionist, the full-time classroom special education teachers familiar with the participant, and the mother of the participant. Interview questions were adapted from the functional assessment interview (O'Neil et al. 1997). Three 1-h direct observation sessions were conducted on non-contiguous days based on answers to interview questions. Continuous measurement was used to collect antecedent-behavior-consequence data so all instances of the behaviors of interest were detected during the observation sessions (Johnston and Pennypacker 2009). The first author conducted the pinpointing and choosing of target behaviors.

Functional Assessment Screening Tool (FAST)

The FAST was designed to prompt informant verbal reports about conditions under which problem behavior might occur and to organize those reports according to common contingencies that maintain problem behavior: positive and negative reinforcement (Iwata et al. 2013). The interventionist facilitated the completion of a FAST with two classroom teachers familiar with the participant. A FAST was also provided to the mother but was never returned. The results suggested that the behaviors were maintained by attention.

Multiple Stimulus Without Replacement (MSWO)

The interventionist conducted three MSWO assessments across three days to identify possible reinforcers to be included in the evaluation. Three possible reinforcers were identified during the administration of the MSWO. During each session, the top three items selected out of five possible choices were snack, phone time, and nail time; but never with the same ranking. Thus, we allowed the participant to choose the reinforcer prior to the beginning of each intervention session (i.e., snack, phone time) with a secondary reinforcer (i.e., nail time) provided at the end of the week contingent on meeting the goal three out of five days.

Experimental Procedures

Data Collection

Data collection occurred during baseline and intervention phases. Baseline data collection occurred during one and a half hour classroom periods. The classroom periods were divided into six 10-min intervals for five days during baseline. A frequency count of target behaviors was collected during each of the six 10-min intervals. We decided to divide the period into intervals so we could check in with the student during intervention phases after each interval. The rationale for this is that reinforcement must be delivered as close to the behaviors as possible to maximize the effect on the target behaviors. We decided that waiting until the end of the class would be too long for the student to contact reinforcement. The reason for using one hour of

the period opposed to the full one and a half hour class was to account for check-ins before instruction behavior, after each interval, at the end of all intervals, and time to deliver reinforcement at the end of the period contingent on the student's performance. During baseline, the interventionist and classroom teachers did not change the way they delivered instruction or managed their classroom.

Intervention data were collected in the same manner as baseline, every 10-min for 6 intervals during one class period. At the beginning of each observation the interventionist had data collection sheets and the DBRC ready, collected the previous day's DBRC (except on first day of implementation), reminded the participant to return the DBRC each day if the participant forgot to do so, reviewed behaviors necessary to earn points, reviewed behavior goals with the participant, reminded her about reinforcers that could be earned contingent on performance, and worded expectations positively. Throughout the DBRC period, the interventionist collected frequency during each interval, reviewed performance on targeted behaviors at the end of each interval with the participant, assigned point totals for behavior demonstrated, reviewed points not earned in a neutral tone and described how she could earn points during the next interval, and praised her for goals met during each interval. During end-of-interval-review sessions, the interventionist discussed how often the participant engaged in the target behaviors as well as praised the participant for engaging in the replacement behavior. Following this review the next 10 min interval began. During the observation intervals the interventionist did not address the participant's behaviors. The teachers were instructed to conduct their class as they always have. At the end of the observation the interventionist reviewed overall performance toward DBRC goals with the participant. Next, the participant was granted access to reinforcers contingent on her performance that day. The interventionist maintained neutral affect if goals were not met and reviewed behaviors that should be demonstrated next time to earn points and reminded the participant that tomorrow was a new day and the point sheet starts over. Last, the interventionist provided feedback for parents on the DBRC, signed the form, and sent it home with the participant for parents review and delivery of reinforcement contingent on her performance.

Intervention Phase Changes

Initial criterion for the first intervention phases across all three behaviors was set at 10% below the mean obtained during baseline. For *talking out* the initial criterion during intervention phase one was set at 64. For *looking at others* behavior, the initial criterion in intervention phase one was set at 40. The criterion for *picking fingers* was set at 10 during intervention phase one. Phase one continued until the participant met criterion three out of five days for each behavior. Criterion for *talking out* and *looking at others* during intervention phase two was set at 10% below the mean obtained during intervention phase one, 14 and 18, respectively. Due to the reduction in *finger picking* behavior during intervention phase one, the criterion during intervention phase two was set at six (i.e., one per interval). Phase 2 continued until the participant met criterion three out of five days for each behavior. Criterion for *talking out* and *looking at others* during intervention

phase three was set at six during intervention phase three due to the significant drops in level. *Picking fingers* was moved to maintenance phase for the remainder of the study. Following intervention phase three *talking out* and *looking at others* behaviors were moved to maintenance. In total there were five phases including baseline and maintenance for the talk out and looks at others behavior and four phases including baseline and maintenance for the picking fingers behavior. Criterion selection was response guided. No procedural changes occurred during the course of the intervention after the start of the study.

Maintenance

Maintenance data were collected on all three behaviors. Data were collected on two behaviors (i.e., talking out, looking at others) for two days after intervention was removed. Data were collected for seven days for the picking finger behavior after intervention was withdrawn. These data were collected to see if the participant engaged in the desired behavior after intervention was removed.

Data Analyses

The current study used visual analysis as the primary method to determine experimental control (i.e., functional relations between the DBRC and positive changes in the dependent variables). Specifically, level, trend, and variability in the data were examined visually to evaluate experimental control (Cooper et al. 2020). Additionally, we calculated means for each condition for all three target behaviors to determined level changes, split middle to determine trend (Lane and Gast 2014). A positive trend equates to a decrease in target behaviors. A negative trend equates to an increase in target behaviors. We set a predetermined criteria of 75% of data must be within 25% of the mean to be considered stable.

A Tau-U statistical analysis was also used to examine the effectiveness of DBRCs on three target behaviors within phases and between phases. Tau-U combines nonoverlap between phases with trend from within the intervention phase and controls undesirable Phase A trends (Parker et al. 2011a, b). Tau-U was calculated for baseline data and phase one data (to detect immediate effect) and baseline data and total intervention (overall effectiveness) data for all target behavior separately using the Single-Case Research Tau-U Calculator. A strength of this web application is the ability to analyze data for several phase contrasts from a single design independently. The software then permits for the calculation of a properly averaged omnibus effect size (Vannest et al. 2016). Tau-U is calculated using the formula: Tau-U = *S*/number of pairs (Parker et al. 2011a, b) where S represents The Kendall Score (Brossart et al. 2018). Tau-U can be interpreted for significance as small effect (< 0.65), medium to high effect (0.66–0.92), or strong effect (0.93–1) (Parker and Vannest 2012).

Reliability, Fidelity, and Validity

Interobserver Agreement (IOA)

The first author conducted mean count per interval IOA during 40% of baseline phases. We followed the guidelines presented by Cooper et al. (2020) for calculating mean count per interval. We divided the entire observation period into six 10 min intervals. During each interval, two observers recorded the number of occurrences of the target behavior within each interval. We then calculated the agreement between each observers' counts within each interval. Next we used the agreements per interval as out basis for calculating IOA. The formula for calculating mean count per interval is as follows:

$$\frac{\text{Int1IOA} + \text{Int2IOA} + \text{Int3IOA} + \text{Int4IOA} + \text{Int5IOA} + \text{Int6IOA}}{n\text{intervals}} = \text{mean count per interval IOA\%}.$$

Mean count per interval IOA data for baseline was 90.8% across all behaviors (range = 83–96%). Mean count per interval IOA for intervention and maintenance across all three behaviors was 98.3% (range = 95–100%).

DBRC Implementation Fidelity

The first author conducted treatment integrity checks on 30% of intervention and maintenance phases. A 16-item integrity checklist was used to assess the extent to which the interventionist correctly implemented the DBRC. The checklist was separated into three sections: (1) upon arrival, (2) throughout the DBRC period, and (3) end of DBRC review period. Additionally, a second observer who was blind to the study used the DBRC treatment integrity checklist to calculate treatment integrity during 40% of the treatment integrity observations. IOA for implementation fidelity was 100%.

DBRC Social Validity

Adapted versions of The Usage Rating Profile-Intervention (Chafouleas et al. 2009) and Schwartz and Baer (1991) were used to develop the social validity surveys. The interventionist, participant, and mother completed social validity surveys to assess the acceptability of the DBRC intervention. Each social validity survey used a Likert-type scale of one through six (i.e., 1 = strongly agree, 2 = agree, 3 = somewhat agree, 4 = somewhat disagree, 5 = disagree, and 6 = strongly disagree). The total possible score for the interventionist ranged from 10 (highest social validity) to 60 (lowest social validity). The total possible score for the participant ranged from seven (highest social validity) to 42 (lowest social validity). The total possible score for the parent ranged from eight (highest social validity) to 48 (lowest social validity).

Results

Does a DBRC Reduce Off-Task Behaviors of a Student with ASD?

Visual Analysis

The results of the evaluation are depicted in Fig. 1. Visual analysis was used to evaluate the results. Specifically, trend, level, and variability in the data were examined to determine the effectiveness of DBRCs.

We conducted trend analysis by using the split-middle approach. The results pertaining to *talking out* showed a positive trend during baseline, zero trend during Phase 1, zero trend during Phase 2, zero during Phase 3, and a zero trend during maintenance. The results pertaining to *looking at others* showed a negative trend during baseline, a negative trend during Phase 1, a negative trend during Phase 2, a positive trend during Phase 3, and a positive trend during maintenance. Visual analysis of *picking fingers* data resulted in a zero trend during baseline, and a positive trend in Phase 1, a positive trend in Phase 2, and a zero trend in maintenance. Over all we see a positive trend in the data across all conditions for all three target behaviors.

Frequency of *talking out* is depicted in the top panel of Fig. 1. During baseline, *talking out* occurred at a high level ($M = 71.25$). We observed an immediate drop in level of frequency of *talking out* during intervention Phase 1. We set a goal of 64 occurrences of *talking out* in Phase 1 and observed an immediate drop to low levels ($M = 16$). Subsequently, we set a goal of 14 occurrences of *talking out* in Phase 2 and continued to observe drops in level ($M = 7$). Next, we set a goal of six occurrences for Phase 3 and observed a continued drop in level ($M = 1.2$). During maintenance we observed a further drop in level ($M = 3$). Overall with *talking out,* we observed a level change from baseline ($M = 71.25$) across all intervention conditions ($M = 6.83$).

Frequency of *looking at others* is depicted on the middle panel of Fig. 1. During baseline, *looking at others* occurred at a high level ($M = 44.25$). We observed an immediate drop in level of *looking at others* during intervention Phase 1. We set a goal of 40 occurrences of *looking at others* in Phase 1 and observed an immediate drop to low levels ($M = 22$). We set a goal of 10 occurrences of *looking at others* in Phase 2 and continued to see drops in level ($M = 8.25$). Next, we set a goal of six occurrences for Phase 3 and saw a continued drop in level ($M = 2.25$). During maintenance, we observed a further drop in level ($M = 0.5$). Overall with *looking at others* we observed a level change from baseline ($M = 44.25$) across all intervention conditions ($M = 8.6$).

Frequency of *picking fingers* is depicted on the bottom panel of Fig. 1. During baseline, *picking fingers* occurred at a high level ($M = 11$). We observed an immediate drop in level during intervention Phase 1 for *picking fingers*. We set a goal of 10 occurrences of *picking fingers* in Phase 1 and observed an immediate drop to low levels of behavior ($M = 2.23$). We set a goal of six occurrences of *picking fingers* in Phase 2 and observed no level change ($M = 2.75$). Next, we set a goal of six for Phase 3 and observed a continued drop in level ($M = 2.25$). During maintenance we

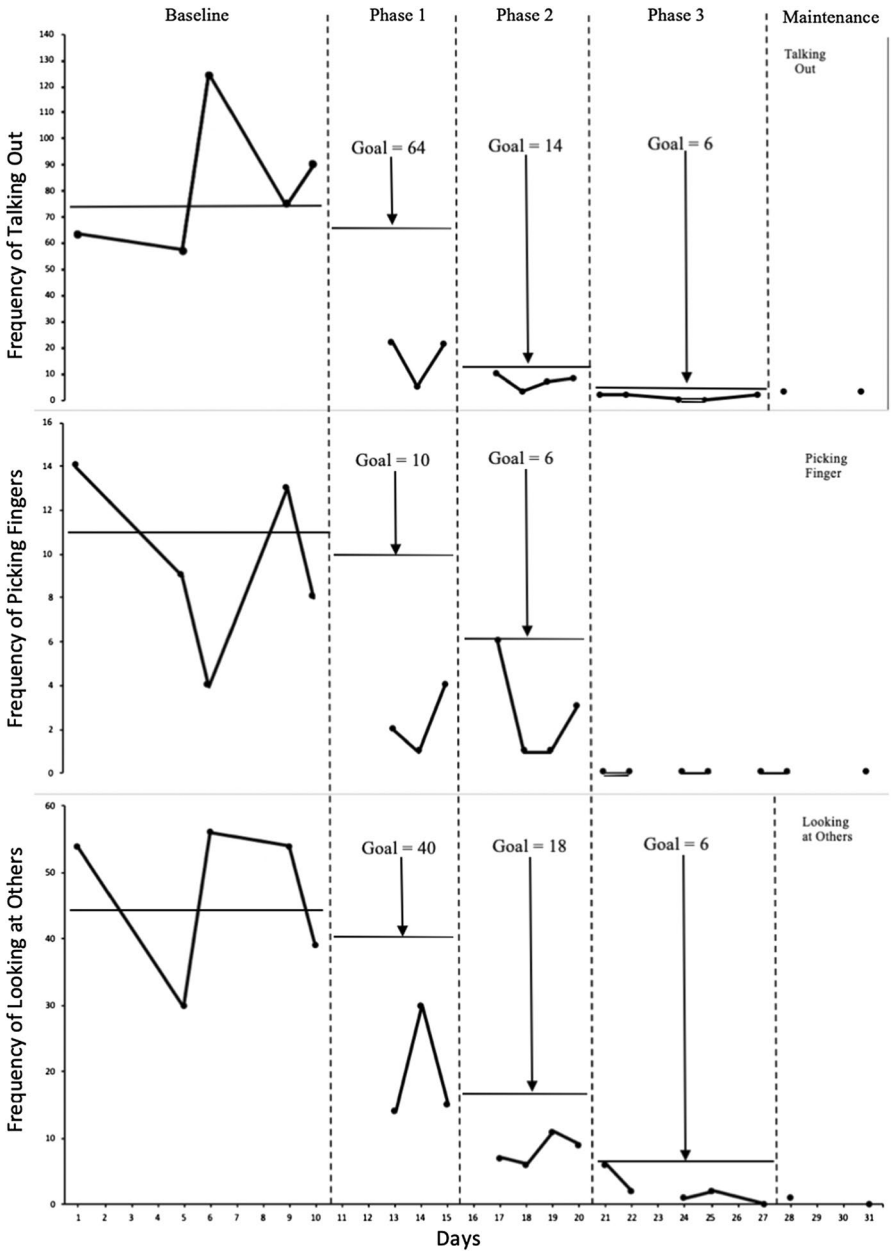

Fig. 1 Frequency count of student's target behaviors

observed zero occurrences of *picking fingers* during the duration of the maintenance phase (i.e., seven sessions). Overall for *picking fingers*, a level change from baseline ($M = 11$) across all intervention conditions ($M = 2.6$) occurred.

We observed variability during baseline with *looking at others* and *picking fingers*. Across all intervention conditions for all three target behaviors we observed minimal variability in the data. Stability was demonstrated across all target behaviors according to our criteria. Baseline *talking out* data resulted in 75% of the data points falling within the predetermined criterion for variability. Baseline *looking at others* data resulted in 75% of the data points falling within the stability envelope. Baseline *picking finger* behavior resulted in 75% of the data points falling within the stability envelope. We used the same criterion to determine stability for intervention conditions. Stability for *talking out* behavior data were not stable in phase one, two, or three. However, we observed stability in maintenance data. Frequency of *Looking at others* was not stable in phase one, had stability in Phase 2, and was not stable in Phase 3 or maintenance. Frequency of *picking fingers* was not stable in Phase 1 or Phase 2. We did observe stability in the data during maintenance.

Effect Size Analysis

Tau-U was calculated for all three target behaviors. Tau-U was calculated for baseline to intervention Phase 1 (immediacy of intervention effect). A large effect was demonstrated with *talking out* [ES = 1.00, $p < 0.001$, confidence interval (90%) = 0.26–1.00]. Tau-U analysis for baseline and across all intervention phases (total intervention effect) for *talking out* resulted in a large effect [ES = 1.00, $p < 0.001$, confidence interval (90%) = 0.49–1.00]. Tau-U for baseline to intervention Phase 1 for *looking at others* data demonstrated a large effect [ES = 0.93, $p < 0.001$, confidence interval (90%) = 0.20–1.00]. Tau-U for baseline and total intervention data for *looking at others* demonstrated a large effect [ES = 0.98, $p < 0.001$, confidence interval (90%) = 0.46–1.00]. Tau-U for baseline to intervention Phase 1 for *picking finger* behavior demonstrated a large effect [ES = 0.93, $p < 0.001$, confidence interval (90%) = 0.20–1.00]. Tau-U for baseline and total intervention data on *picking finger* demonstrated a large effect [ES = 0.91, $p < 0.001$, confidence interval (90%) = 0.34–1.00]. Overall, a strong effect size across all three target behavior was demonstrated [ES = 0.97, $p < 0.001$, confidence interval (90%) = 0.66–1.00].

What Level of Fidelity Does a Preservice Teacher Implement a DBRC?

The interventionist implemented the intervention with 100% fidelity during each fidelity probe conducted by the first author. Additionally, she implemented intervention with 100% fidelity during each fidelity probe conducted by the doctoral candidate who was blind to the study. The interventionist implemented the treatment package for all sessions at 100% fidelity.

How Acceptable was the DBRC Intervention?

The interventionist, the mother of the participant, and the participant completed social validity surveys with a Likert scale rated 1 through 6 at the conclusion of the study to assess the usefulness of the DBRC intervention as well as their attitudes

towards its effectiveness and ease of implementation. On the 10-question survey, the interventionist scored all of the questions as Strongly Agree or Agree ($M = 1.3$) providing evidence of the social validity of the intervention from an interventionist's perspective. The participant also completed a seven-question survey and responded with Agree (M = 2) for all questions indicating that the DBRC intervention was considered socially valid for her. Finally, the mother was given a social validity survey consisting of eight questions ($M = 1.75$). Her responses had more variability with ratings ranging from Strongly Agree (i.e., 1) to Somewhat Agree (i.e., 3). Anecdotal conversations with the mother during the post intervention meetings indicated that the participant had been doing much better at home and the family was experiencing a significant reduction in problem behaviors.

Overall, the results indicated improvement across all three behaviors. Visual analyses indicated a strong functional relation between intervention and dependent variables. Aggregated Tau-U results suggest a strong effect [ES = 0.97, $p < 0.001$, confidence interval (90%) = 0.66–1.00]. Data from the DBRC treatment integrity checklist suggested the interventionist implemented intervention with 100% fidelity. Results indicated that a preservice teacher can implement a DBRC intervention with 100% treatment integrity. Social validity data indicated that the DBRC intervention is acceptable to the interventionist, participant, and parent of the participant.

Discussion

Findings suggest that a DBRC implemented by one novice interventionist can reduce problem behavior of one individual with ASD. Specifically, we observed a significant and immediate change in level across target behaviors. Additionally, the target behaviors became stable at low levels throughout the duration of intervention and remained at low levels through maintenance.

Daily behavior report cards have been investigated and deemed effective in numerous studies for students in primary grades. However, there is a lack of studies looking at DBRCs and students in secondary settings. Further, the extant literature focuses on researchers or teachers acting as the intervention agents. The results of this study begin to address gaps in behavior research, specifically DBRC research, in secondary settings that focus on affecting change in a student with ASD when implemented by a preservice special education teacher. Equally important to conducting behavior intervention experimental research in high school is working with preservice teachers to implement complex behavior interventions in the natural setting. As noted in the introduction, educators struggle managing problem behavior and implementing complex interventions. Certainly, we have not solved this problem, however, a gap in the literature exists pertaining to working with preservice special education teachers as intervention agents. This study attempts to move the needle in preservice special education preparation to a position that preservice special education teachers are capable of implementing intensive interventions with the hope that this generalize to the classroom when they enter the field.

The participant met the criterion for earning reinforcers each day for the primary reinforcers and met her weekly goal (i.e., meeting criterion 3 out of 5 days)

to earn the secondary reinforcer (i.e., nail time with teacher). The reinforcers identified during the MSWO matched the function of the behavior identified by the FAST. Although the FAST is not considered a substitute for a functional analysis of problem behavior, its use provided valuable information prior to conducting direct observation of the participant's behavior in the classroom. Additionally, the current results are encouraging with regard to the ease of implementation of DBRCs constructed of research-based components (i.e., feedback, reinforcement contingencies, home–school communication) by a novice interventionist. The interventionist implemented the intervention with 100% fidelity. Additionally, all three individual stakeholders (i.e., interventionist, participant, parent) provided support for the social validity of DBRCs. The results of the social validity assessment are highly meaningful as using a DBRC should include the teacher/interventionist, participant, and the parents/guardians at home to maximize its effectiveness (Riden et al. 2018).

The current results should be considered in light of several limitations. First, the significant and immediate change in level of all three behaviors made seeing the stepwise change in behavior we expect to see in a changing criterion design less clear. It is important to note that between phases two and three there was some variability in the data that brings into the question the extent to which experimental control may have been established. Specifically, Between Phases 2 and 3, the data continued on a downward trend for *looking at others* and we observed a small change in level with some overlap between phases two and three for talking out. Issues surrounding experimental control for *looking at others* may have been due to the replacement behavior becoming learned as the intervention had been in place for some time. The small change in level with some overlap with *talking* out was likely due to the small window remaining for behavior change (i.e., the goal change was small). Next, during the intervention phases in using a CCD it is recommended that at least one change in criterion phase should revert to a previous goal level and/or baseline phase to further demonstrate a functional relationship between the intervention and the target behaviors (Cooper et al. 2020). Due to significant time restraints, the current study did not adhere to that recommendation. Ultimately, although variability in the data limits somewhat inferences regarding experimental control, the data strongly suggest the DBRC, implemented by a novice interventionist, was responsible for the dramatic reduction in off-task behaviors.

Third, a functional analysis of the problem behavior did not occur; instead the FAST was used which has been shown to have limited reliability and validity (Iwata et al. 2013). Fourth, due to variability in high school schedules (e.g., work release, transition services) we were only able to implement the DBRC during one period each day that occurred in two different settings; thus, generalization was not assessed. Fifth, the operational definition of the *looking at others* was not as clearly defined as we initially thought. During initial interviews, this behavior was brought to our attention as a form of bullying. The participant would look at what others were doing in the classroom or what others in the classroom were working on and would then begin to tell them how they were wrong and would tell them why the way she would do the task was correct, even if it was incorrect; and did so in a condescending tone. In our behavior definition and subsequent data collection we would count a *looking at others* occurrence even if she looked at someone entering

the room, per our definition. A more appropriate operational definition would have included a clear explanation of what was occurring during the occurrences of *looking at others* rather than the act of looking. Lastly, we did not collect fidelity of parent provided reinforcement. Future research should examine fidelity of reinforcement delivery to determine its impact on student outcomes.

The current findings support previous research on the use of DBRCs to reduce problem behavior (e.g., Atkeson and Forehand 1979; Chafouleas et al. 2002; Smith et al. 1983; Vannest et al. 2010). The DBRC has been shown to be a viable behavior change agent that can be used by expert and novice teachers alike. However, the most current research has shown variability in effectiveness of the DBRC interventions (Riden et al. 2018; Vannest et al. 2010). This may be due to inconsistent implementation by teachers in the field as there is a lack of guidance pertaining to explicit steps that teachers need to perform. Future research should include focus on specific and immediate feedback, preferred items as reinforcers, clearly defined behavioral definitions, and treatment integrity.

The results of the current study and previous research suggest that in implementing DBRCs, practitioners should focus on seven elements. First, practitioners should conduct initial observation to determine if there is a problem and what those behaviors might be. Second, the function of the behavior should be identified prior to intervention. Third, a preference assessment should be conducted to identify preferred items that may be used as reinforcement. Fourth, behaviors used to create scales on a DBRC should be operationally defined. Fifth, home-school communication is a critical component of DBRC and must be included in the implementation if DBRC interventions. Sixth, immediate performance feedback should be provided to students on the progress towards behavior goals on a DBRC. Lastly, those wishing to use DBRCs as a behavior intervention should implement daily behavior reports cards with fidelity in order for the intervention to be successful. Failure to ensure treatments are implemented as planned poses threats to internal and external validity of the experiments (Moncher and Prinz 1991; Gresham et al. 1993).

The research literature is brimming with evaluations of interventions addressing individual educational domains (e.g., social interactions, reading, self-management) for elementary and preschool students with ASD (Carter et al. 2010; El Zein et al. 2014), far less attention has focused on adolescents (Kucharczyk et al. 2015). While early intervention is warranted and critical for the success of individuals with ASD, we must not forget about them as they approach adulthood. Perhaps most disconcerting about the lack of research in this area is the high school years may be the last touch point educators have to affect behavior change before students transition out of high school.

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Compliance and Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Standards All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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