

Exploratory study of the effectiveness of a professional development program on the academic achievement and classroom behavior of students with Fetal Alcohol Spectrum Disorder in British Columbia, Canada

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Abstract

Aim: Exploratory assessment of a professional development program for teachers supporting students with Fetal Alcohol Spectrum Disorder (FASD).

Design: A mixed-method research design, using qualitative descriptive and quasi-experimental methods, was employed.

Setting: The study occurred in selected public elementary schools in a British Columbia school district.

Participants: Elementary school teachers and students with FASD.

Measures: For the quasi-experimental component, the Behavior Assessment System for Children, 2nd edition (BASC-2) Teacher Rating Scale (TRS), and Student Observation System assessed classroom behavior. The Curriculum-Based Measure (CBM) assessed reading, writing, and mathematics skills of children with FASD. Inductive thematic analysis was used to derive themes from teachers' interviews.

Findings: A statistically significant improvement in intervention students' classroom behavior was observed. An improvement of moderate effect size was seen for academic achievement, although the changes were not statistically significant. Teachers reported that the professional development program changed their teaching practice. Intervention teachers described how they redefined students' behaviors and adapted their teaching practice to accommodate students' neurological deficits.

Conclusions: The results provide preliminary support for the effectiveness of the professional development program for elementary school teachers teaching students with FASD. Further research is needed with a larger sample size to reduce type II error.

The Provincial Outreach Program for Fetal Alcohol Spectrum Disorder (POPFASD) (<http://www.fasfoutreach.ca>) in British Columbia (BC), Canada, is unique in offering a professional development (PD) program for teachers that focuses on changing the classroom environment to meet the unique needs of students with FASD. Our study provides preliminary evidence of the effectiveness of the PD program. Fetal Alcohol Spectrum Disorder (FASD) is an umbrella term used to describe the spectrum of effects that may result from prenatal alcohol exposure (Chudley et al., et al., 2005). FASD is estimated to have a prevalence rate

of one percent of Canadian students (Burstyn, Sithole, & Zwagenbaum, 2010; Health Canada, 2002).

Pianta and Walsh's (1996) contextual systems model provides a framework for understanding the effects of cognitive challenges experienced by students with FASD on classroom behavior and academic achievement. According to the model, children react as open, dynamic systems that interact with and respond to the people and resources in their environments (Pianta & Walsh, 1996).

The quality of the relationships; the fit between environments, people and resources; and the cognitive, behavioral, and neurodevelopmental skills of children influence children's behavior over time (Pianta & Walsh, 1996). Students with FASD may experience one or more cognitive challenges, including slower information processing speed (Burden, Jacobson, & Jacobson, 2005), learning and memory difficulties (Kaemingk & Halverson, 2000; Mattson & Roebuck, 2002), and attention (Streissguth, Barr, Sampson, & Bookstein, 1994) and working memory deficits (Streissguth, Barr, & Sampson, 1990). There is no typical profile associated with FASD (Burden, Jacobson, Sokol, & Jacobson, 2005; Kable & Coles, 2004; McGee, Fryer, Bjorkquist, Mattson, & Riley, 2008). A child may have deficits in information processing speed and working memory that make thinking about several instructions at one time difficult and impede rapid reaction to instructions. The teacher-student relationship may be negatively affected if the teacher reprimands a student for slow reaction to instructions. Over time, the student may disengage from his or her school work and experience a deteriorating relationship with that teacher. Our hypothesis is that adapting the classroom environment will improve students' behavior, resulting in more opportunities for learning.

Existing literature on interventions for children with FASD indicates increased success through adaptations to children's classroom and home environments (Bertrand, 2009; Malbin, 2006). Three programs targeted parents (Bertrand, 2009), while the fourth included parents and teachers (Malbin, 2006). Behavior was redefined as a neurodevelopmental disability, rather than willful disobedience, and parents and teachers were taught to change their responses and prevent situations that triggered problem behavior (Bertrand, 2009). In summary, these studies support the hypothesis that changes to the environments of students with FASD may improve behavior.

POPFASD developed a PD program based on the contextual systems model to support educators teaching students with FASD. POPFASD staff implemented the PD program over a school year; it included two full-day and four half-day workshops and weekly mentor-teacher meetings. At the initial two-day workshop, teachers received an overview of FASD and completed the Know Learn and Need to Know (KLN) and Learner Environment Instruction Curriculum (LEIC) forms, using information from school files and the teachers' experiences with their students. The information in the files, including previous assessments, varied between students. The KLN and LEIC forms helped teachers organize information, prompted them to search for more information, and identified potential accommodations based on students' strengths. The four half-day workshops included presentations on FASD, psychology, occupational therapy, and speech and language therapy, as well as more planning of accommodations for students with FASD. The LEIC and KLN forms and details on workshop content are available from POPFASD.

This study aimed to answer the following questions:

1. Do teachers perceive the professional development program as affecting their abilities to adapt the classroom environment for students with FASD?
2. Is the professional development program associated with changes in teachers' perceptions of classroom behavior of students with FASD?
3. Is the professional development program associated with changes in students with FASD's classroom behavior, observed by researchers?
4. Is the professional development program associated with improved ability to complete grade-appropriate reading, writing, and math curriculum amongst students with FASD?

The PD program was administered to teachers, who applied the training in a non-uniform manner to their students with FASD. Outcomes of interest were students' classroom behavior and academic achievement.

Methods

This study used a mixed-methods research design (Green, Caracelli, & Graham, 1989) that combined quasi-experimental methods (Cook & Campbell, 1979) with qualitative descriptive methods (Sandelowski, 2000).

Quasi-experimental design

Students' behavior and academic achievement were measured pre-, mid-, and post-intervention in the intervention and untreated comparison groups.

Measures

The Curriculum-Based Measure (CBM) was used to assess reading, writing, and mathematics skills. The CBM maintains strong test-retest and inter-rater reliability and good concurrent, criterion-related and predictive validity, and reflected curriculum taught in the school district where the study was undertaken (Fewster & MacMillan, 2002; Hintz, Shapiro, Conte, & Basile, 1997; McMaster & Espin, 2007; Wayman, Wallace, Wiley, Ticha, & Espin, 2007). Two research assistants blind to group membership administered the CBM.

The Behavior Assessment System for Children, 2nd edition (BASC-2) Teacher Rating Scale (TRS), a self-report survey completed by teachers, assessed teachers' perceptions of students' classroom behavior. The BASC-2 TRS has demonstrated adequate test-retest reliability and construct and criterion-related validity, and focuses on positive and negative attributes of student behavior (Reynolds & Kamphaus, 2004; Tan, 2007).

The BASC-2 Student Observation System (SOS) assesses observed positive and negative classroom behavior using momentary time sampling (Reynolds & Kamphaus, 2004). The BASC-2 SOS was administered by a research assistant blind to group membership.

Analysis

Analysis utilized the *t*-test for pre-intervention between group differences, and Friedman's test with post-hoc analysis for within-group change over time (Siegel & Castellan, 1988). Alpha (α) was set at .10 to increase the power to detect significant findings and lower the risk of type II errors (Ellis, 2010). All statistical analysis used SPSS version 19.0. Effect size calculations were completed for intervention group pre- to post-intervention (Morris & DeShon, 2002; equation 13). According to Wolfe (1986), an effect size greater than .50 indicates educational significance.

Qualitative descriptive design

Inductive thematic analysis was undertaken on verbatim transcripts of teachers' semi-structured interviews. The interview questions (Clark, 2012, p. 232) asked teachers to describe their perceptions of students' behavior and strategies for accommodating students' needs. The analysis employed an inductive approach, using descriptive and pattern coding (Miles & Huberman, 1994). Teachers were engaged in member checking to support credibility of the results (Guba & Lincoln, 1989).

Recruitment

Elementary schools were eligible if they did not have a concurrent FASD intervention. A teacher was eligible if her principal consented and she had at least one eligible student in her classroom. A student was eligible if she or he was diagnosed with Fetal Alcohol Syndrome (FAS), partial FAS, or Alcohol Related Neurodevelopmental Disorder by a medical doctor, and her or his teacher consented to participate.

Recruitment of teachers and students was undertaken using two strategies. Initially, teachers in eligible elementary schools were recruited for the study. After a teacher

consented to participate, caregivers were contacted to determine if any students were eligible. In the second strategy, a local pediatrician mailed consent forms and information letters to the caregivers of students she had diagnosed. Teachers were recruited after caregivers and children consented to participation. Intervention and comparison-group teachers were also recruited for the qualitative component.

Ethics

Approvals were obtained from the University of British Columbia Behavioural Research Ethics Board and the University of Northern British Columbia Research and Ethics Board. All participants provided informed consent or assent.

Results

Participants

Fifteen teachers from eight elementary schools were recruited, and 12 teachers from seven schools agreed to participate. Participating teachers' experience ranged from 15 to 32 years, with a mean of 22 years. All participating teachers were female and Caucasian. Ten teachers taught primary classrooms and two taught intermediate classrooms.

Twenty-two students were recruited for the study; 13 were eligible to participate. Exclusion occurred at the school, classroom, and student level. One school was excluded because it was conducting a concurrent FASD intervention ($N = 5$ students). Three teachers declined to participate because they were not interested or too busy, which excluded their students ($N = 3$). One student did not have a medical diagnosis. The nine excluded students did not differ significantly from eligible students (see Table 1).

Table 1

Demographics of all students recruited, $N = 22$

Independent variable	Eligible students ($N = 13$)	Excluded students ($N = 9$)	Degrees of freedom (ν)	<i>t</i> -Test statistic	Two-tailed <i>p</i>
Age					
Range	6–12 years	6–12 years	20	0.51	0.62
Mean	7.9 years	7.8 years			
Ethnicity					
Aboriginal	62%	89%	20	-1.53	0.14
Caucasian	38%	11%			
Gender					
Male	77%	67%	20	-0.22	0.83
Female	23%	33%			

Participating students were diagnosed with FAS by the same pediatrician, using Gestalt diagnostic guidelines (Sokol & Claren, 1989). Sixty-nine percent of students were in foster care; the remainder lived with their biological families.

Six teachers and seven students were allocated to the intervention group and six teachers and six students to the comparison group. Students, but not teachers, were blinded to the intervention. Students and teachers were allocated by assigning one student-teacher dyad to the comparison group, randomizing the remaining participants, and reassigning student-teacher dyads to match as closely as possible for student age, gender, and school report of disruptive behavior. Experimental groups were not equivalent (see Table 2), and students and teachers were lost to follow-up (see Figure 1). The intervention group scored significantly higher, indicating greater challenges, on Percent Observed Problem Behavior ($v = 10$, $t = 2.17$, $p = .06$), Behavioral Symptoms Index ($v = 10$, $t = 2.09$, $p = .10$), and Externalizing Problems ($v = 10$, $t = 3.57$, $p = .01$) Scales.

Three students were lost to follow up ($N = 2$ intervention and $N = 1$ comparison groups) and five students experienced major changes in their home environments ($N = 4$ intervention and $N = 1$ comparison groups) (see Figure 1). Changes included increased or new visits with a birth parent, new foster homes, and preparations to move.

Changes occurred at mid- and post-intervention ($N = 2$ and $N = 3$, respectively).

Pre- and post-intervention changes

Measures were obtained of students' classroom behavior and academic achievement pre-, mid-, and post-intervention. Statistically significant differences were observed between pre- and post-intervention for the intervention group only: BASC-2 TRS Adaptive Skills ($v = 4$, $\chi^2 = 7.60$, $p = .02$) and School Problems ($v = 4$, $\chi^2 = 6.40$, $p = .04$) (see Table 3). No statistically significant differences were observed for the comparison group (see Table 3). The Adaptive Skills scale measures emotional expression and daily living, communication, and study skills, while School Problems measures motivation, attention, learning, and cognition (Reynolds & Kamphaus, 2004). Attention, learning, motivation, cognition (School Problems Scale), and adaptive behavior (Adaptive Skills Scale), as assessed by the BASC-2 TRS are important skills contributing to students' success in school (Reynold & Kamphaus, 2004). Post-hoc analysis indicated a pre- to mid-intervention increase for the BASC-2 TRS Adaptive Skills (see Figure 2; mean rank difference = 1.5, $z = 1.34$, $p = .09$) and decrease for School Problems Scale (see Figure 3 and Table 4); mean rank difference = 1.60, $z = 1.34$, $p = .09$). The effect size for the intervention group was greater than .50 for four independent variables: Percent Observed Problem Behavior, Behavioral Symptoms Index, Adaptive Skills, and School Problems (see Table 5).

Table 2

Differences in students' age, classroom behavior, and academic performance of pre-intervention using t-Test

Dependent variable	Intervention μ (SD) $N = 7^a$	Comparison μ (SD) $N = 5$	Degrees of freedom (ν) ^a	t-Test statistic	Two- tailed p
Age	7.43 (.79)	8.80 (1.64)	10	-1.73 ^b	0.14
BASC-2 SOS					
Percent Observed Problem Behavior	52.94 (18.60)	32.63 (10.86)	10	2.17	0.06*
BASC-2 TRS Percentile Scores					
Behavioral Symptoms Index	91.29 (5.56)	73.40 (18.58)	10	2.09 ^b	0.10*
Adaptive Skills	6.43 (3.60)	16.20 (10.92)	10	-1.93 ^b	0.11
Externalizing Problems	85.43 (14.51)	47.00 (23.05)	10	3.57	0.01***
Internalizing Problems	43.57 (23.68)	59.60 (24.43)	10	-1.14	0.28
School Problems	90.57 (7.79)	84.20 (14.36)	10	0.90 ^b	0.40
CBM Percentile Scores					
Reading	49.00 (28.97)	24.20 (19.91)	8	1.58	0.15
Words Spelled Correctly	38.38 (39.55)	24.20 (28.98)	7	0.62	0.55
Math	57.13 (40.23)	38.13 (24.18)	6	0.81	0.45

^aTwo intervention students refused to complete CBM reading, three intervention students refused to complete CBM writing, and three intervention and one comparison student refused to complete CBM math.

^bEqual variances not assumed.

* significant at $\alpha=0.10$, *** significant at $\alpha=0.01$

Notes. Data not available for student lost to follow-up in the fall. BASC-2 SOS = Behavior Assessment System for Children, 2nd Ed. Student Observation System (Reynolds & Kamphaus, 2004); BASC-2 TRS = Behavior Assessment System for Children 2nd Ed. Teacher Rating Scale (Reynolds & Kamphaus, 2004); CBM = Curriculum-Based Measure (Fewster & MacMillan, 2002).

Figure 1

Flowchart of students lost to follow up and students who experienced change at home during the study

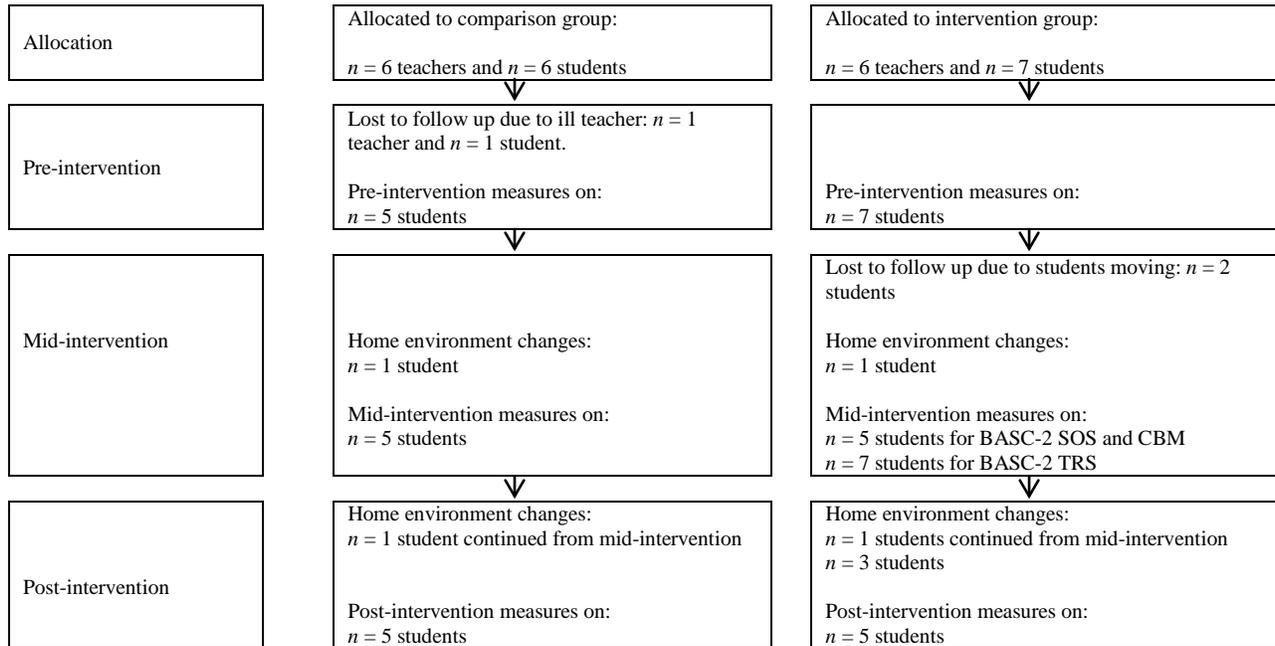


Table 3

Friedman test statistics comparing behavior and academic measures for students pre-, mid-, and post-intervention

Dependent Variable	Pre μ (SD)	Mid μ (SD)	Post μ (SD)	N	χ^2	<i>p</i>
Intervention Group						
BASC-2 SOS						
Percent Observed Problem Behavior	52.94 (18.60)	33.86 (23.24)	42.90 (12.58)	5	3.60	.17
BASC-2 TRS Percentile Scores						
Behavioral Symptoms Index	91.29 (5.56)	86.43 (16.52)	87.00 (19.74)	5	1.41	.49
Adaptive Skills	6.43 (3.60)	10.43 (8.16)	10.00 (6.52)	5	7.60	.02**
Externalizing Problems	85.43 (14.51)	82.14 (17.27)	84.20 (18.62)	5	2.00	.37
Internalizing Problems	43.57 (23.68)	51.29 (26.25)	54.00 (32.27)	5	2.21	.33
School Problems	90.57 (7.79)	76.71 (19.17)	81.80 (10.16)	5	6.40	.04**
CBM Percentile Scores						
Reading	49.00 (28.97)	41.50 (29.93)	45.00 (29.37)	5	1.60	.45
Math	57.13 (40.23)	49.00 (42.89)	41.00 (38.71)	4	1.50	.47
Words Spelled Correctly	38.38 (39.55)	45.00 (36.95)	54.70 (48.76)	4	.14	.93
Comparison group						
BASC-2 SOS						
Percent Observed Problem Behavior	32.63 (10.85)	32.29 (11.20)	30.01 (17.34)	5	.40	.82
BASC-2 TRS Percentile Scores						
Behavioral Symptoms Index	73.40 (18.58)	78.40 (16.29)	80.20 (20.77)	5	1.60	.45
Adaptive Skills	16.52 (10.92)	18.40 (15.14)	15.20 (12.21)	5	2.21	.33
Externalizing Problems	47.00 (23.05)	48.60 (26.70)	62.40 (37.09)	5	2.21	.33
Internalizing Problems	59.60 (24.43)	56.60 (31.82)	64.20 (27.98)	5	1.00	.61
School Problems	84.20 (14.36)	76.71 (19.17)	81.8 (10.16)	5	.11	.95
CBM Percentile Scores						
Reading	24.20 (19.91)	28.75 (5.95)	23.20 (14.98)	4	.00	1.00
Math	38.13 (24.18)	30.63 (33.50)	20.00 (23.98)	3	2.67	.26
Words Spelled Correctly	24.20 (28.98)	19 (20.26)	15.50 (22.73)	4	.13	.94

** significant at $\alpha=0.05$

Note. Students with missing data excluded from analysis. Some students refused to complete parts of the CBM. BASC-2 SOS = Behavior Assessment System for Children 2nd Ed. Student Observation System (Reynold & Kamphaus, 2004); BASC-2 TRS = Behavior Assessment System for Children 2nd Ed. Teacher Rating Scale (Reynold & Kamphaus, 2004); CBM = Curriculum Based Measure (Fewster & MacMillan, 2002).

Academic achievement did not show statistically significant change (see Table 3).

Figure 2

Mean percentile score for BASC-2 TRS Adaptive Skill Scale grouped by experimental group to show direction of change in Friedman analysis

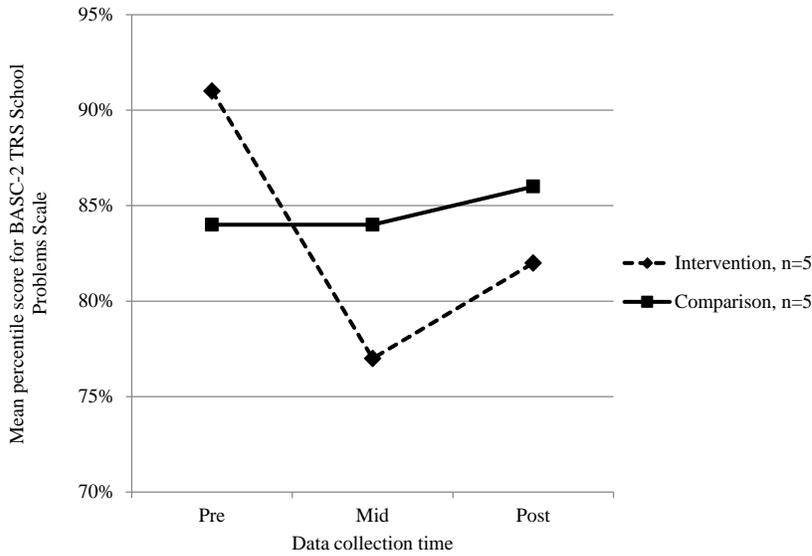


Figure 3

Mean percentile scores for BASC-2 TRS School Problem Scale grouped by experimental group to show direction of change in Friedman analysis

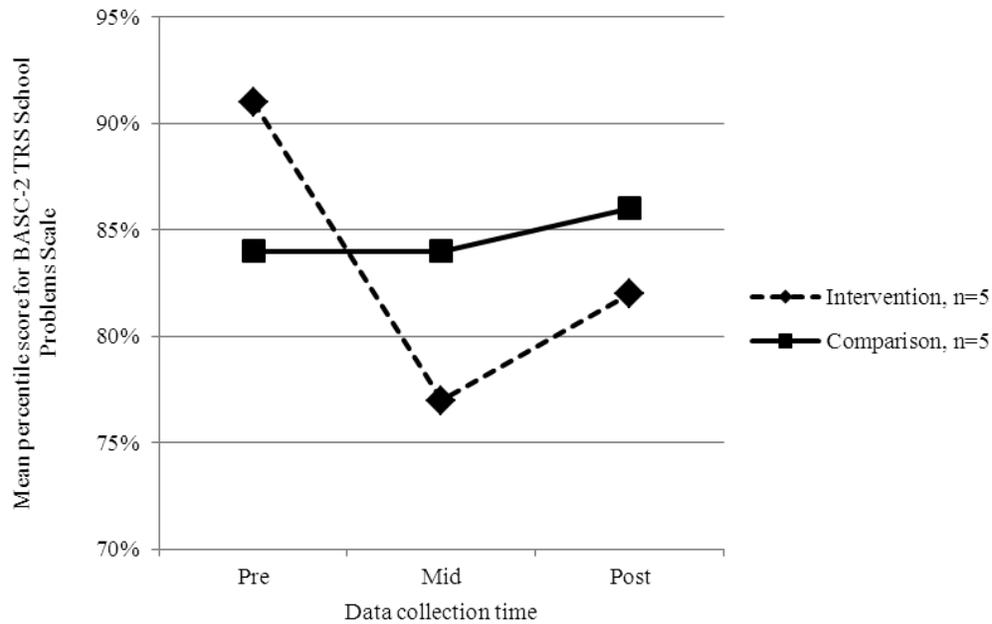


Table 4

Post-hoc analysis of Friedman test for statistically significant intervention group BASC-2 TRS scales for students with FASD

	Mean Rank			k	N	z	p
	Pre	Mid	Post				
Adaptive Skills Percentile	1.30	2.80*	1.90	3	5	1.34	.09
School Problems Percentile	2.80	1.20*	2.00	3	5	1.35	.09

*significantly different from pre-intervention at $\alpha=0.10$

Table 5

Effect size for intervention group students pre- to post-intervention

Outcome measure	Cohen's d ^a	Direction of change
BASC-2 SOS Percent observed problem behavior	0.54	improved
BASC-2 TRS Behavioral symptoms index percentile	0.77	improved
BASC-2 TRS Adaptive skills percentile	0.99	improved
BASC-2 TRS Externalizing problems percentile	0.09	improved
BASC-2 TRS Internalizing problems percentile	0.44	declined
BASC-2 TRS School problems percentile	1.13	improved
CBM Reading percentile	0.14	declined
CBM Words spelled correctly percentile	0.41	improved
CBM Math	0.40	declined

^aEquation 13 Morris and DeShon, 2002

Note. Students with missing data excluded from analysis. BASC-2 SOS = Behavior Assessment System for Children 2nd Ed. Student Observation System (Reynold & Kamphaus, 2004); BASC-2 TRS = Behavior Assessment System for Children 2nd Ed. Teacher Rating Scale (Reynold & Kamphaus, 2004); CBM = Curriculum-Based Measure (Fewster & MacMillan, 2002).

Qualitative description findings

Inductive thematic analysis of the teachers' interviews yielded three themes: importance of the PD program; change in behavior perception; and strategies for students with FASD.

Importance of the professional development program.

Intervention teachers believed the professional development program impacted their teaching practice. Program length, mentoring, and use of the LEIC tool were highlighted as important features, although all parts of the program were valued. Intervention teacher A commented: "Every time, I learned new things that I can incorporate." Spreading the PD program over the school year helped intervention teachers incorporate the training into their daily practice. Intervention teacher B stated, "I think [spreading out the program] was very effective. Rather than trying to fit it all into the fall . . . then you might be floundering or falling back or forgetting." The intervention teachers appreciated the mentor. Intervention teacher C noted: "[The mentor] had good suggestions and was really supportive and not critical." All intervention teachers highlighted the LEIC tool as invaluable to developing accommodations applicable to the everyday complexity of their classrooms. One intervention teacher explained:

[Information] in the files was very useful in terms of background but didn't give a lot of really useful things that would work down on the ground on a day-to-day

basis in the classroom . . . Just having the LEIC page the way it was set out was good because I wouldn't have thought of all those things to include and really trying to build on strengths. (Intervention teacher A)

Intervention teachers were unanimous that the PD program improved their ability to accommodate students with FASD in their classrooms.

Perceptions of classroom behavior. Changes in behavior perception were identified as an important outcome of the PD program. One teacher described how her understanding of underlying neurological impairment altered her response to problem behavior:

I remember when S first came into the classroom, he wasn't listening and I was getting very firm with him and he just huddled up . . . I just thought he was being a jerk . . . but he was trying. Now we understand that, so we leave it. (Intervention teacher B)

Intervention teacher D stated, "It reminded me to slow down, think about the child, be patient, and realize that he can't help it." Intervention teachers valued their new perspective on problem behavior and how it changed their responses.

Strategies for students with FASD. All teachers described their appreciation for students' strengths;

however, intervention teachers indicated they were very purposeful in leveraging those strengths and confident in developing accommodations. Intervention teacher C had a student with excellent penmanship who needed extra time to process instructions. She gave her class paper stoplights to indicate their progress in a lesson and began displaying examples of good penmanship. This accommodation allowed the student with FASD to complete her work

without being singled out, and reinforced the value of her work. In contrast, comparison teacher A stated, "I don't know that much in terms of FASD and what the best strategies to use with kids are." Intervention teachers used a variety of accommodations; comparison teachers identified challenges in developing accommodations (see Table 6).

Table 6
Examples of classroom environment accommodations

Environment	Instruction	Curriculum
Seat student near teacher for group work	Blunt, simple directions given one at a time	Provide as many hands-on opportunities as possible
Pictorial checklist for morning routine	Pair verbal instruction with a visual	Developmentally appropriate social skills training
Gadgets to decrease sensory stimuli, e.g., earphones or hat	Prepare student for transitions to next activity	One-to-one sharing with classroom peers
Provide opportunities to leave desk when becomes fidgety during seat work	Provide extra time to process instructions and complete work	Provide assistive software and/or a scribe for writing
Provide fidget toys	Repeat instructions	Model language skills

Discussion

There were four principal findings: teachers were satisfied with the PD program; there was no statistically significant change in observed behaviors of intervention students; teachers reported more positively on student behavior; and there was no statistically significant change in academic achievement. Given the lack of research regarding effects of PD programs on teachers of students with FASD and on these students, it is important to report these findings in spite of study limitations.

Behavior observed by research staff did not demonstrate a statistically significant change; however, the effect size was greater than .50 (see Table 5). The effect size suggests that the sample size was inadequate to detect change in the BASC-2 SOS measure.

The statistically significant changes in Adaptive Skills and School Problems represent meaningful changes in students' behavior. When teachers perceive students are more attentive, motivated to learn, and better able to perform daily living skills, they are more likely to interact with them in a positive manner, which may lead to better student-teacher relationships (Pianta & Walsh, 1996).

Statistically significant changes were not observed for academic achievement; this could be due to the changes that happened within the intervention group or insufficient follow-up time. The intervention group was small and all but one intervention student experienced changes in their home environment at mid- or post-intervention (see Figure 1) which may have limited our ability to detect statistically significant changes.

In our intervention, teachers were taught to reframe behaviors associated with FASD as neurodevelopmental disability rather than willful disobedience. This is consistent with the work of Bertrand (2009), who found positive results from parents' reactions to their children with FASD in the home environment. It is possible that, with a larger sample, we would see results similar to Bertrand (2009) in the school setting. Further work could validate the intervention in a larger population. Future interventions could examine changes by parents and teachers in both home and school settings respectively.

Limitations

Generalizability of findings to other populations of students with FASD are limited by the small sample size, non-equivalent groups, homogeneity of teachers, and use of only one mentor working with a group of experienced, female Caucasian teachers. Having one mentor allows for consistency for research purposes; however, the results might be attributed to the mentor's or intervention teachers' unique skill sets. Intervention group improvements could be due to regression towards the mean, because groups were non-equivalent pre-intervention.

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