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# Evaluating the Prevent–Teach–Reinforce Model for High School Students With Autism Spectrum Disorder

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**Abstract**

This study evaluated the use of the Prevent–Teach–Reinforce (PTR) model as an intensive individualized behavior intervention. Three educators and three high school students with autism spectrum disorder participated in the study. A concurrent multiple baseline design across participants was used to demonstrate the outcomes. The results indicated that the educators implemented the PTR intervention plans with high levels of fidelity, and their implementation of the intervention plans led to decreases in problem behavior and increases in replacement behavior across all three participating students with autism spectrum disorder. The educators demonstrated using the Individualized Behavior Rating Scale Tool effectively as designed to monitor student progress, and the educators and students found the PTR intervention to be acceptable and satisfactory. All three educators expressed interest in continuing to implement the PTR intervention after the completion of the study. Implications and areas for future research are discussed.

**Keywords**

prevent–teach–reinforce, functional behavior assessment, autism, high school, manualized intervention

Students with autism spectrum disorder (ASD) are characterized by difficulties with social communication skills and restricted, repetitive behaviors (American Psychiatric Association, 2013). In addition to the core symptoms of ASD, co-occurring problem behavior can impede their school success (Ashburner et al., 2010; Schreibman et al., 2000). It is estimated that approximately 94.3% of children and adolescents with ASD, ranging in age from 2 to 17 years, display various problem behavior (e.g., aggression, disruption, self-injury, stereotypy) that may impinge on their development and learning (Matson et al., 2008), with the prevalence of physical aggression alone being estimated as 53% (Mazurek et al., 2013), which can persist into adulthood (Hutton et al., 2008; Rattaz et al., 2018). Persistent problem behavior can have a detrimental effect on post-secondary outcomes (Hammerton et al., 2019), and it is imperative that students with ASD who exhibit persistent problem behavior receive the support necessary to succeed in the educational setting and beyond. However, the limited knowledge and skills among educators in implementing effective interventions has been a major barrier in the application of evidence-based practices for students with ASD (Boutot & Hume, 2012; Wilson & Landa, 2019).

In the last two decades, an emerging research base has supported the practice of using functional behavior assessment (FBA) and function-based interventions in schools to address persistent challenging behavior (Gage et al., 2012; Loman & Horner, 2014; McIntosh & Av-Gay, 2007; Walker et al., 2018). FBAs describe the relation of the problem behavior to environmental events, both those that occur prior to (antecedents) and immediately after (consequences) performance of the behavior. The FBA information is summarized through a hypothesis statement that describes the relation and identifies the function that the behavior serves for the student. Behavior intervention plans (BIPs) are developed to (a) prevent the occurrence of the problem behavior by developing strategies to directly modify the antecedents; (b) teach functionally equivalent replacement behaviors that are more efficient and effective at getting the reinforcement function than the problem behavior; and (c) changing responses to problem behavior so that they no longer are effective at getting the student the reinforcement function. Evidence exists that shows interventions based on FBAs are effective at reducing problem behavior and increasing appropriate replacement behavior of students with ASD in various grade levels (e.g., Camacho et al., 2014; McComas et al., 2000; Sigafoos et al., 2009). However, it is

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currently unknown to what extent FBAs are implemented with technical adequacy by typical school practitioners. Previous research has indicated that school-based implementation of FBAs is flawed and may not result in effective BIPs (e.g., Blood & Neel, 2007; Couvillon et al., 2009; Gable et al., 2014; Scott et al., 2010; Van Acker et al., 2005); however, there has not been a recent systematic review that can confirm continued challenges. Researchers, although, have speculated that school-based practitioners may have difficulty translating clinical applications of FBAs into practical processes feasible for school implementation (Gable et al., 2014).

In recent years, several studies evaluated a specific FBA/BIP approach titled Prevent–Teach–Reinforce (PTR; Barnes et al., 2020; Dunlap, Iovannone, Kincaid, et al., 2010; Dunlap, Iovannone, Wilson, et al., 2010; Dunlap et al., 2013; Sullivan et al., 2021). PTR is a manualized intervention that provides clear descriptions of procedures to be followed. The PTR approach is facilitated by a coach who has expertise in applied behavior analysis and who guides a student-centered team through a multi-step process to develop a function-based BIP with the contextual fit (Dunlap, Iovannone, Kincaid, et al., 2010). Throughout the process, teachers have significant input on the development of the BIP, including the selection of the interventions to be implemented and a description of how the interventions will be implemented within the naturally occurring routines or activities in which the target student's problem behavior is performed. Active coaching is provided to the teachers to support implementation fidelity and to make immediate adjustments as needed to BIP to enhance effectiveness.

To enhance the process, PTR includes user-friendly tools, including an indirect FBA checklist, Individualized Behavior Rating Scale Tool (IBRST), menu-driven intervention selection checklist, and PTR process fidelity checklist. Of these tools, the IBRST, which utilizes a 5-point Likert-type scale that allows teachers to rate their perception of student target behavior occurrence, has been found to be an efficient and nonintrusive method that teachers can use for daily progress monitoring (Barnes et al., 2020; Iovannone et al., 2014; Narozanick & Blair, 2019). To date, there have been two randomized controlled trials (Dunlap et al., 2018; Iovannone et al., 2009) and several single subject studies (e.g., Barnes et al., 2020; DeJager & Filter, 2015; Kulikowski et al., 2015; Sullivan et al., 2021) that have evaluated PTR. Results yielded from research thus far have shown that PTR is effective in reducing problem behavior and increasing appropriate or replacement behavior of students with disabilities or at risk of requiring special education due to severe problem behavior. Furthermore, teachers implement PTR intervention plans with high fidelity (e.g., $\geq$80%) and find it to be socially valid.

A limitation of PTR is that only a single study (Strain et al., 2011) has included students with ASD, and the study occurred in an elementary school. In addition, only a single study has included high school students, and it targeted students with emotional–behavior disorder (Sullivan et al., 2021). To address the gap, we evaluated the use of PTR with high school students with ASD. Specifically, the study examined the extent to which (a) student problem behavior and replacement behavior improved when teachers implemented the PTR intervention plans with fidelity, (b) teachers used the IBRSTs as designed to monitor student progress, and (c) teachers and students found PTR to be socially valid.

## Method

### *Participants and Setting*

This study was conducted in three classrooms at a U.S. public high school located in a rural area of central Florida. The school had a population of approximately 2,300 students and was a Title 1 school with more than 90% of the students receiving free or reduced-price lunch and with 65% of the students having ethnic/racial minority backgrounds, of which the majority of the students were from a Latino background. Of the three classrooms, two classrooms were in the Exceptional Student Education (ESE) unit serving 3 to 6 students, and one classroom was a general education honors classroom with 25 students. All three classrooms were staffed with one teacher and two to three instructional aides. PTR was implemented during identified target academic time periods (e.g., English and U.S. History).

The participants were three students with ASD and three educators (two teachers and one instructional aide). Inclusion criteria for student participants were (a) receiving special education supports under the category of autism, (b) engaging in a minimum of one persistent problem behavior, and (c) having consistent attendance (i.e., averaging 4 days a week). Inclusion criteria for educators were (a) having a student with ASD who meets the inclusion criteria in their class, (b) regularly interacting with the student participant, (c) expressing difficulty addressing the student's problem behavior, and (d) willing to participate in the PTR process. To recruit participants, the researcher (first author) distributed teacher and student recruitment flyers to all teachers at the high school. The teacher recruitment flyer directed teachers who were interested in the study and had a student who met the inclusion criteria to contact the researcher to schedule a meeting to obtain informed consent and confirm eligibility. Flyers were sent home with all students of the three teachers who consented to participate in the study. Parents who were interested in the study contacted the researcher through email or telephone to discuss the study; a meeting was scheduled for those desiring to discuss the study further. Four parents provided signed permission-informed consent forms. However, one student was

excluded from the study due to inconsistent attendance. After parental permission-informed consent was secured, the first author obtained written assent from three student participants for participation in the study.

Colton was a 16-year-old White, non-Hispanic male student enrolled in the 10th grade. He received all instruction in self-contained special education. In addition to autism, Colton had been diagnosed as having attention-deficit/hyperactivity disorder (ADHD) and bipolar disorder. Colton was not receiving any additional services. He obtained "at risk" scores from his mother's responses on the Behavior Assessments for Children–Second Edition (BASC-2; Reynolds & Kamphaus, 2004) in the areas of social skills, adaptability, leadership, activities of daily living, and functional communication. However, his teacher's responses to the BASC-2 yielded "clinically significant" scores in the areas of study skills, learning problems, school problems, and "at risk" scores in areas of attention problems, depression, and withdrawal. Colton exhibited difficulty maintaining independent and small-group academic work and would occasionally argue with his teachers. It was reported that when Colton would argue with his teachers, he would have a difficult time calming down and would often be sent home from school with his parent. When Colton continued to engage in problem behavior, his teachers would call his parents, and he would be removed from school for the remainder of the day.

Sean was a 16-year-old White, non-Hispanic boy enrolled in the 11th grade. Sean was classified as gifted and was enrolled in general education honors classes. Although Sean was enrolled in the 11th grade, he was eligible for early graduation at the end of his current school year. The Wechsler Intelligence Scale for Children–Fourth Edition (WISC-IV; Wechsler, 2003) was completed to assess Sean's IQ, which yielded a full-scale IQ of 118, placing him in the High Average range and ranked at the 88th percentile for his age. In addition to ASD, Sean had been identified as having ADHD. Sean's teachers reported problem behaviors of frequent outbursts and arguments in class. This resulted in him being removed from class frequently and being sent to the principal's office or home. Due to his problem behavior, Sean was receiving weekly counseling services. During baseline, Sean was referred for office discipline for inappropriate touching behavior and received a 5-day out-of-school suspension.

Ben was a 19-year-old White, non-Hispanic male student. Ben was receiving special education support for the categories of autism and speech and language impairment, and he was also diagnosed with ADHD. He received "Extremely Low" ratings in the areas of conceptual, social, and practical adaptive behavior on the Adaptive Behavior Assessment System–Second Edition (ABAS-II; Harrison & Oakland, 2003) when he was assessed at age 7. His deficits in these areas had persisted into adolescence. Ben's teachers reported that Ben displayed significant social skills deficits, including an inability to appropriately greet and conversate with peers and adults. This social deficit was reported to disrupt the learning environment for himself and others during all class subjects.

Both teachers and the aide were White, non-Hispanic females. Colton's teacher, Kaitlyn, was a 37-year-old first-year teacher with a bachelor's degree. She taught U.S. history and functional skills classes in the special education unit. Sean's teacher was 31 years old, had a bachelor's degree, and had been teaching for 8 years in middle and high schools. She taught 12th-grade English and honors English. Ben's team chose to have the instructional aide participate in the study due to the extensive amount of academic time she spent with Ben during school hours. She was 37 years old, had an associate degree, and had been working as an instructional aide for 5 years, 3 of them directly with Ben. The researcher (first author) facilitated the PTR process as a coach. The researcher was a master's-degree student in applied behavior analysis (ABA) and had the board-certified assistant behavior analyst (BCaBA) certification. The researcher had 3 years of professional work experience in clinical and school settings, providing ABA and behavior intervention services to children with disabilities.

## Measurement

*Direct Observations of Student Behavior.* Direct observations of the problem behavior and replacement behavior occurred 2 to 3 times per week for 50 min per student. Each student's PTR team identified and defined both problem behavior (behavior to decrease) and replacement behavior (behavior to increase).

Colton's team targeted task refusal as the behavior to decrease, which was defined as verbally or physically refusing to initiate or complete a task, follow instructions, or engage in a group activity (e.g., saying "No," swiping materials off the table, putting head down), drawing or rewriting on an activity sheet, or speaking off-topic. Colton's team targeted task engagement as the behavior to increase, which was defined as actively engaging in an assigned activity or task for more than 3 s, including using a pen or pencil to complete table work or engaging verbally and physically on-topic with peers during a group activity. Non-examples included playing with other materials instead of working, getting out of seat, or leaving the activity area without teacher's permission. A duration measurement system was used to collect data on both behaviors, which was reported in minutes.

Sean's team targeted disruptive behavior as the behavior to decrease, which was defined as argumentative statements directed at peers or teachers in a voice volume that could be heard from outside the classroom. Sean's team targeted appropriate responding as the behavior to increase. It was

defined as raising his hand and/or addressing the teacher by name during whole-class instruction to contribute on-topic statements or questions to the classroom discussions at a conversational volume. Frequency count was used to measure both targeted behaviors.

Ben's team targeted repetitive greetings as the behavior to decrease, which was defined as two or more greetings to the same person within one class period (e.g., "Hi, Ms. Joelle. Hi, Ms. Joelle."). The targeted behavior to increase was appropriate greeting, which was defined as asking a question or starting a conversation following the initial greeting in the absence of any additional greeting, answering questions, or closing the conversation during interactions with peers and adults within the targeted class time period. A frequency count was used to record both targeted behaviors.

*Individualized Behavior Rating Scale Tool.* The participating teachers used the IBRST (Iovannone et al., 2014) for daily progress monitoring of student behaviors. Interrater reliability of the IBRST is reported as .72 to .83 (Iovannone et al., 2014) and concurrent validity, which examined the association between IBRST scores and systematic direct observation data, is reported as .70 (Barnes et al., 2020). The teachers rated each targeted behavior using a 5-point Likert-type scale that described a level of behavioral occurrence within the specified measurement routine. A rating of 5, for either problem behavior or replacement behavior, represented a high occurrence of the behavior while a 1 represented low or no occurrence. Each targeted behavior rating descriptions were individually defined. In this study, educators completed the IBRST each day at the end of the academic time period in which they identified as experiencing problem behavior of the participating students. The researcher converted the direct observational data into rating scale scores using the same individual IBRST criteria for each student to identify the extent to which the educators used the IBRST as designed to monitor student progress by examining the correspondence between direct observation and teacher-collected IBRST data.

Colton's task refusal behavior was rated by his teacher during history. Problem behavior IBRST ratings were established as *41 to 50 min* (5), *31 to 40 min* (4), *21 to 30 min* (3), *11 to 20 min* (2), and *0 to 10 min* (1). His academic engagement behavior ratings were established identical (e.g., 41–50 min = 5). Sean's task refusal behavior was rated by his teacher in his Honors English class period. IBRST ratings were established as *>8 disruptions* (5), *6 to 7 disruptions* (4), *4 to 5 disruptions* (3), *2 to 3 disruptions* (2), and *0 to 2 disruptions* (1). Appropriate responding ratings were established as *>6 responses* (5), *4 to 5 responses* (4), *3 to 4 responses* (3), *1 to 2 responses* (2), and *0 response* (1). Ben's instructional aide rated his repetitive greetings during his morning reading routine. IBRST ratings were established as *>8 disruptions* (5), *6 to 7 disruptions* (4), *4 to 5 disruptions* (3), *2 to 3 disruptions* (2), and *<2 disruptions* (1). Ratings for appropriate greetings were established as *6 greetings* (5), *5 greetings* (4), *4 greetings* (3), *3 greetings* (2), and *0 to 1 greetings* (1).

*Teacher Implementation Fidelity.* Teacher fidelity of implementing the PTR intervention plan was assessed in 100% of the intervention sessions through direct observations. A fidelity checklist was used for each teacher, which included all procedural steps for each specific intervention strategy to be implemented by each educator. The observers (first author and research assistant) indicated whether each step was or was not implemented or whether there was no opportunity to implement (e.g., routine interruptions). A fidelity percentage score was calculated by dividing the number of steps implemented by the total number of steps and multiplying by 100. The total number of intervention steps on each fidelity measure across the three teachers varied from 13 to 19 steps depending on the individual student's PTR plan. All three teachers demonstrated high implementation fidelity. The fidelity mean score was 96.22% for Colton's teacher, 96.43% for Sean's teacher, and 93.5% for Ben's instructional aide, ranging from 85% to 100%.

*Coach Procedural Fidelity of the PTR Process.* The procedural fidelity of the coach (first author) implementing the PTR process was assessed using a task analysis checklist in 33% of meetings for each student by an independent observer and 100% of meetings by self-assessment. The checklist included the behaviors to be performed by the coach in each PTR step. The procedural fidelity percentage score was measured by dividing the number of steps performed by the number of total steps and multiplying by 100. Researcher procedural fidelity across all meetings was 100%.

*Social Validity.* Immediately after all post-intervention data were collected, each educator completed an adapted Treatment Acceptability Rating Form–Revised (TARF-R; Reimers et al., 1992) to evaluate the acceptability and satisfaction with the PTR intervention. The adapted TARF-R, a 13-item questionnaire, used a 5-point Likert-type rating scale with higher scores (4–5) indicating strong agreement and lower scores (1–2) indicating strong disagreement. Students were also asked to complete an adapted version of the TARF-R social validity form, which included 5 questions rated on a 5-point Likert-type scale, with higher scores indicating higher acceptability and satisfaction. To ensure accurate responses from teachers, the TARF-R form and an envelope were given to the team members and students immediately before the researcher left. The forms were returned directly to the researcher in the sealed envelope or to the school exceptional student education specialist in the sealed envelope to return to the researcher.

*Interobserver Agreement.* Two trained observers who were graduate students collected direct observational data on student target behaviors and teacher implementation fidelity. Interobserver agreement (IOA) for student behaviors measured by frequency was calculated by dividing the smaller frequency count by the larger frequency count and multiplying by 100. IOA for behaviors measured by duration was calculated by dividing the lesser duration by the higher duration and multiplying by 100. IOA for the teacher implementation fidelity was calculated by diving the number of agreements in the task analysis of steps by the total number of steps and multiplying by 100. Observers were trained by the researcher, which involved practice scoring videos of student behavior obtained online. Training continued until they reached an IOA criterion of 90% or higher. IOA was assessed for a mean of 47.37% (range = 45.5–50%) of all sessions across all phases for educator and student behaviors. For implementation fidelity, the mean IOA was 100% for Colton's teacher, 98.8% for Sean's teacher, and 100% for Ben's aide (range = 95–100%). For student problem behavior, mean IOA was 95.6% for Colton (range = 87.5–100%), 100% for Sean, and 100% for Ben. For student replacement behavior, mean IOA was 98.7% for Colton (range = 94.6–100%), 100% for Sean, and 100% for Ben.

## Experimental Design

A concurrent multiple baseline design across students was used to demonstrate a functional relation between PTR and student behavior change. The multiple baseline design demonstrated experimental control of the PTR intervention without removal of the intervention by replicating the effects of the intervention across time and across students (Kazdin, 2011).

## Procedure

The PTR process consists of five steps: (1) teaming, (2) goal setting, (3) PTR assessment, (4) PTR intervention with training and coaching, and (5) evaluation. These steps were completed through a series of team meetings throughout the course of this study in which the researcher facilitated the PTR process with the team members. Student input on each step was also gathered during individual meetings conducted separately with two of the students (Colton and Sean). Ben chose not to participate in any team or individual meetings. Information from the educators and the students was integrated into making decisions. Meeting time duration ranged from 25 to 45 min with educator teams and 10 to 45 min with students. Step 1 (Teaming) for this study was accomplished through the enrollment of study participants. Teachers were asked to identify any other school personnel who regularly interacted with the students to be on the team. Colton's team consisted of the researcher, his three primary teachers, and the ESE specialist. Sean's team consisted of the researcher, his honors teacher, and the school social worker. Ben's team consisted of the researcher, his primary teacher, his instructional aide, and the ESE specialist.

*Meeting 1: Steps 2 and 3—Goal Setting, IBRST Development, and PTR Assessment.* Each team identified, prioritized, and operationalized the target behaviors for intervention for each student (described earlier), with the educators first followed by the students. The researcher described the behaviors identified by the team as potential targets for each student. The students indicated that the primary problem and replacement behavior they agreed to were valid.

After reaching consensus on the behaviors, the IBRST for each student was developed. In developing the IBRST, the researcher presented questions and options to the educators regarding how best to measure behaviors (e.g., number of times and length of behavior lasted) and the academic activity/class in which the behaviors would be monitored. Based on their measurement preference, the researcher guided each teacher to set up the 5-point Likert-type scale ratings for the problem behavior and replacement behavior by asking questions about how behavior typically occurs and desired goals. After completing the IBRST, educator team members were asked about their preference for completing the PTR Assessment (Dunlap, Iovannone, Kincaid, et al., 2010). The PTR Assessment used a checklist format in three categories (prevent, teach, and reinforce) that address environmental variables that trigger the target problem behavior, the maintaining consequences (i.e., function) of the problem behavior, and any social or communicative skills that can be taught as an alternative to the problem behavior. The assessment was developed by reviewing several existing structured FBA interviews and can be completed as a structured interview or by having respondents answer questions independently. Educators on all three teams chose to complete the assessment independently and provide it to the researcher by a specific date (before the second meeting).

Colton and Sean were also provided choices for completing the student version of the PTR Assessment. Colton chose for the researcher to verbally discuss each question and answer; Sean chose to independently complete the PTR Assessment during the meeting, asking the researcher questions as needed. Meeting 1 lasted 30 min with each student and 45 min with the educator teams. Prior to the second meeting, the researcher conducted direct antecedent-behavior-consequence (ABC) observations of each student. The responses from the educator and student versions of the assessment as well as ABC observations were synthesized, and draft hypothesis statements were developed for each team to review in the second meeting. The following hypotheses were agreed upon for each student's problem behavior.

**Table 1.** Prevent–Teach–Reinforcement Strategies Selected for Each Student.

| Participant | Prevent | Teach | Reinforce |
|---|---|---|---|
| Colton | • Visual cues/tools (small card w/ task engagement behavior) | • Task engagement<br>• Self-monitoring on-task behavior | • Provide escape to engage in preferred activity upon meeting task engagement goals<br>• Positive praise (minimum of 3 statements) for task engagement<br>• Redirect to replacement behavior by gesturing to self-monitoring card |
| Sean | • Provide choices (who to work with) | • Responding appropriately<br>• Social problem-solving | • Provide escape to engage in preferred activity upon meeting daily replacement behavior goal<br>• Minimize attention to inappropriate responses |
| Ben | • Visual cues/tools (lanyard w/ sample greetings) | • Social skills/appropriate greetings | • Provide escape to visit preferred staff member upon reaching appropriate greeting goal<br>• Remove attention for 1 min following inappropriate greeting<br>• Redirect to replacement behavior by gesturing to lanyard |

*Colton.* When asked to complete independent or small group academic work, he would engage in off-task behavior. As a result, he gained attention from adults and avoided or delayed the academic task.

*Sean.* When (a) participating in a class discussion or (b) presented with a writing task, he would engage in disruptive behavior. As a result, he gained attention from peers and adults and avoided or delayed the writing task.

*Ben.* When (a) someone entered the classroom or (b) he was given free time, he would engage in repetitive greetings. As a result, he would gain attention from adult and peers.

*Baseline Data Collection.* Baseline data collection began promptly after the initial meeting. The teachers engaged in classroom activities as usual and rated student behavior using the IBRST. The research team conducted systematic direct observations of student behavior.

*Meeting 2: Step 4—PTR Intervention.* The researcher met with each team and student separately to have them rank order between two to four intervention strategies from three categories, *Prevent* (antecedent strategies), *Teach* (replacement behavior instructional strategies), and *Reinforce* (changing contingencies by reinforcing the replacement behavior and responding differently to problem behavior). The researcher helped guide the PTR teams in selecting strategies by using the PTR Intervention Menu (a listing of evidence-based interventions within each category; Dunlap, Iovannone, Kincaid, et al., 2010) and providing descriptions and examples of strategies that best matched each hypothesis. They selected the highest ranked intervention strategy that was agreed upon by the teacher and the student in each category, which was directly aligned with the identified hypothesis on the problem behavior. The information provided by the students and teams was congruent, and a consensus was reached easily. The teams and the students used the PTR Intervention Menu separately and ranked two to four intervention strategies from each category. For each strategy selected, the first researcher and teachers task-analyzed the steps that were feasible for implementation in the classroom. Table 1 describes the interventions selected for each student. The second meeting with the students and the teachers lasted approximately 25 to 45 min.

As shown in Table 1, the selected Prevent strategies included using visual cues (Colton & Ben) or providing choices (Sean), and the Teach strategies included teaching replacement behaviors of task engagement and self-monitoring (Colton), appropriate responding and social problem-solving skills (Sean), or social skills-appropriate greetings (Ben). For Reinforce strategies, the following strategies were selected: (a) providing the reinforcer hypothesized to maintain the target behavior contingent on targeted replacement behavior (e.g., allowing to escape to preferred activity, providing praise or attention) and (b) using extinction procedures or redirecting to replacement behavior contingent on targeted problem behavior. The specific strategies used to teach and reinforce replacement behaviors included: (a) training to self-monitor every 10 min using a checklist and allowing to engage in reinforcement activities for 5 to 10 min while earning 12 checkmarks (Colton); (b) training to use social problem-solving strategies when responding to class discussions, by teacher's provision of alternative statements and scenarios and weekly social worker's counseling sessions, and providing daily 5- to 10-min reinforcement activities and weekly US$10 gift cards to Nintendo eShop based on accumulated points (Sean); and (c) training to use specific greeting skills when communicating with peers and adults through teacher-led social skills training that incorporated BST procedures, and providing a 5-min

break to leave the classroom and visit a preferred staff member to engage in a short conversation (Ben).

*PTR plan training.* After developing the PTR intervention plans, the participating students' teachers were trained on the strategies by the researcher, using behavior skills training (BST; Miltenberger, 2012). The BST procedures included explanation, modeling, role-playing, and feedback. The training sessions continued until educators role-played the plan with 80% accuracy. All three teachers achieved more than 80% in training. The training for each teacher lasted approximately 30 min. Following training, teachers for Colton and Sean briefly (2–3 min) reviewed the intervention strategies with them prior to implementing the plan in the classroom without providing individual training, whereas Ben received individual training during non-educational time from the researcher (coach) and teacher on his plan via BST procedures. The joint training was planned to reduce the training time. Training for Ben lasted 10 min.

*Intervention implementation.* Within 1 week of receiving training on the interventions, the teachers implemented the PTR intervention plans in the designated classes. The coach provided teachers in vivo coaching during implementation of intervention procedures as needed on the first day of implementation to ensure fidelity and feasibility. In vivo coaching included a review of steps and modeling the intervention steps with Ben (upon teacher request). Performance feedback followed the observation session and consisted of (a) reviewing of steps and fidelity, (b) praise for correct completion, (c) reflection and corrective feedback for any challenging steps, and (d) answering questions. For one student, Colton, two weekly follow-up probe data were collected 2 weeks after the intervention ended to assess maintenance of Colton's behavior improvement during the targeted history class time period.

*Meeting 3: Step 5—Progress Monitoring and Data-Based Decisions.* In addition to direct observational data collected by the researcher, educators continued to use the IBRST to rate student behaviors daily. Contingent upon data, small changes were made to plans (e.g., changes in goal criterion and reinforcement choices). Data-based decision-making was implemented throughout the intervention phase to decide when to end the intervention implementation across all students. Student behavior data were stable and changes were not made to the intervention plans based on the data collected; however, changes to Colton's and Sean's reinforcers were made based on their teacher's requests. For example, Sean's teacher requested the addition of a reinforcer of extra credit points that Sean could earn daily to address the increase in problem behavior when the researcher was not present; Colton's teacher mentioned Colton's interest in origami and requested that it be added to his reinforcement list. Following the final post-intervention data points, the educators and students were given the TARF-R social validity form to assess the feasibility and acceptability of the PTR intervention in the classroom.

## Results

### Student Behavior

Figure 1 displays the results of PTR on the behaviors of each student. All three students' problem behavior decreased, and replacement behavior increased when the intervention was introduced. In the baseline phase, Colton engaged in task refusal for an average of 25.96 min and was academically engaged for an average of 11.85 min. During the intervention, Colton's task refusal decreased to an average of 2.38 min and academic engagement increased to an average of 45.35 min, demonstrating stability with little variability. Colton's intervention data demonstrated an immediate reduction in problem behavior and an increase in replacement behavior with no overlapping data points between baseline and intervention phases for both target behaviors. During follow-up, Colton engaged in task refusal for an average of 2.02 min and academically engaged for an average of 45.34 min.

Sean engaged in disruptive behavior in the baseline phase for an average of 10.5 times and appropriately responded an average of 1.83 times. Sean's disruptive behavior demonstrated a high level with an increasing trend at the end of the baseline, whereas appropriate responding demonstrated a low level with a stable decreasing trend at the end of the baseline. During the intervention, Sean's disruptive behavior immediately decreased to an average of 1.86 times and appropriate responding increased to a mean of 10.14 times, demonstrating an immediate reduction in disruptive behavior and an increase in appropriate responding. At the end of the intervention, Sean exhibited a stable decreased level of disruptive behavior and an increased level with some variability for appropriate responding. Sean's data exhibited no overlapping data points between baseline and intervention phases for both behaviors.

During baseline, Ben engaged in repetitive greetings an average of 15 times (range = 3–40 times) and engaged in conversation skills on average 0.67 times. During the intervention, Ben's repetitive greetings decreased to a mean of 3.5 times and conversation skills increased to a mean of 9.8 times. In baseline, Ben's disruptive behavior initially demonstrated a low level followed by an increasing trend at the end of baseline, whereas conversation skills remained stable. Ben's repetitive greeting, which was found to be reinforced by teacher and peer attention during the PTR assessment, increased extensively during the last 3 sessions in baseline when teacher attention was reduced due to the unavailability of an instructional assistant. During the

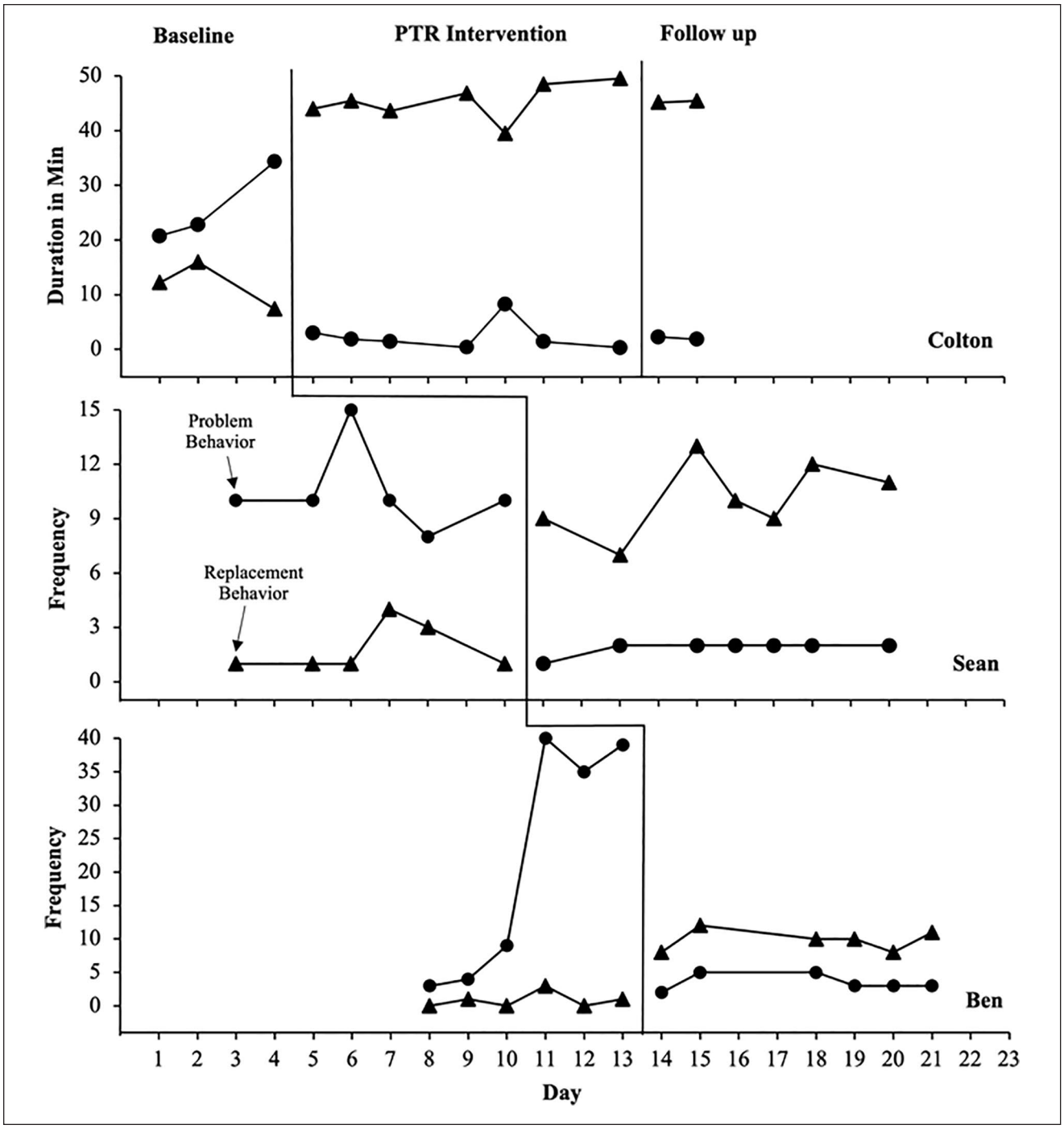


**Figure 1.** Direct Observational Data on Student Problem Behavior and Replacement During Each Phase Across Participants.
*Note.* Duration in minutes for Colton and frequency count for Sean and Ben. PTR = Prevent–Teach–Reinforce.

intervention, Ben demonstrated stable responses for both disruptive behavior and conversation skills. At the end of intervention, Ben exhibited a stable low level of disruptive behavior and a stable high level for conversation skills, with 5 overlapping data points between baseline and intervention phases for disruptive behavior.

### *Individualized Behavior Rating Scale Tool*

Figure 2 displays IBRST data on student behaviors collected by teachers. Overall, results show that the IBRST ratings had similar trend or stability patterns to direct observational data points across phases with the exception of baseline for Colton. The overall teacher ratings of problem behavior in baseline were consistently higher than those for the intervention across students, whereas the ratings of replacement behavior in baseline were consistently lower than those for the intervention, which indicated that the teachers also observed dramatic decreases in problem behavior and increases in replacement behavior during intervention. The mean ratings of teacher-observed problem behavior decreased from 2.7, 4.0, and 3.7 in baseline to 1.1, 2.4, and 2.2 in intervention for Colton, Sean, and Ben, respectively. Likewise, the mean ratings of replacement behavior increased from 3.0, 2.5, and 1.3 in baseline to 4.9, 4.9, and 3.2 in intervention, for Colten, Sean, and Ben, respectively.

### *Social Validity*

Social validity data from teachers indicated that the PTR intervention was highly acceptable and satisfactory. Overall mean ratings were 4.6 (Colton), 4.0 (Sean), and 4.5 (Ben). Items receiving the highest ratings ($M$ = 4.7–5.0) across teachers were "willingness to carry out the plan and like the procedures in the plan" and "fit into existing routine." Items receiving lowest overall mean ratings ($M$ = 3.9–4.1) were "likeliness of behavior plan permanently improving student behavior," "confident plan will be effective," and "willingness of other staff members to implement plan." Student social validity results also indicated high acceptance of PTR with mean overall ratings of 4.8 (Colton), 4.2 (Sean), and 5.0 (Ben). Highest mean ratings were found for the "acceptability of the plan" ($M$ = 5.0), liking the procedures ($M$ = 4.7) and "fit with personal goals" ($M$ = 5.0). Sean rated "effectiveness of plan" and "disadvantages of plan" as 3 whereas both Colton and Ben rated those items as 5.

## Discussion

The primary purposes of this study were to evaluate whether implementation of the PTR process for high school students with ASD would improve student behaviors and whether the high school educators (teachers and instructional aide) would implement the PTR interventions with fidelity. The study also examined the extent to which educators and students found the PTR intervention to be socially valid and the extent to which the educators used the IBRST to monitor student progress. The results of this study indicated that PTR was effective when used by high school teachers of students with ASD. All three teachers implemented each of their PTR intervention plans with high fidelity, and the PTR interventions resulted in immediate improvements in all three participating students' behaviors. The social validity assessment indicated that both teachers and students found PTR to be highly acceptable and effective. High agreement of teacher IBRST ratings of student behavior with systematic direct observations was reached for two of the three teachers and moderate agreement for one teacher, indicating that educators could use the IBRST easily and accurately to monitor student progress as designed.

These results support previous research that PTR is an effective FBA/BIP model to be implemented in school settings for students with persistent problem behavior (e.g., Barnes et al., 2020; Iovannone et al., 2009; Strain et al., 2011; Sullivan et al., 2021). This study adds to the literature as it is the first evaluation of PTR for high school students with ASD. This is promising as high school students with ASD who engage in problem behavior have difficulty succeeding in school and have a negative prognosis for post-secondary outcomes (Shattuck et al., 2012).

An aim of any behavioral intervention is to improve student behaviors; however, teacher willingness to implement behavior intervention plans is the key to achieving the aim. The PTR process considers this and builds in actions to ensure the contextual fit of the plans and teacher preferences. To enhance buy-in, teachers select strategies that both match the conditions in the hypothesis statement and are acceptable for implementation by teachers, which consist of strategies that are evidence-based, many requiring low effort to implement. Rather than having a large quantity of interventions, PTR asks to prioritize one Prevent (antecedent) intervention, one Teach (replacement behavior) intervention, and one Reinforce (contingencies) intervention for responding to replacement behavior and problem behavior. The teacher and PTR coach partner to develop a detailed description of the procedures for implementation of each selected strategy, to ensure that the plan is implemented with fidelity and is effective. The descriptions are based on how the teacher wants to implement the interventions and takes into consideration of teacher comfort level and feasibility.

Beyond high implementation fidelity, other indicators of buy-in in this study were suggested when two of the teachers were observed using the PTR strategies with other students in their classrooms. For example, after implementing the plan for Colton, his teacher more frequently used positive behavior-specific comments with other students. Sean's teacher, who initially was reluctant to deliver pre-correction prompts to students (e.g., reminding them to raise hands) due to concerns about dampening discussions, began to remind the class to raise their hands after seeing its positive impact on Sean's behavior. Finally, social validity ratings indicated that teachers rated PTR as highly effective and

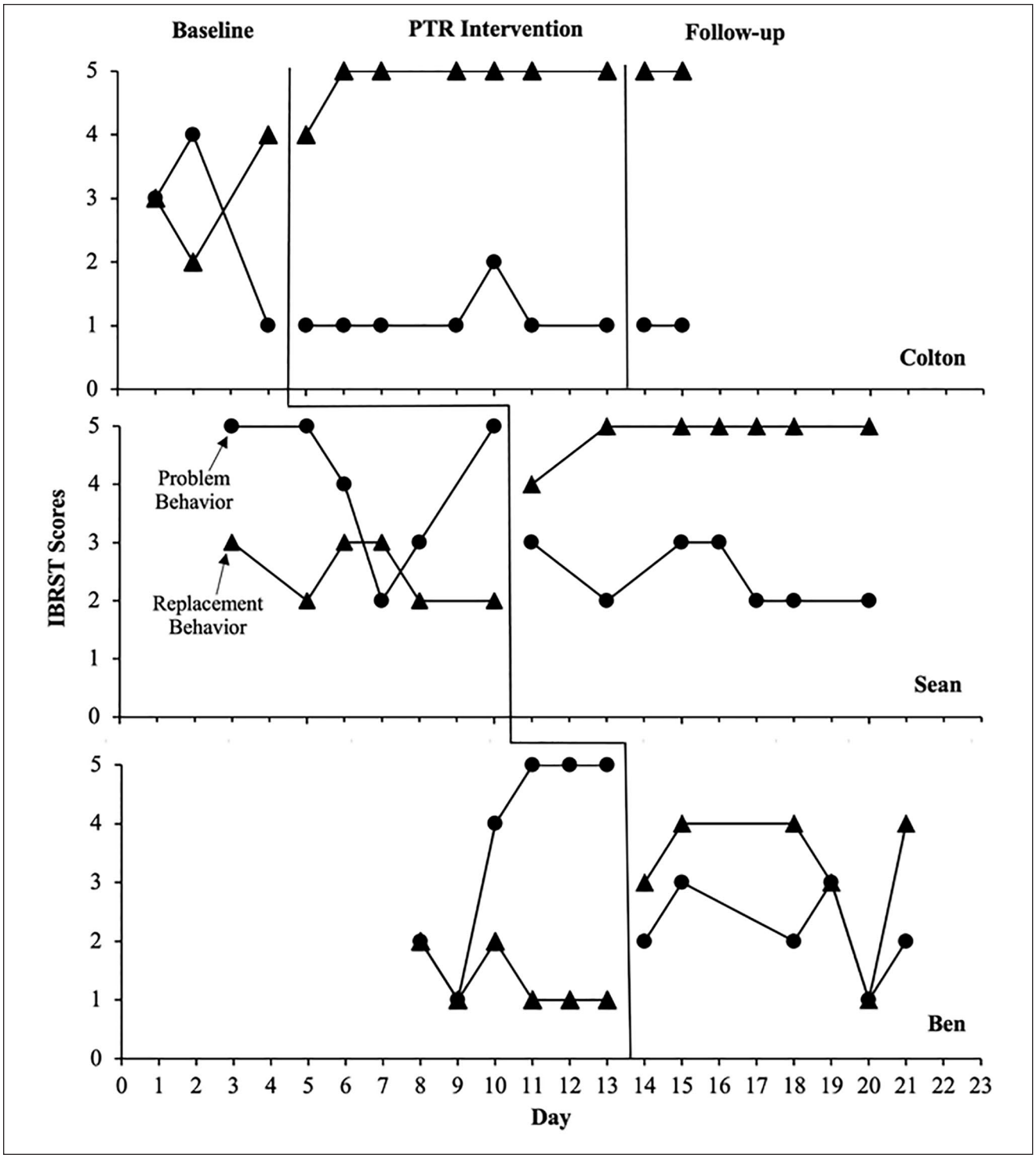


**Figure 2.** Teachers' Individualized Behavior Rating Scale Tool Rating Scores on Problem and Replacement Behavior During Each Phase Across Students.
*Note.* PTR = Prevent–Teach–Reinforce; IBRST = Individualized Behavior Rating Scale Tool.

acceptable, with all three educators indicating that they would continue to use the PTR strategies.

While teacher buy-in is essential for the implementation of strategies, student buy-in is equally important, particularly at the secondary level. As youth enter early and middle adolescence, they desire more control over decisions made about their lives and less on adult authority (Reis et al., 2000). Research has found that students in school environments that

support autonomy are more likely to be well-adjusted and motivated to learn (Hinnersmann et al., 2020; McElhaney et al., 2009). Student involvement in decisions made about their behaviors is an important feature of PTR, specifically with high school students. In this study, each student's level of involvement varied, with two students participating to some degree and one student (Ben) choosing not to be involved. Initially, Colton was very involved in the PTR goal-setting and assessment process, asking the researcher for clarification on questions he was unsure about and provided detailed answers about his goals and dreams. Colton participated in all components of the intervention and assisted in the identification of replacement behaviors and the development of reinforcement strategies. On the contrary, Sean initially expressed hesitation regarding the PTR process. He preferred to complete his own PTR Assessment instead of having the researcher interview him. This pattern continued into the second meeting with the PTR-SEC Assessment and PTR-SEC Intervention Checklist. When completing the PTR-SEC Assessment, Sean requested to complete the assessment packet independently as he did not want the researcher to interview him. Upon independent completion of this assessment, Sean identified potential prevention interventions, teaching interventions, and reinforcement interventions that closely aligned with the information provided within the PTR-SEC Assessment.

### *Limitations and Future Directions*

A few limitations exist within the current study. First, the study was conducted with only three students and their teachers/instructional aide in one high school. Although a functional relation of effects was established for all three students using a multiple-baseline design, generalizability is limited, and we cannot assume that PTR will work with other high school teachers and their students with ASD (Maggin et al., 2018). Although the students' placements were diverse and general education teachers were included, there continues to be a need for more replication research using PTR with teachers of students in high school settings, particularly with general education teachers.

A second limitation and need for future research is determining whether any of the PTR intervention components contributes more toward student behavior change and teacher implementation fidelity. Although all three students showed immediate improvement after implementing the PTR intervention plans, it is unknown whether all three components (i.e., Prevent, Teach, Reinforce) are necessary or if one component may contribute more than others toward student improvement. Likewise, it is unknown whether teachers have higher implementation fidelity with a specific category or have higher acceptance of one category over the others. Future research should examine exactly what components of the PTR intervention are responsible for improvements in student behaviors and lead to higher implementation fidelity.

Other limitations include the brief intervention duration of the study (approximately 4–6 weeks per student) and the inclusion of only one follow-up probe for one student (Colton). Thus, it is unknown whether teachers continued to use the intervention after the study concluded, or whether the behavior improved to the point of mastery and interventions could be faded. Furthermore, the long-term impact of behavior interventions for students with ASD was not explored in this study. Although it has been documented that unresolved problem behavior leads to poorer post-school outcomes, it is not known what level of intervention sustainability is essential for student mastery. Sustainability of interventions is an area that is sorely in need of research, and future studies should consider exploring this issue.

This study used both descriptive assessment (antecedent-behavior-consequence observations) by the researcher and completion of indirect assessment (PTR Assessment) to conduct the FBA and generate hypotheses on problem behavior. The PTR Assessment can be used as a checklist or as an interview for teachers and students. Although all three intervention plans, derived from the hypotheses, were effective in improving student behaviors, to date no studies have validated the PTR Assessment. This would be valuable research to instill confidence that the hypothesis obtained from the PTR Assessment has a high degree of contribution to the intervention plan and outcomes that follow and could possibly alleviate the use of resources by determining when a descriptive assessment is needed or not needed. Treatment utility studies may be a method for exploring this area (see Hayes et al., 1987 for descriptions of several treatment utility methodologies). Despite the limitations, the current study contributes to the existing knowledge of using PTR with high school student to address the challenging behaviors of students with ASD. Results indicate that PTR can be implemented by high school teachers and can have an impact on student behaviors.

## Authors' Note

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