Title: Fidelity of Implementation and Academic Achievement:
A Preliminary Study of Colorado PBIS Schools

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Abstract/Summary

The purpose of this report was to increase our understanding of the scope and impact of the PBIS framework in Colorado. Also, this study serves to initiate a research agenda that supports best-practices and facilitates successful PBIS implementation. The key findings include: (1) PBIS schools tend to support higher percentages of minority and free lunch students compared to the state; (2) more than half of PBIS sites are implementing with fidelity; and (3) for elementary and middle schools roughly a three to five point gain on the Benchmarks of Quality predicts a 1% increase in math and reading proficiency scores on the CSAP.

Subject: Fidelity of Implementation (FOI); Positive Behavioral Intervention Supports; Academic Achievement; School Climate

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Fidelity of Implementation and Academic Achievement:
A Preliminary Study of Colorado PBIS Schools

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Executive Summary

Positive Behavioral Interventions and Supports (PBIS) is a multi-tiered systems approach

developed to foster social and academic success for all students. Current research has

revealed a substantial impact of PBIS on reducing the rates of office discipline referrals. In

addition, an emerging body of research is providing evidence of the ability of school-wide

PBIS to positively impact student academic achievement. This study expands on this

research by exploring the relationship between fidelity of implementation (FOI) and

achievement outcomes in schools within the state of Colorado. A quantitative examination

of the relationship between Colorado Student Assessment Program (CSAP) reading/math

scores and FOI scores occurred to elucidate relationships. A large number of significant,

positive correlations were identified between these variables.   In addition, regression

analyses of FOI scores on achievement outcomes were conducted at the elementary and

middle school levels. The obtained regression models accounted for approximately three to

nine percent of the variance in proficiency scores. The most robust models were that of the

Benchmarks of Quality (BoQ) scores regressed on middle school achievement. These

models accounted for approximately nine percent of the variance in both math and reading

proficiency levels. Also, the BoQ model successfully predicted reading achievement in

elementary schools. In contrast, the School-wide Evaluation Tool (SET) was better able to

account for the variance associated with math and reading performance at the elementary

levels compared to the BoQ. The obtained results suggest the importance of FOI for

achieving positive academic outcomes. In addition, the results may be interpreted to

suggest that fidelity of PBIS implementation may facilitate the improvement of achievement outcomes in students.

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Introduction

Positive Behavioral Interventions and Supports (PBIS) is a multi-tiered systems approach designed to foster social and academic success for all students by focusing on systems, data, practices and outcomes ("What is School-Wide", 2012; Sugai, Horner, Dunlap, Hieneman, Lewis, Nelson, Scott, Liaupsin, Sailor, Turnbull, Wickham, Ruef, and Wilcox, 2000). A growing body of research has demonstrated a substantial impact of PBIS on promoting positive school climate and reducing punitive practices such as office discipline referrals (Caldarella, Shatzer, Gray, Young, and Young, 2011; Bradshaw, Mitchell, and Leaf, 2010). The model has also been shown to have a positive impact on recovering lost instructional time that may contribute to improved academic achievement (Scott & Barrett, 2004; Algozzine & Algozzine, 2009). In addition, research indicates a strong relationship between academic achievement and social behavior (see Algozzine, Wang, & Violette, 2011).

The PBIS model while well-defined and having been linked to numerous social and behavioral outcomes has been less studied in regards to the relationship between fidelity of implementation (FOI) and achievement outcomes with findings often appearing inconclusive (Putnam, Horner, and Algozzine, 2006; Ryoo and Hong, 2011). An examination of schools implementing PBIS in New Hampshire revealed academic gains for 73% of participating schools, operating at fidelity as measured by the School-wide Evaluation Tool (SET), in regards to math achievement (Muscott, Mann, and LeBrun, 2008). In contrast, only 41% of school sites operating at fidelity showed improvement in reading performance (2008). However, the relative impact of PBIS is not specified in this study

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without the presence of control data. An examination of the impact of PBIS on achievement in 324 Illinois schools, with and without FOI, revealed by Hierarchical Linear Modeling (HLM) analysis, improved outcomes in math scores of students in schools implementing with fidelity according to the SET with no statistically significant change in reading performance (Simonsen, Eber, Black, Sugai, Lewandowski, Sims, and Myers, 2012).

Another study documented substantial achievement gains for students enrolled in an urban elementary school in reading comprehension and math between years (Luiselli, Putnam, Handler, and Feinberg, 2005). The study lacked FOI measures and the participating school self-selected into the study which may contribute to the observed differences due to expectation effects, co-occurring initiatives, or other unaccounted confounds (2005). In order to reduce errors/confounds, a more recent study attempted to mitigate the effects by application of a quasi-experimental design that employs both propensity score matching with structural equation modeling to equate disparate groups (Ryoo & Hong, 2011). The preliminary findings indicated no difference in math and reading performance for the matched elementary school sample (2011). Additional studies, with some addressing FOI, have shown mixed results in regards to PBIS implementation on achievement (Bradshaw, Mitchell, and Leaf, 2010; Horner, Sugai, Smolkowski, Eber, Nakasato, Todd, and Esperanza, 2009; Lassen, Steele, and Sailor, 2006). The mixed results make sense when viewed from the perspective that PBIS implementation alone may not suffice to alter outcomes.

Horner, Sugai, & Anderson (2010) write:

"It is premature to claim that investing in SWPBS is causally associated with improved academic outcomes. In fact, the conceptual logic does not support the expectation that building social support would lead to improved reading, math, or writing skills. Rather, the expectation is that establishing a predictable, consistent, positive, and safe social culture will improve the behavioral engagement of students in learning, and that if this engagement is coupled with a functional curriculum and effective teaching, academic outcomes will be more likely" (p.8).

The purpose of this study is to expand on prior research that has examined the relationship between FOI of PBIS and academic achievement. This study will help further build the knowledge base of the relationships between achievement and degree of PBIS implementation within the state of Colorado. To present, the primary focus of supports provided by the Colorado Department of Education has been on ensuring FOI and ascertaining impact on office discipline referral and out of school suspension rates. This study includes a comprehensive analysis of FOI and achievement outcomes within Colorado schools implementing the PBIS framework during the 2010-2011 academic year. Specifically, the manner in which FOI and achievement interact will be examined for a better understanding of the relationship among these variables.

In sum, this study will attempt to answer the following questions:

1. **What is the demographic "profile" of schools that participate in the Colorado PBIS initiative?**

2. **Are Colorado sites currently implementing PBIS with fidelity?**

3. **What relationship exists between FOI and math/reading achievement?**

Methods

Participants. All schools within the State of Colorado from the 2010-2011 academic year in which FOI data was available within the PBISEval system are included within this study. In sum, 566 sites including schools, eligible facilities, or alternative education campuses within the state of Colorado reported FOI data. A total of 37.7% of the sites were located within the Denver metro region of Colorado. The majority of sites were elementary schools (i.e. 69.5%; n=394). In sum, FOI data from 63 districts, which represents 35.3% of all the districts in Colorado, were utilized in this study. For regression analysis, the results of elementary and middle schools were disaggregated and are reported separately. The high schools were excluded from regression analysis due to the small sample size.

Demographic Data. The demographic information for this study was obtained from data submitted by Local Education Agencies to the Colorado Department of Education on an annual basis. Aggregate reports are generated by school and posted to the state web-site for public use. The selected data from these reports include percentage of students receiving free or reduced price lunch (FRL), percentage of minority students (i.e. non-white) and percentage of male students.

Fidelity Measures. All school sites implementing PBIS that are supported by the Colorado Department of Education, are required to complete a FOI tool on an annual basis. The utilized tools include the Benchmarks of Quality (BoQ) and the School-wide Evaluation Tool (SET). The tools have been psychometrically validated and have been described within a number of empirical studies (Cohen, Kincaid, Childs, 2007; Horner, Todd, Lewis-Palmer, Irvin, Sugai, and Boland, 2004; Vincent, Spaulding, Tobin, 2010). The obtained

results are submitted on-line and uploaded to the University of Oregon's PBIS Assessment site. The Colorado Department of Education has the ability to extract all submitted scores from participating Colorado sites for analysis.

The BoQ is completed by sites in the spring semester of each year. The BoQ measures the degree of implementation across ten critical components of universal PBIS implementation. The completed BoQ provides a quantitative, interval level measure of total points received on the tool. Fidelity of implementation is assigned if 70% of the points are obtained on the overall measure. The present study uses the total BoQ score for all correlation and regression analyses. The SET is a fidelity tool that sites may administer in the spring semester of each year. The SET is composed of 28 items falling within seven subscales linked to the key features of PBIS. In addition, the SET generates subscale summary scores along with a overall summary score (Horner et al., 2004). It has been suggested that FOI is achieved on the SET when the Total score and Expectations Taught subscale scores are both at least 80% (2004). This study utilizes both scores as predictor variables in our regression models.

Achievement Data. The Colorado Student Assessment Program (CSAP) is a statewide assessment that is administered annually to all students enrolled in 3rd to 10th grades in the content areas of Reading, Writing, and Math. Additionally, 5th, 8th, and 10th grade students are assessed in science (Colorado Department of Education, 2009). The tests have been developed to be psychometrically sound, vertically-aligned and inclusive of Colorado content standards (CTB McGraw-Hill, 2011). All aggregate assessment results, by district

and school, are available to researchers via the Colorado Department of Education web-site (i.e. www.cde.state.co.us). For this study, we obtained assessment data for all sites in which FOI data were available. The obtained CSAP data included the percentage of students by proficiency level, grade, and content area (i.e. math, reading, and writing). The researchers considered using other measures such as CSAP scale scores but the use of the school level percent proficient provides a common metric across schools and grade levels.

It's important to recognize that some limitations may exist when utilizing school-level percent proficient as a primary outcome measure (Ho, 2008; Betebenner, Shank, Xiang, Zhao, and Yue, 2008). Specifically, in terms of this study, it must be recognized that any trend magnitudes depend on proficiency cut scores which are judgmentally based (2008). Also, individual score error can be compounded via the creation of an aggregate proficiency measure (Betebenner et al., 2008). In effect, the placement of cut scores could potentially impact the quality and stability of any derived statistics. This observation leads us to emphasize the preliminary nature of these results. Of course, all obtained results should be considered descriptive in nature until appropriately replicated and addressed by additional experiment and/or quasi-experimental methodology.

Analysis

The initial phase of this study involved the calculation of the descriptive statistics for the sample to profile the demographics of all Colorado PBIS schools (i.e. from 2010-2011 with corresponding FOI data). The obtained values were contrasted with those of all schools in the state to better understand whom the Colorado PBIS initiative primarily

supports. Second, a correlation matrix for all PBIS sites was generated to determine the

relationship(s) between school demographics, achievement, and fidelity score (BoQ/SET).

Also, correlations were calculated between the fidelity measures and achievement

outcomes based on school level (i.e. elementary, middle, and high). Lastly, a series of

regression models that predict the achievement criterion variable based on the fidelity of

implementation predictor variable, were developed for elementary and middle schools.

Regression analysis of high school achievement and fidelity was not conducted due to the

small sample size. Analysis also includes an examination of the relative weights of

variables in predicting academic outcomes (i.e. math and reading proficiency).

Results

Demographics. The demographic data for schools that submitted 2010-2011 fidelity of

implementation (FOI) data is provide in Table 1 below. Also, state demographic and

achievement data is provided to allow for comparisons with PBIS sites. The schools

representing our 2010-2011 samples reflect the diversity of the Colorado student

population. However, for most demographic measures the PBIS schools revealed more

impacted populations. The PBIS schools had higher rates of FRL eligible students (+14.1%)

and minority students (+7.5%) compared to the state. The minority student population in

Colorado includes large numbers of second language learners (i.e. 14% of all students) thus

sites would require additional educational supports for these students.

The obtained BoQ and SET mean scores approximate the fidelity cut scores for these

measures. The CSAP performance of PBIS sites is slightly higher in regards to math

compared to the state (i.e. +0.5%). However, for reading and writing the percent of

students performing at the proficient or advanced level were approximately 5.5% lower

than the state rate.

Table 1. Descriptive Statistics for PBIS Schools Providing FOI Data (10-11): All Sites

Variable	State Mean	PBIS Sites					
		Mean	Median	SD	Min	Max	n
% FRL	40.3%	54.4%	56.4%	27.4%	1.9%	98.6%	551
% Minority (non-white)	43.2%	50.7%	47.6%	27.3%	2.0%	98.0%	552
% Male	51.3%	51.4%	51.5%	2.9%	38.2%	65.0%	552
Reading (% Prof+)	67.9%	62.5%	65.1%	18.2%	4.8%	97.0%	539
Math (% Prof+)	55.7%	56.2%	57.9%	20.4%	0.0%	99.4%	538
Writing (% Prof+)	55.3%	49.6%	50.7%	18.3%	0.0%	91.5%	538
BoQ Score	--	72.7%	74.8%	15.8%	19.6%	100%	295
SET Score (Total)	--	78.5%	83.3%	17.9%	11.6%	100%	458
SET Score (Exp Taught)*	--	77.5%	90.0%	25.8%	0.0%	100%	458

Note. The total number of schools/sites included in the descriptive analysis is 566. State Mean: data obtained from public reports, posted on, http://www.cde.state.co.us/FRL: percentage of students eligible for free or reduced lunch. *: refers to expectations taught subscale score.

Figure 1. Descriptive Statistics for PBIS and State Schools (10-11)
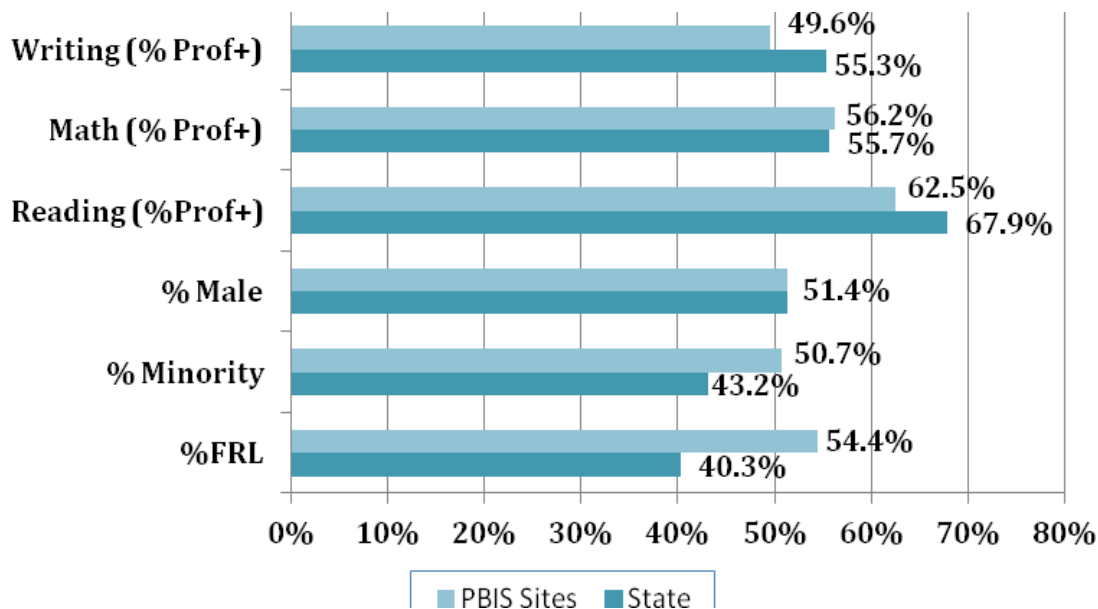
Fidelity of Implementation. In Table 2, the percentage of sites from 2010-2011 found to be implementing at fidelity are presented. The results indicate that 62.4% of sites using the BoQ are implementing at fidelity. For the SET, 53.7% of sites were identified as achieving fidelity of implementation. A number of sites (n=186) were also assessed using both tools. For these sites, 49.5% were at FOI on both measures (see Table 2). The results, when disaggregated by level, indicate that elementary schools are the most likely to be classified as operating at fidelity followed by middle and then high schools (i.e. for all fidelity measures).

Table 2. **Percentage of Sites Operating at Fidelity of Implementation (10-11)**

School Level	Fidelity Measure/Tool					
	BoQ & SET*		BoQ		SET	
	%	Total n	%	Total n	%	Total n
Overall	49.5%	186	62.4%	295	53.7%	458
Elementary	52.3%	130	66.3%	202	58.1%	322
Middle	44.4%	36	56.4%	55	52.4%	84
High	37.5%	16	45.5%	33	24.4%	41

Note. *: Both instruments used. % At FOI indicates both measures scores exceeded fidelity cuts. These schools are also reflected in the subsequent line. Sites identified as "other" or "pre-K" are only included in overall values.

It should be noted, from cross-tabulations, that the BoQ was slightly more likely to classify a school at FOI compared to the SET (see table 3). While these differences might be attributed to differences in the content of the measures or differences in the cut score (70% for BoQ and 80% for SET), these results provide information regarding the consistency of the application of the instruments. In sum, there was high overall agreement between the measures for FOI determinations (i.e. 75%; see table 3). In addition, the classification agreement rates were high for all of the data disaggregated by school level (i.e. 73.1% to 81.3%; see tables 4 to 6).

Table 3. Cross-tabulation of SET and BoQ at Fidelity: All Sites

SET At Fidelity	BoQ (At Fidelity)		Total n
	No	Yes	
No	*25.27% (47)*	13.98% (26)	73
Yes	11.29% (21)	*49.46% (92)*	113

Note. Total n=186. 74.7% of cases were similarly classified across FOI tools.
Disaggregated results fail to match overall values as "other" & "pre-k" sites aren't included.

Table 4. Cross-tabulation of SET and BoQ at Fidelity: Elementary

SET At Fidelity	BoQ (At Fidelity)		Total n
	No	Yes	
No	*20.77% (27)*	14.62% (19)	46
Yes	12.31% (16)	*52.31 (68)*	84

Note. Total n=130. 73.1% of cases were similarly classified across FOI tools.

Table 5. Cross-tabulation of SET and BoQ at Fidelity: Middle

SET At Fidelity	BoQ (At Fidelity)		Total n
	No	Yes	
No	*36.11% (13)*	10.26% (4)	17
Yes	8.33% (3)	*44.44% (16)*	19

Note. Total n=36. 80.6% of cases were similarly classified across FOI tools.

Table 6. Cross-tabulation of SET and BoQ at Fidelity: High

SET At Fidelity	BoQ (At Fidelity)		Total n
	No	Yes	
No	*43.75% (7)*	12.50% (2)	9
Yes	6.25% (1)	*37.50% (6)*	7

Note. Total n=16. 81.3% of cases were similarly classified across FOI tools.

Correlations between Fidelity and Achievement. The correlation analysis reflected in

Table 7, included: (a) the correlations between FOI measures (i.e. SET/BoQ), (b) the

correlations between school-wide CSAP proficiency levels and content areas, (c) the

correlations between FOI measures and CSAP proficiency levels. All sites were included

within this analysis. The obtained Pearson product-moment correlations between the BoQ

and SET total scores indicate a strong positive relationship between scores

($\underline{r}$(186)=.492,$\underline{p}$<.001). This is aligned with prior studies that have examined the concurrent

validity of each FOI measure and have shown high rates of score concordance (Cohen, Kincaid, and Childs, 2007). The correlations between school-level CSAP proficiency levels were high between subjects (r's(538)>.827,p's<.05) with the strongest observed relationship existing between reading and writing performance. Finally, FOI scores for the BoQ were correlated with CSAP performance (r's(282)>.175, p's<.05). The obtained correlation with math achievement was the strongest (r=.305) and parallels other research study findings (Muscott et al, 2008; Simonsen et al 2012). In contrast, the relationship between the total SET scores and CSAP writing proficiency levels was weaker, with no significant relationship detected (r(437)=.07, p>.05). However, significant correlations were detected between math/reading proficiency levels and total SET scores (r's(437)>.101,p's<.05). Again, the relationship with math achievement was the strongest (r=.192), however, it was still weaker then that observed for the BoQ measure.

Table 7. Correlations Between FOI Scores and Overall CSAP Proficiency (10-11)

Variable		BoQ	SET-ET	SET-TTL	Math 11 Pr+	Rdg 11 Pr+	Wrg 11 Pr+
BoQ - Total	r-value	1	*.382***	*.492***	*.305***	*.175***	*.178***
	N	295	186	186	282	283	282
SET – ET	r-value	*.382***	1	*.852***	*.266***	*.154***	*.127***
	N	186	458	458	437	438	437
SET - TTL	r-value	*.492***	*.852***	1	*.192***	*.101**	.070
	N	186	458	458	437	438	437
Math 11Pr+	r-value	*.305***	*.266***	*.192***	1	*.827***	*.832***
	N	282	437	437	538	538	538
Rdg 11 Pr+	r-value	*.175***	*.154***	*.101**	*.827***	1	*.957***
	N	283	438	438	538	539	538
Wrg 11 Pr+	r-value	*.178***	*.127***	.070	*.832***	*.957***	1
	N	282	437	437	538	538	538

Note. **: $p < 0.01$ level (2-tailed). *: $p<.05$ level (2-tailed). Pr+: indicates proficient and advanced; Rdg: reading, Wrg: writing. SET-ET: reflects obtained expectations taught subscale score from the SET.

Additional correlation analysis by school level revealed significant positive relationships between BoQ total scores for math and writing at the elementary schools (r's(195)>.145, p's<.05) and for math, reading, and writing with the BoQ total score for middle schools (r's(54)>.321,p's<.05; see table 8). For the SET, expectations taught scale significant correlations were identified across content areas in elementary schools (r's(312)>.160,p's<.05). No significant findings were detected at the middle or high school levels between content areas and the SET expectations taught scale (p's>.05). For the SET total score a significant positive correlation existed with reading for elementary schools (r(312)=.117,p<.05).

Table 8. Correlations of FOI Measures & Achievement Outcomes by School Level (10-11)

| Variable	Elementary School			Middle School			High School		
	Math 11 Pr+	Rdg 11 Pr+	Wrg 11 Pr+	Math 11 Pr+	Rdg 11 Pr+	Wrg 11 Pr+	Math 11 Pr+	Rdg 11 Pr+	Wrg 11 Pr+
BoQ - Total r-value	*.192**	.138	*.145*	*.326*	*.329*	*.321*	.006	.087	.072
N	195	195	195	54	54	54	30	31	30
SET – ET r-value	*.238**	*.205**	*.160**	.032	.024	.003	-.235	-.014	-.082
N	312	312	312	83	83	83	36	37	36
SET – Total r-value	.144	*.117*	.076	-.005	-.007	-.028	-.177	.059	-.037
N	312	312	312	83	83	83	36	37	36

Note. **: p< 0.01 level (2-tailed). *: p<.05 level (2-tailed). Pr+: indicates proficient and advanced; Rdg: reading, Wrg: writing. SET-ET: reflects obtained expectations taught subscale score from the SET.

Regression Analysis of FOI and Achievement. This section reports the results of the regression analyses, for elementary and middle schools, used to test for the relationship between FOI and achievement. Two different dependent variables were used: the percentage of students performing at the proficient/advanced level on the CSAP reading assessment and the percentage of students performing at the proficient or advanced level on the CSAP math assessment. The writing performance level wasn't included as an

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outcome variable due to the high inter-correlation (r=.957) with reading. The dependent variables were regressed solely on the FOI measure in the models with separate models being generated for the SET and BoQ. Also, a separate analysis wasn't conducted for high schools due to the small sample size and a lack of statistically significant correlations between fidelity and achievement measures.

Tests of Normality. A visual examination of histograms for the two outcome measures, reading and math percent achievement revealed near normal distributions for both variables (see figures 2 and 4). As an additional test of normality, Q-Q plots were generated and Kolmogorov-Smirnov tests were conducted (see figure 3 and 5; table 9). The results indicate a normal distribution with a slight negative skew for math. For reading, the distribution had a more pronounced negative skew, thus all regression results should be interpreted cautiously.

Figures 2/3. Math Proficiency Distributions: Histogram & Q-Q Plot Analysis

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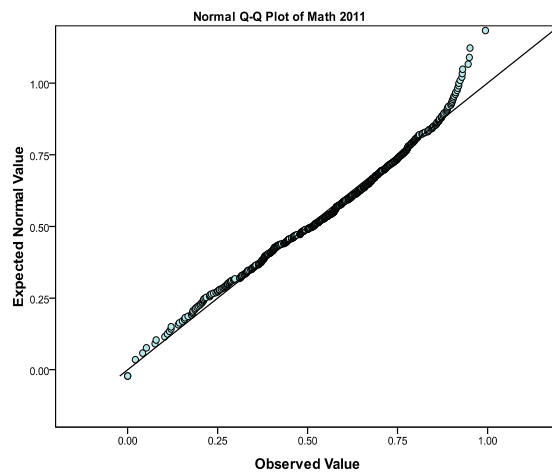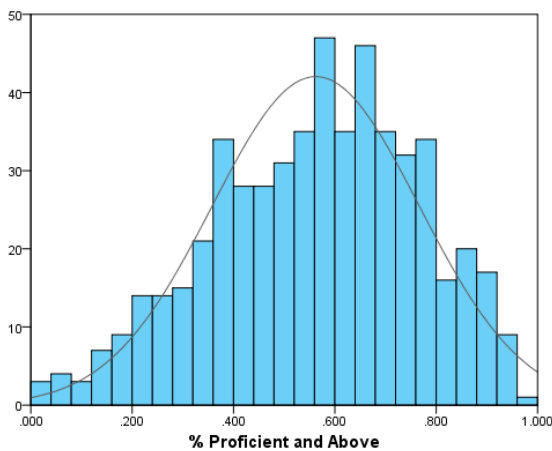
Figures 4/5. Reading Proficiency Distributions: Histogram & Q-Q Plot Analysis
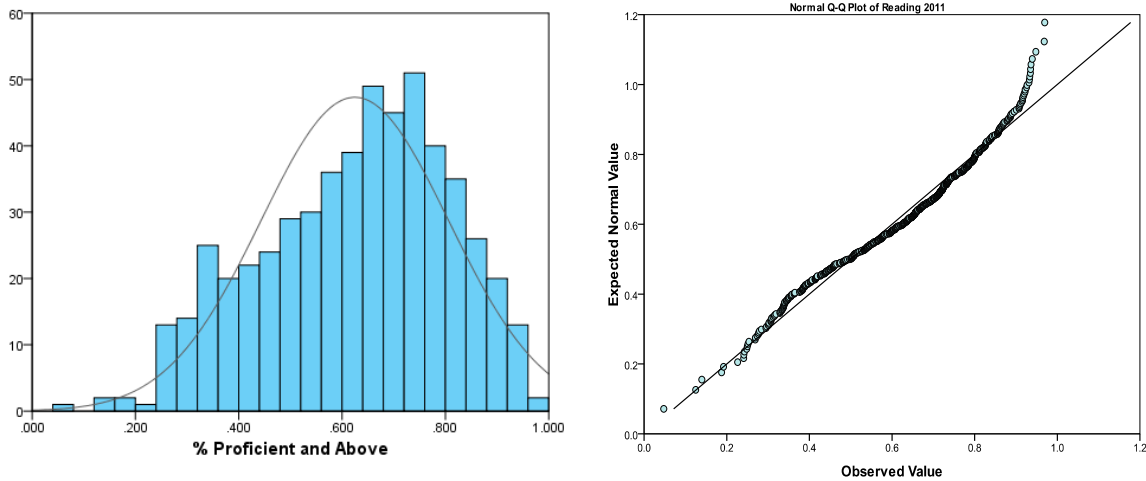
Table 9. Measures of Skew & Kurtosis by Content Area

Content Area	n	Mean	Skew	SE	Kurtosis	SE
Math (% Prof)	538	.56226	-.310	.105	-.465	.210
Reading (%Prof)	539	.62461	-.391	.105	-.549	.210

BoQ Analysis Results. The regression of Math achievement on BoQ scores accounted for a statistically significant, albeit small (i.e. Elementary School: 3%; Middle School: 9%), amount of the variance in math achievement ($R^{2's}$>.037, F's>6.19, $p's$<.05); see Table 10). In addition, the BoQ alone was able to predict reading achievement within elementary and middle schools (R^2>.014, $F's$>3.76, $p's$<.054). However, the adjusted R^2 accounted for only 1% of the variance associated with reading proficiency for elementary schools but 9% of the variance in middle schools. The results indicate that the FOI tool is better at predicting achievement at the middle school level then the elementary school level. In addition, it appears that the tool tends to be equally effective in predicting math and reading scores across school levels.

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Table 10. Predictors of Student Achievement, BoQ (Unstandardized Coefficients)

Predictor Variable	Math Achievement		Reading Achievement	
	ES	*MS*	*ES*	*MS*
BoQ Score	*.212**	*.363*	*.170*	*.360*
R²	.037	.107	.019	.108
Adjusted R²	.032	.089	.014	.091
Sample Size	194	53	194	53
p-value	**.007**	**.016**	.054	**.015**

Note. *p<.05, **p<.01, ***p<.001. All reported significance tests are two-tailed. ES: elementary school sites; MS: middle school sites.

SET Analysis Results. The elementary school math and reading regression models were found to be statistically significant (R^2's>.050, F's>8.16, p's<.05; see Table 11). However, for both models, the expectations taught score solely contributed to the models with total scores being statistically insignificant in all cases. For middle schools, the regression models failed to achieve statistical significance (R^2's<.003, F's<.203, p's>.05).

Table 11. Predictors of Student Achievement, SET (Unstandardized Coefficients)

Predictor Variable	Math Achievement		Reading Achievement	
	ES	*MS*	*ES*	*MS*
SET Score - Total	-.002	-.001	.000	.000
SET Score - ET	*.292*	.087	*.281*	.067
R²	.065	.005	.050	.003
Adjusted R²	.059	.000	.044	.000
Sample Size	311	82	311	82
p-value	**.000**	.817	**.000**	.874

Note. *p<.05, **p<.01, ***p<.001. All reported significance tests are two-tailed. ES: elementary school sites; MS: middle school sites. ns: not significant. SET-ET: reflects obtained expectations taught subscale score from the SET.

The obtained regression models indicate that the SET expectations taught scale score is more effective in predicting math and reading performance at the elementary level then the BoQ. In contrast, the BoQ predicted performance at the middle school level while the SET models were not statistically significant.

Discussion

Positive Behavioral Interventions and Supports (PBIS) is a school wide systems framework developed to promote social and academic success for all students ("What is School-Wide", 2012; Sugai, Horner, Dunlap, Hieneman, Lewis, Nelson, Scott, Liaupsin, Sailor, Turnbull, Wickham, Ruef, and Wilcox, 2000). Few studies have examined the ability of school-wide PBIS, implemented with fidelity, to impact student academic achievement in a positive manner (Putnam, Horner, and Algozzine, 2006; Ryoo and Hong, 2011). The purpose of this study was to examine the relationship between fidelity of implementation and achievement outcomes within Colorado local education agencies utilizing the PBIS framework. Also, an analysis of demographic variables was presented to better understand the profiles of sites served within Colorado.

The study findings indicate the ability of FOI measures to successfully predict achievement levels at the elementary and middle school levels. The strength of the relationships, while marginal, were statistically significant and serve to provide additional evidence of the value of the FOI construct for the prediction of academic achievement in schools. It may be argued, PBIS is not expected to affect academic gains directly, so even the smallest of detected effects may be deemed important (Horner, Sugai, and Anderson, 2010). As previously proffered, "In fact, the conceptual logic does not support the expectation that building social support would lead to improved reading, math, or writing skills" (2010). The increases may be expected by the presence of a favorable school climate paired with high quality instruction and improved student engagement.

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It is important to recognize that this study reflects descriptive results based on schools participating in the Colorado PBIS initiative. Because this study did not use experimental methodology, it is difficult to discern if other mitigating factors might influence the results. For example, high implementation schools might also have better leadership, instructional practices and/or curriculum which might have contributed to the higher CSAP scores. Future research on the impact of PBIS should work to examine and/or account for some of these differences. Also, research should examine if PBIS implementation is related to increased academic engagement. In effect, a study examining the impact of PBIS on improved attendance would be valuable. Finally, it should be recognized, the revised BoQ tool now includes a "classroom" sub-scale. It is expected that the implementation of classroom practices may be a stronger predictor of academic effects then the overall measures used in this study. The "classroom" subscale may allow for more sophisticated analytic approaches that allow for matching of classrooms thus providing a better gauge of the impact of FOI on measured achievement outcomes. Additional research will serve to further reveal the complex interplay between fidelity, behavior, and achievement outcomes.

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