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Using a Multicomponent Function-Based Intervention to Support Students With Attention Deficit Hyperactivity Disorder

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Abstract

The current study evaluated the effects of a multicomponent function-based intervention on students with other health impairment (OHI) for attention deficit hyperactivity disorder (ADHD) in a private special education school. The focus of the intervention was to prevent problem behaviors and to increase academic engagement by modifying classroom activities, teaching replacement skills, and changing behavior consequences. Data using a multiple-baseline design across academic subjects revealed that target problem behaviors decreased and academic engagement increased in reading, writing, and mathematical activities for students. Social validity with the classroom staff indicated that the intervention process and outcomes were highly acceptable and effective. In conclusion, this study provides strong evidence that a multicomponent function-based intervention can be successfully applied to students with both ADHD and problem behaviors.

Keywords

ADHD, problem behavior, positive behavior support, function-based intervention, teacher training

According to the Centers for Disease Control and Prevention (CDC), attention deficit hyperactivity disorder (ADHD) is one of the most widely diagnosed disorders among public school students (CDC, 2015). Approximately 11% of students 4 to 17 years of age were diagnosed with ADHD in 2011 and rates of ADHD diagnosis increased an average of 5% yearly from 2003 to 2011 (CDC, 2015). Students with ADHD often experience a myriad of issues in social and academic development, including impulsivity, inability to sustain attention, over-activity, difficulty following teacher directions and classroom rules, off-task behaviors, and failure to complete class activities (Ervin, DuPaul, Kern, & Friman, 1998). As a result of these difficulties, many students with ADHD are at risk for academic failure (Bussing et al., 2012; Ek, Westerlund, Holmerg, & Fernell, 2011). They are often retained a grade, and may be suspended or expelled from school (Loe & Feldman, 2007). However, teachers struggle to provide effective support for these students in the classroom (Kos, Richdale, & Hay, 2006). Function-based interventions have been identified as effective strategies to address challenging behaviors of students with various disabilities. This study examines the effects of multicomponent function-based interventions on students with ADHD.

Students with ADHD can qualify for individualized supports through either Section 504 of the Rehabilitation Act of 1973, or the Individuals With Disabilities Education Improvement Act (IDEA) of 2004. Section 504 requires that students with disabilities receive appropriate educational accommodations designed to meet their individual needs. Students with ADHD are eligible for these services under the category of other health impairment (OHI) of IDEA. Under IDEA and its implementation regulations, school districts are required to consider the use of positive behavioral interventions and supports (PBIS) and a functional behavior assessment (FBA) for a student whose behavior impedes his or her learning or that of others (34 CFR § 300.324). PBIS is a systematic problem-solving process for addressing challenging behaviors exhibited in students with various disabilities. FBA uses a variety of techniques and strategies to identify the nature of behavior and the surrounding environment that influences the behavior (Horner & Carr, 1997). However, prior to the implementation of FBA and PBIS, the law requires that the local education agency, the parent, and the relevant members of the student's individualized education program (IEP) team

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need to determine the manifestation of his or her disability (34 CFR § 300.530; U.S. Department of Education, n.d.).

Various intervention strategies are available to teachers of students with ADHD. Students with such a diagnosis perform better in a highly structured classroom with minimal sensory distractions, a routine ordering of daily events, a better seating arrangement, frequent breaks during class time, and a modified curriculum (Jarman, 1996). Modified curricular are the most widely used intervention strategies because of their proven effectiveness (Clarke & Dunlap, 2008; Conroy, Dunlap, Clarke, & Alter, 2005; Jarman, 1996; Lane, Umbreit, & Beebe-Fankenberger, 1999; Umbreit, 1995). Similarly, teaching an appropriate way to request breaks from tasks increases the levels of task engagement of students with ADHD who display erratic behaviors to escape tasks (Umbreit, 1995). Academic engagement of students with ADHD is enhanced by the effective use of preferred activities or allowing choice-making (Kern, Bambara, & Fogt, 2002; Powell & Nelson, 1997), and self-management of their own behaviors (Barry & Messer, 2003). Contingency management procedures such as differential reinforcement and extinction have been effectively used to reduce problem behavior and to teach new skills (Petscher & Bailey, 2008). When these strategies are included in multicomponent intervention plans, the effects of interventions may be maximized.

Research has shown that function-based interventions effectively reduce problem behavior while increasing appropriate skills for students with a range of conditions including ADHD (e.g., Conroy et al., 2005; Lane, Kalberg, & Shepcaro, 2009; Wood, Blair, & Ferro, 2009). Unlike other conventional intervention approaches, interventions addressing the behavioral functions use more proactive techniques to increase student active engagement in learning and to promote appropriate or replacement skills (Carr et al., 1999; Clarke & Dunlap, 2008; Umbreit, Lane, & Dejud, 2004). Function-based interventions focus on designing and implementing a PBIS plan, a good fit for all stakeholders (i.e., teachers) involved in the student support process (Dunlap, Iovannone, Wilson, Kincaid, & Strain, 2010; Lane, Weisenbach, Little, Phillips, & Wehby, 2006). These interventions have enabled some professionals to effectively address problem behavior, promote social-emotional competence, and raise academic achievement in the classroom (Carr et al., 1999; Dunlap, 2006). However, many teachers have tendency to rely on punitive strategies (Conroy, Clark, Fox, & Gable, 2000; Pas, Cash, O'Brennan, Debnam, & Bradshaw, 2015; Scott, Liaupsin, Nelson, & McIntyre, 2005). Thus, there is a strong need for bridging this gap between research and practice in schools.

Students with disabilities and challenging behavior benefit from multicomponent function-based interventions (Blair, Cho, Lee, & Dunlap, 2011; Dunlap, 2006). Such intervention plans have been found to decrease student problem behaviors (Bambara & Kern, 2005; Dunlap et al., 2000; Sears, Blair, Iovannone, & Crosland, 2013). In general, these multicomponent interventions have been applied to students with severe disabilities and with low frequency, high-intensity behavior. There is a need for research that focuses on diverse groups of students, with personnel support of varying backgrounds, and in various settings (Conroy et al., 2005; Crimmins & Farrell, 2006; Wood et al., 2009). A particular concern when providing individualized interventions to students with problem behaviors is the ability of classroom teachers to develop function-based intervention plans.

Literature on function-based interventions indicates both teachers and school-based consultants have difficulty linking FBAs to intervention (Crone, Hawken, & Bergstrom, 2007; Van Acker, Boreson, Gable, & Patterton, 2005). Blood and Neel (2007) found that the bulk of FBAs conducted by school personnel did not include hypothesis statements—the basis of designating function-based interventions. Applying function-based interventions can be intense, and requires lengthy training, extensive data collection, expert model delivery, and additional resources and staff (Crimmins & Farrell, 2006). Considering that many professionals experience difficulties in applying the function-based intervention, there is a need to evaluate the extent to which teachers alone can design and implement function-based interventions with fidelity for students with ADHD (Wood et al., 2009). Thus, the current study aimed to examine whether multicomponent function-based interventions would be effective for improving classroom behaviors of students with ADHD and whether the teachers could implement intervention plans with fidelity.

Method

Setting and Participants

The study was conducted in one self-contained classroom at a private elementary special education school located in the Northeastern United States. Students in the school were diagnosed with various disabilities including learning disabilities, ADHD, language impairment, emotional and behavioral disorder, and autism. Classrooms at the school consisted of eight to 12 students with one teacher, one teaching assistant, and one-on-one aides when necessary. All teachers were certified in general and special education, and the majority had taught students with disabilities. They received high levels of support and resources from administrators, related service professionals, staff, and families. Nevertheless, some teachers reportedly expressed their concerns about a high frequency of problem behavior as well as dependency on one-on-one adult support that some students displayed during instruction.

The participants were two sixth-grade students and their classroom teacher. Sam was a 13-year-old, Caucasian, male student. Sam was diagnosed with OHI for ADHD when he was 8 years old by the Committee of Special Education (CSE) appointed by the school district. Since the diagnosis, Sam received special education services in a self-contained classroom of his homeschool for 2 years, but made little progress toward his academic and behavioral goals during that time. As a result, the team and his parents decided to transfer him to the current school when he was 10 years old. When the data were collected, he had attended the current school for 3 years. Sam's diagnostic assessment report was unavailable; however, his IEP confirmed that he displayed several symptoms of pervasive developmental disorder (PDD), along with ADHD. According to his IEP, he exhibited inappropriate social behavior, great difficulty with transitions, and unusual sensitivity to sound and touch. Academically, he performed at fifth-grade level in English Language Arts and Math. For reading and listening comprehension, he needed support with understanding what was read, identifying main ideas, and remembering details. In writing, he required assistance when generating ideas and creating an outline for his paper, and struggled with adding detail and expanding his idea. In math, he showed several difficulties including choosing the correct operation to solve problems, estimating decimals and sums, and identifying and writing equivalent decimals. Although both his IEP and his teacher indicated that he had made significant progress, his teacher also indicated that Sam still had difficulty following teacher directions, staying on-task, and completing schoolwork and homework. He also had difficulty establishing and maintaining peer relationships, as well as making frequently inappropriate statements to his peers and his teachers.

Katrina was a 12-year-old, Caucasian, female student. At age 9, her OHI for ADHD was diagnosed with several characteristics of emotional and behavior disorder (EBD). The CSE diagnosed her when she was at her homeschool. A year after the diagnosis, her parents transferred her to the current school. Her diagnostic assessment information was not available, but her IEP indicated that her academic problems mainly were in English Language Arts; her decoding skills were at the third-grade level, and reading and listening comprehension skills were at the fourth-grade level. She also required much teacher support for her writing tasks. According to the teacher, she had difficulty sustaining attention, following directions, and completing homework and tasks requiring sustained mental efforts. She often left her seat without teacher permission, easily lost her temper, argued with her peers and adults, and refused adult requests. She deliberately did things to provoke other people and would blame others for her misbehavior. Her mood changed quickly and drastically; on occasion, her emotions were so severe that the teacher devoted the entire period calming her down. These disruptions deprived Katrina and other students of scheduled instructional time. For these behavioral difficulties, the current school IEP team developed a PBIS plan as part of her IEP.

The classroom teacher, a male in his 30s, had 7 years of teaching experience, all of which was at this school. It was his second year teaching Sam and his first year working with Katrina at the onset of the study. He was dually certified in general and special education for Grades 1 to 6. Although he had adequate classroom management skills, he admitted that he often had difficulty managing some challenging behaviors, and tended to react to student disengagement and noncompliance by reprimanding.

Target Behaviors

Academic engagement and problem behavior were targeted for intervention in this study. According to the teacher and the students' IEPs, both Sam and Katrina experienced difficulties in several academic areas. Academic engagement included following teacher directions and the sequence of class activities, completing given tasks, asking for help (e.g., raising a hand), and participating in class discussions. Problem behaviors included leaving the seat during teacher instruction or independent work without teacher permission, ignoring teacher directions, and shouting "no" to the teacher's directions or shouting out answers. These problem behaviors were put in a cluster (response class) for two reasons: (a) all behaviors served the same functions, and (b) all behaviors were displayed in an escalating chain.

Data Collection and Inter-Observer Agreement (IOA)

Data on students' target behaviors were collected using an event recording system for problem behavior and a 10-s partial interval system for academic engagement. The number of occurrences or percentage of intervals for each target behavior was measured during 40-min activities. Data were collected daily, 3 to 4 times per week. IOA were assessed for approximately 30% of the sessions across the experimental conditions, activities, and behaviors. Two observers, the first author and a student teacher studying to be certified in special education, collected the data. They practiced recording the target behaviors until they reached 95% agreement prior to collecting baseline data. IOA for problem behavior was calculated by dividing the smaller frequency count by the larger frequency count and multiplying by 100. IOA for academic engagement was calculated by dividing the number of agreement intervals by the number of agreement intervals plus disagreement intervals and multiplying by 100. The mean IOA was 96% for academic engagement and 97% for problem behavior across participants and phases, ranging between 92% and 100%

Table 1. Operational Definitions of Preventive, Instructional, and Response Strategies.

Preventive strategies
- Modification of schedule: Providing frequent breaks for tasks that require much effort. Allow them to stretch and walk around as ways to revitalize himself.
- Modification of activities: Breaking structured activities into smaller steps or activities. Modify activities to match his ability level and preference.
- Seating arrangement: Moving them to the front center of the classroom to have a better peripheral vision of the board.
- Visual cues: Using a mini schedule for the target activity and displaying tasks/activities in a schedule board; having them make and review a daily activity schedule.
- Safety signal: Giving a 5-min warning when switching from preferred to nonpreferred activities (turning the lights off–on 5 min prior to change and then cueing him again at 3 min).
- Transition activities: Providing transition activities such as collecting papers, assisting the teacher in getting ready for the next activity by erasing the board, passing out papers, lining-up students for moving to another class.
- Choices: Providing choices throughout the activities by using a choice board.
- Modification of setting event: Having Sam put some water on his face or lie down in the nurse's office for a few minutes before coming back to class

Skills instructional strategies
- Self-monitoring: Teaching them to independently complete tasks and take an active role in monitoring their own behavior by having his set goals (e.g., working quietly and keeping his hands and other objects to himself) for structured activities, observe their own behavior, record its occurrence on a data collection form, and graph the data to evaluate progress.
- Impulse control: Using a cue card, one side reads "Slow down, Think" (in yellow) and the other side reads "Stop" (in red) to help with impulsive behavior such as think before you act, think before you say something.
- Communicative skills: Teaching them to raise their hand to request help or activities by providing verbal prompts

Response strategies
- Reinforcement: Providing positive statements that acknowledge the appropriate behavior or using new replacement skills, providing help when requested or in the absence of problem behavior, and allowing them to access special activities at the end of the day if they completed all their expected work.
- Extinction: Ignoring when problem behavior occurs; not providing assistance contingent upon problem behavior.

Implementation Fidelity

The two data collectors observed the teacher during the intervention to assess the levels of intervention adherence (whether the teacher implemented each strategy) and quality (the accuracy and completeness of implementation) using a fidelity checklist with a yes/no format. The fidelity checklist consisted of 12 strategies for Katrina and 13 for Sam (see Table 1), and each of the strategies included three to five steps. The steps implemented as intended were measured to assess the implementation fidelity. For example, self-monitoring included five steps: (a) give students self-recording sheet at the start of the activity, (b) review the sheet with them, (c) prompt them to use tracking sheet, (d) review the completed sheet with them, and (e) provide verbal complement for correctly using the sheet. The data showed an average of 95% fidelity (range = 92%–100%) across academic periods. The mean IOA, assessed during 30% of the sessions in each subject, was 93% (range = 90%–98%) for teacher implementation fidelity. IOA for fidelity was calculated by dividing the number of items agreed upon by each observer by the total number of items and then multiplying by 100.

Social Validity

Social validity of the behavior support process and outcomes were assessed with the classroom staff using an 11-item 5-point Likert-type scale upon the completion of the intervention (0 = *not at all acceptable*, 4 = *very acceptable*). Social validity focused on assessing the acceptability of the team process (one item), FBA and intervention testing (two items), intervention components (three items), effectiveness of intervention in changing the student's behavior (three items), and usability of the individualized behavior support process by the teacher (two items).

Design and Procedures

A concurrent multiple-baseline design across academic subjects was used to evaluate the degree to which the multicomponent interventions altered each student's behaviors at school. The interventions were implemented during the 40-min reading, writing, and math periods, respectively.

Teacher training. At the time of the study, the classroom teacher already acquired knowledge and skills of PBIS as part of his training in special education. The student teacher was taking a course on FBA procedures, part of the training for the master's degree. She participated in the study as an inter-observer. The first author provided them with additional 2-hr of training that focused on skills for developing hypotheses based on FBA results, developing multicomponent function-based intervention plans and monitoring

implementation fidelity and student progress. The training involved instruction, discussion, modeling, role-play, and feedback (Miltenberger, 2008). During the training, she used the competing behavior model (O'Neill et al., 1997) to help the teacher identify replacement and desired behaviors and develop antecedent-based prevention strategies, new skill instruction strategies, and consequent strategies that could be implemented in the target instructional periods.

FBA. The classroom teacher (a) reviewed the students' IEP, (b) conducted interviews with each of the target students individually using a *Student Functional Assessment Interview and Reinforcement Survey* (FAI; O'Neill et al., 1997) during two lunch breaks, and (c) conducted direct observations using an A-B-C narrative analysis form (Bijou, Peterson, & Ault, 1968) during target academic time periods across 2 or 3 days to corroborate the interview results. The first author also observed the students using the same A-B-C form during the target academic periods to confirm the observation results by the teacher. After conducting the interviews and observations, the teacher developed hypotheses in collaboration with the author.

Initial FBA data indicated that both students (Sam and Katrina) engaged in the lessons and independent work at high rates when the teacher provided them with one-on-one assistance. However, they engaged in high rates of problem behavior when there was no teacher assistance, which resulted in reprimands or assistance by teacher most of the time. These behaviors occurred significantly more during the target subjects than during other subject periods that offered more student-directed activities. These results suggested that gaining access to teacher attention and escaping from task demands might have been the function for their problem behavior. Both students stated during the interviews that their work was always challenging so that they preferred working with the teachers, indicating that both escape and teacher attention were motivating their problem behaviors. Sam's problem behavior was more likely to occur when he was tired according to the interview with him, which was consistent with the description in his IEP.

These results were validated by direct observations of the students during problematic academic time periods. A-B-C observations revealed that the students rarely engaged in problem behavior when participating in preferred activities regardless of academic periods. Sam's problem behavior occurred 25 times during the reading, writing, and math periods (totaling 120 min). Katrina's problem behaviors occurred 15 times during the reading and writing (80 min). Each student's problem behavior occurred approximately 90% of the time when the given tasks were demanding. In addition, 90% of the demand stimuli resulted in the consequence of escape, whereas 10% of the demand stimuli resulted in the consequence of teacher attention for both students, indicating that their problem behaviors were maintained by both escape and attention. Based on these results, the researchers hypothesized that the students' engagement in activities would increase (a) when academic activities were modified based on their preference or preferred activities were scheduled in classroom routines, (b) when they learned replacement behaviors, and (c) when access to teacher attention increased. For Sam, one additional hypothesis was developed: His engagement would increase when opportunities for rest were provided when he was tired.

Hypothesis testing. Before designing interventions, the classroom teacher conducted a brief hypothesis testing with regard to preference and teacher attention across reading, writing, and math periods for Sam and reading and writing for Katrina using an alternating treatments design. A total of four conditions were tested once during 10-min sessions in each academic period for a period of 1 week: (a) preferred activity (e.g., reading a book of their choice) with attention, (b) preferred activity without attention, (c) nonpreferred activity (e.g., reading a text-rich article) with attention, and (d) nonpreferred activity without attention. As found in the initial FBA results, almost no problem behavior occurred when preferred activities were provided; at most one problem behavior occurred across academic periods for both students in each condition with or without teacher attention. However, when nonpreferred activities were presented without teacher assistance, high frequency of behavior was observed (see Figure 1).

Baseline. Baseline consisted of conditions already established by the teacher during reading and writing periods for both Sam and Katrina, and math period for Sam. Both Sam and Katrina participated in business-as-usual activities and interactions with classroom staff during baseline, which included group activities and independent seatwork as well as teacher verbal feedback for engaging in activities, and encouraging acceptable choices. Teachers redirected to stay on-task, reprimanded, or provided individual one-on-one assistance when problem behavior occurred.

Development and implementation of behavior intervention plan. In developing multicomponent function-based interventions, the researchers used the competing behavior model to identify prevention, teaching, and response strategies. Table 1 shows the definitions of these strategies. To ensure the teacher achieved a successful outcome, simple and contextually appropriate strategies were used based on the teacher's ability, resources, and needs. The preventive strategies for both students consisted of (a) using a schedule board and activity sequence charts to help with predictability and expectations of activities, (b) providing a 5-min warning when switching from preferred to nonpreferred activities, (c) interspersing preferred and nonpreferred

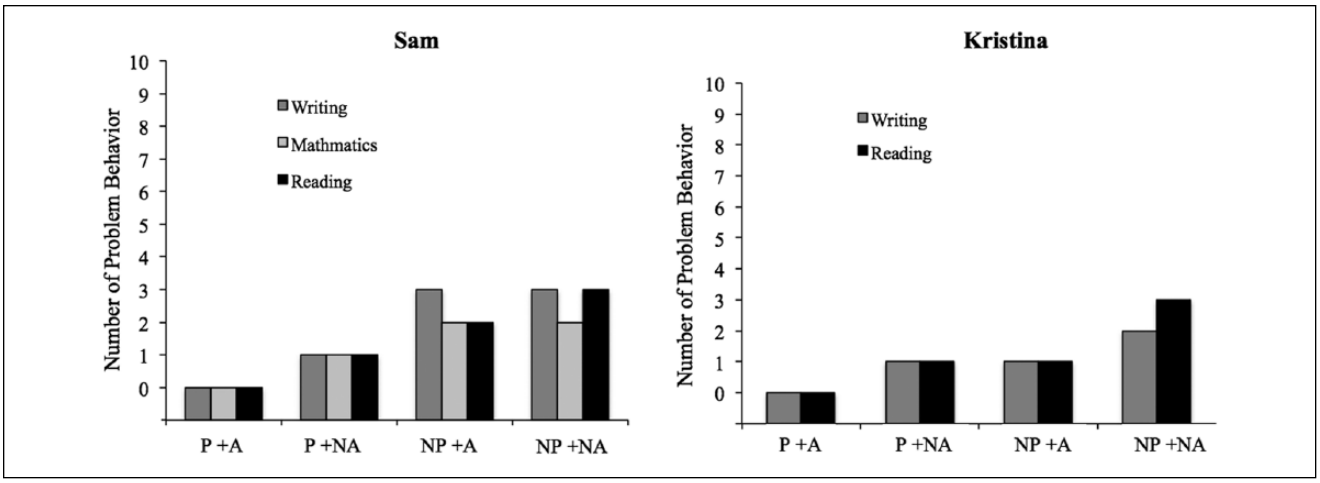

Figure 1. Results of brief intervention testing across conditions and participants.
Note. P = preferred activity; A = attention; NA = no-attention; NP = nonpreferred activity.

activities, and (d) providing seating arrangements. In addition, a setting event modification was added to Sam's plan to minimize the likelihood that he would avoid task demands due to lack of sleep or tiredness. It was planned that Sam would be allowed to put some water on his face or lie down in the nurse's office for a few minutes before coming back to class. In the beginning of each target period, the teacher reviewed with the students the daily schedule and sequences of activities, and stated expected behavior.

Skill instructional strategies focused on replacement skills by teaching the students to make a request for help by raising their hand when needed, self-monitor on-task behavior, and self-regulate their behavior to control impulse. Self-monitoring skills included having them independently complete tasks all along taking an active role in monitoring their on-task behavior. The teacher instructed them to set their goals (with teacher assistance) for independent seatwork, observe their on-task behavior by recording its occurrence on a simple rating scale, and graph the data to see their own progress. The teacher taught both students to use a clock timer to record their time on-task every 10 min. In addition, the teacher taught them (a) to raise their hand after self-recording during independent seatwork, and (b) to walk up to him to receive feedback on their assignment. The teacher used a behavior skill training procedure to teach the students, which involved instruction, modeling, role-play, and feedback, and reviewed progress with each student on a daily basis. Together, they celebrated success at the end of the day as a contingent reinforcement for replacement and other appropriate behaviors. Other prevention and teaching strategies were also included in the intervention plans.

Response strategies included providing social praise, assistance, and access to desired activities contingent on the use of target replacement behavior. Other strategies included providing 15 min at the end of the day for Sam to play or practice guitar and for Katrina to listen to an iPod™, when each had earned a sufficient number of Post-Its™ based on the agreement between the teacher and each student completed self-recording sheets. Response strategies also included redirecting the students to alternative activities, asking what choice they could make for a better outcome, and withholding attention.

The first author made a 20-min visit during each academic period (totaling 60 min) in the first week of intervention to provide coaching and feedback to ensure the strategies were consistently implemented. Overall, the teacher adhered to implementing the intervention as planned, but inconsistently ignored student behavior and often provided assistance to the target students. The researcher modeled consistently ignoring student behavior and providing assistance for the teacher, asked the teacher to perform them while observing him, and discussed the outcomes during the meeting in the first week. In addition, the researcher met with the teacher for an hour each week during the intervention implementation to review progress or to address any issues in implementing the multicomponent function-based interventions. When the intervention data indicated improvement in the levels of the students' appropriate behaviors, the schedule of feedback meeting was decreased to once per 2 weeks to facilitate the maintenance of intervention with minimal researcher support.

Results

Intervention data collection lasted for approximately 4 weeks for each student, and the data are presented in Figures 2 and 3. Each data point in the graphs represents each session per day. As shown in the figures, both Sam

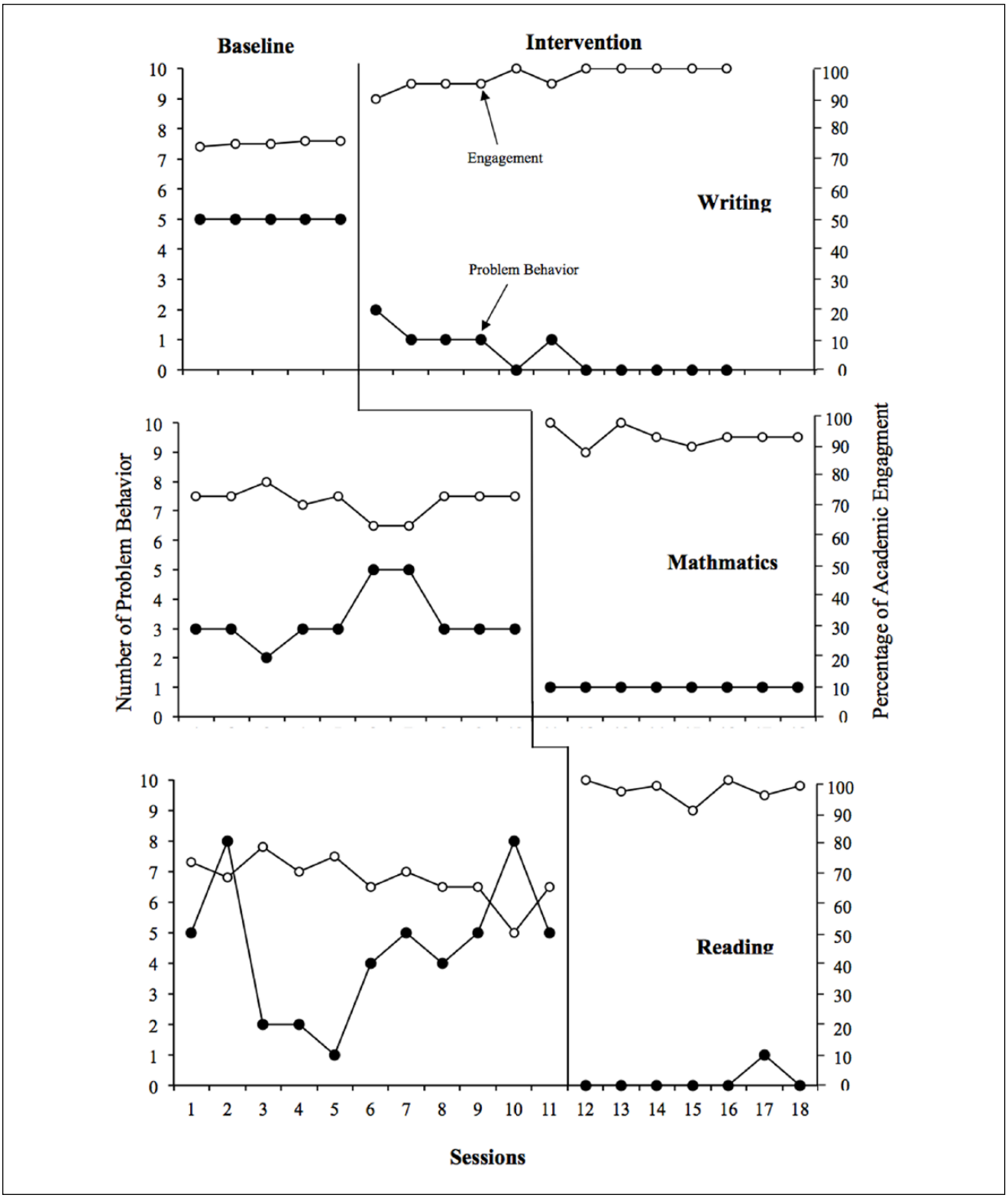

Figure 2. Number of occurrences of problem behavior and percentage of intervals with academic engagement across experimental phases and activities for Sam.

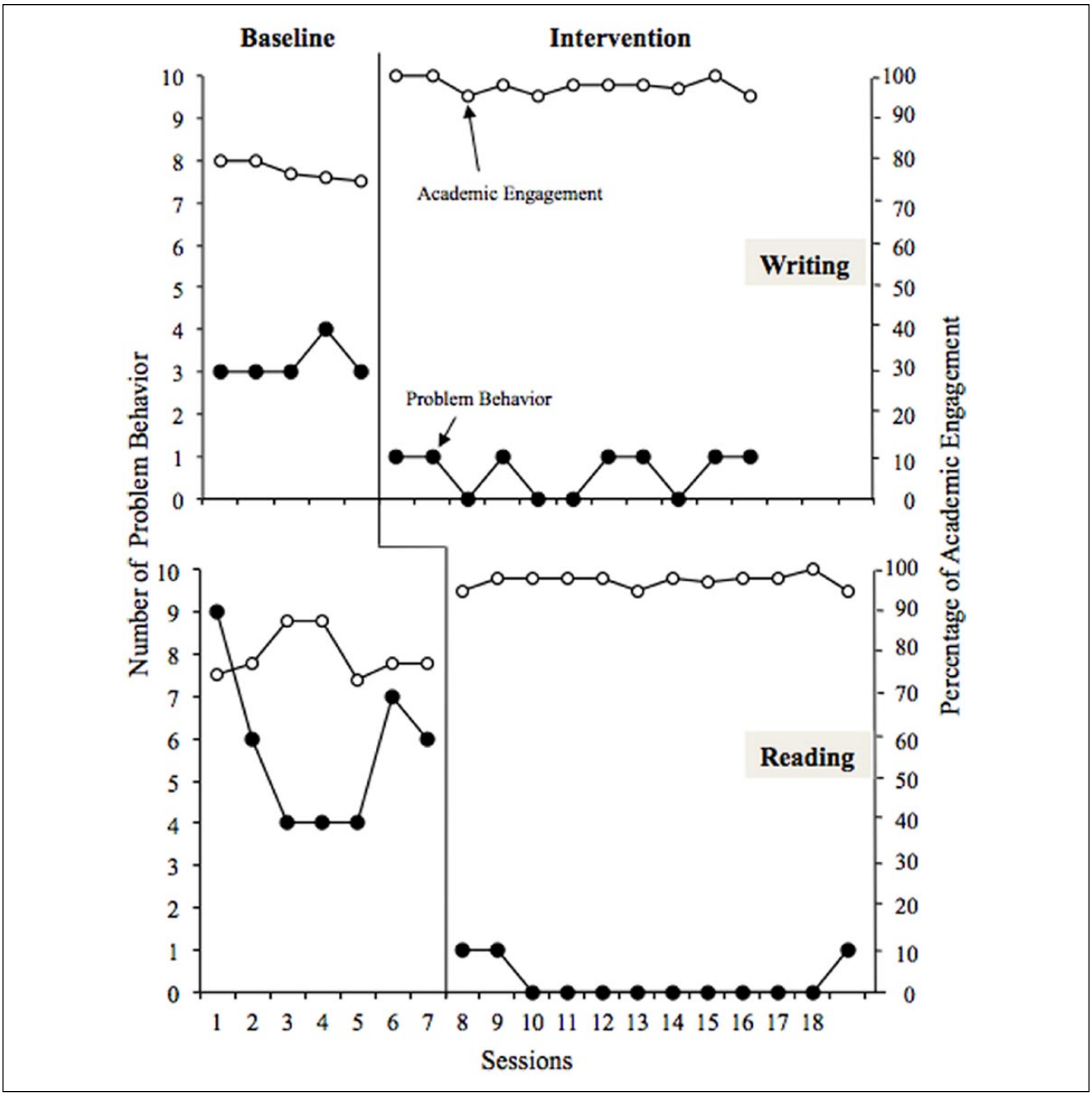

Figure 3. Number of occurrences of problem behavior and percentage of intervals with academic engagement across experimental phases and activities for Katrina.

and Katrina consistently engaged in high frequency of problem behaviors and low levels of academic engagement during baseline. Problem behavior by the two students decreased while their academic engagement increased in each academic period when the multicomponent function-based interventions were implemented. On average, Sam's problem behavior occurred 3.4 times (range = 1–8) across the academic periods. However, his problem behavior decreased to 0.54 times (range = 0–2) during the intervention. The changes in behavior were immediate and profound. Data were quite variable during baseline in reading, but showed low and stable pattern during intervention. Katrina's baseline problem behavior occurred 4.6 times (range = 3–9) across the academic periods, and decreased to 0.25 times (range = 0–2) during intervention. Overall, the stable patterns in the problem behavior were maintained at a very low level with little variability over the course of intervention.

Both students' academic engagement correlated to problem behavior as shown in Figures 2 and 3. Baseline data demonstrate that the level of Sam's academic engagement was at 75% on average (range = 74%–76%) during writing, 73% (range = 68%–75%) during math, and 78% (range = 60%–95%) during reading. Katrina's academic engagement on average was at 76% (range = 80%–72%) during writing and 78% (range = 75%–87%) during reading. Intervention data show that Sam's average academic engagement increased to 97% (range = 88%–100%) for writing, 95% (range = 90%–100%) for math, and 96% (range = 95%–100%) for reading. Katrina's academic engagement was at 93% on average (range = 92%–100%) for writing and 95% (range = 95%–100%) during reading. Across students and academic periods, data on academic engagement were quite stable with no variability during intervention.

Effect sizes were calculated using the percentage of all nonoverlapping data points (PAND), a nonregression based approach to determine the effectiveness of the multicomponent function-based intervention (Parker, Vannest, & Davis, 2011). Instead of using the most extreme data point, we used all baseline data points from each participant to calculate PAND. The PAND comparing baseline and the multicomponent function-based intervention was 100% for both students across activities, demonstrating a large treatment effect. There were no overlapping data points between baseline and intervention conditions for both students across activities.

Social Validity

The results from social validity ratings from the classroom staff indicated that both the teacher and student teacher rated the multicomponent function-based intervention process and outcomes as highly acceptable and effective with a mean score of 4.7 on a 5-point scale. The staff strongly agreed that the interventions had positive impacts on the students' behaviors.

Discussion

The current study examined the effects of multicomponent function-based interventions involving classroom staff in the assessment and intervention process on academic engagement and problem behavior of students with ADHD. The results revealed that the multicomponent function-based interventions increased their academic engagement and significantly decreased problem behaviors over the course of 4 weeks. Although the levels of academic engagement were relatively high in baseline due to the teacher's provision of individual assistance in responding to problem behavior, the teacher was able to promote the students' engagement in academic activities effectively withholding individual assistance. In addition to reinforcement of target replacement skills and extinction of problem behavior, modification of activities based on student preference, environmental arrangement, and teaching self-management skills were effective in preventing their problem behavior and increasing academic engagement.

The results of the study are consistent with the literature in that multicomponent function-based interventions should be designed and implemented when addressing problem behavior and promoting academic engagement among students with problem behavior (Blair et al., 2011; Umbreit et al., 2004). In designing the interventions, we adhered to several useful suggestions offered by Detrich (1999) and Lucyshyn et al. (2007) making intervention simple and easy to implement over time within the abilities of the classroom teacher or caregiver. A variety of contextual variables such as lack of time, high cost, inadequate training and supervision requirements, as well as little institutional support have been found to contribute to a practitioner's failure to effectively use evidence-based interventions for managing behavior (Shernoff & Kratochwill, 2007). Therefore, we focused on designing a plan that was both effective and easily implementable considering the classroom teacher's skill levels. We also accommodated competing demands on the teaching staff and resources that were available to implement the plan. Most importantly, we ensured that the strategies developed for the students arose from empirical evidence, were congruent with student motivation, and were appropriate for the context in which the behavior occurred. As indicated by the implementation fidelity and social validity assessment results, the multicomponent function-based interventions implemented in this study had a high level of teacher implementation fidelity across academic subjects and a high level of acceptance by the teacher.

The classroom teacher and student teacher in the study were able to assess the students' behavior and design and implement the multicomponent function-based interventions. Although the teachers needed training and performance feedback from the researchers, with their prior training in supporting students with disabilities, the teachers were able to design and implement the function-based interventions with fidelity with minimal consultation support. Considering that many teachers have difficulty with FBA and linking FBA to intervention (Blood & Neel, 2007; Crone et al., 2007; Van Acker et al., 2005), the results of the study suggest that teachers may need consultation support in the process of assessment and intervention considering the time, knowledge, and skills required for teachers to conduct FBA and intervention design and implementation (Conroy, Katsivannis, Clark, Gable, & Fox, 2002).

Prior to conducting this study, the classroom teacher had implemented various instructional strategies. Nevertheless, the teacher admitted that he neither

consistently implemented the strategies nor addressed the functions of the students' problem behavior. The students were off-task or engaged in disruptive behavior particularly when individual assistance was absent. As a result, the teacher frequently attended to the students with assistance to prevent disruption in the classroom, which eventually reinforced the students' problem behavior. During this study, we incorporated several preventative strategies along with helping the teacher make teaching and response strategies more specific and clearer. Although *what* strategies are being implemented may be crucial to the success of any intervention plan, this study demonstrates *how* strategies are implemented by classroom teachers, which is a more significant factor in helping improve students' behavior.

The study extends the literature on function-based intervention by adding evidence that the teacher implementation of multicomponent function-based interventions can produce positive outcomes for students with ADHD already receiving intensive special education services in a highly structured, small-sized classroom. However, this study included only two students; thus, the results should be interpreted with caution. In addition, it did not evaluate the generalization and maintenance effects, and thus it is difficult to determine whether the intervention implemented in the study can promote generalization and maintenance of behaviors. Research using additional measures of skill generalization and follow-up assessment would increase confidence in the findings. A core value of function-based intervention is to build collaborative partnerships among teachers, students, and their families in designing behavior support plans, and sharing responsibility for intervention (Carr et al., 2002; Horner, 2000). In this study, we could not involve the families in the assessment and intervention process due to their busy schedules although family involvement in the PBIS process has been found to increase effectiveness of the planned intervention. Thus, future research should implement interventions across home and school to maximize intervention effects (Blair et al., 2011; Harvey, Lewis-Palmer, Horner, & Sugai, 2003). Despite its limitations, this study provides evidence that classroom staff can successfully implement multicomponent function-based interventions to students with both ADHD and problem behavior.

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