

# In Need of a Research Base: Evidence-Based Reading Interventions for Elementary Students With Overlapping EBD and LD

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*Students with or at-risk of emotional/behavioral disorders (EBD) often have reading difficulties and/or undiagnosed learning disabilities (LD). Reading challenges among this group of children and youth often exacerbate associated emotional and/or behavioral problems. This systematic review and quantitative synthesis yielded seven studies focused on improving the reading outcomes of students with or at-risk of EBD at the elementary school level. Summarized are participant and reading intervention characteristics across the seven studies. Effect sizes were calculated for each study, and results are reported for both academic and behavioral outcome measures. Implications for research and practice are discussed.*

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**Keywords:** emotional and behavioral disorders, reading interventions, elementary school, research synthesis

## INTRODUCTION

Reading fluently and with comprehension (i.e., being literate) is a critical protective factor in guarding against social-behavioral risk and poor academic outcomes for students with or at-risk of emotional/behavioral disorders (EBD). A significant amount of research has been conducted that addresses on-task and other pro-social behaviors for students with EBD in the school setting. However, less is focused on instructional practices for improving their academic outcomes (Anderson et al., 2001; Dunn et al., 2017). There is a robust body of research regarding instructional approaches to address reading and literacy difficulties for students with learning disabilities (LD), but less research has been conducted with a focus on students with EBD—including students with co-occurring LD. The need for such a literature base is particularly noteworthy as students with EBD frequently experience poor reading outcomes (Boon et al., 2020; Garwood et al., 2014), and they have been found to often be non-responders when participating in reading interventions (Jacobson et al., 2013; Lane, 2007). From the reading literature, longitudinal research has shown that students who do not learn to read fluently early generally lag behind their peers, and have lower reading trajectories as they progress through school (Vellutino et al., 2004;

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Wanzek et al., 2014). This trend has been found for youth with EBD as well (Trout et al., 2006).

Research has long documented that students with EBD consistently lag behind their peers academically and have academic profiles similar to students with LD (Glassberg et al., 1999; Levy & Chard, 2001; Reid et al., 2004; Rivera et al., 2006; Vaughn et al., 2002; Wehby et al., 2003). In a meta-analysis of the academic status of students with EBD, Reid et al. (2004) reported moderate to large deficits in the academic performance of students with EBD who performed at significantly lower levels than the comparison groups for all subject areas. More specifically, Reid et al. reported overall moderate to large effect size differences across all subject areas including the area of reading where an effect size of  $-0.61$  was found. Taken together, these studies point to the poor academic outcomes of students with EBD, and the need to improve their reading outcomes.

Finally, children and youth who have been identified as having an emotional disturbance (ED) under the Individuals with Disabilities Education Act (IDEA, 2004) fall under the umbrella of the broader EBD term. National longitudinal and individual study data reveal that youth with ED have been found to exhibit poorer reading comprehension and word reading outcomes than their peers with other disabilities (Taft & Mason, 2011; Wei et al., 2011). This group of students has also been found to perform 1 to 2 years below grade level (e.g., Trout et al., 2003).

### ***Previous Reviews on Reading Interventions for Students with EBD***

Numerous reviews have emphasized the necessity for further research for students with EBD around reading and literacy. Gunter and Denny (1998) were among the first researchers to highlight the persistent lack of research dedicated to academic skills for this specific group of students with disabilities. Coleman and Vaughn (2000) conducted an extensive literature review on reading interventions for students with EBD. They identified only eight studies that met their inclusion criteria and concluded that the existing literature offered limited guidance on effective reading interventions for this population. Similarly, Kostewicz and Kubina (2008) conducted a review of studies published both before and after the National Reading Panel report in 2000. They found a total of 21 studies, with 10 published before the report (covering the period from 1975 to 2000) and 11 published after. The majority of these studies focused on alphabets, such as phonological awareness and phonics, while only a few explored vocabulary or text comprehension interventions. In a meta-analytic review, Benner et al. (2010) analyzed six group studies and 18 single-case research (SCR) studies. The studies meeting their inclusion criteria revealed moderate to strong effects for the group studies, but the SCR studies showed more varied effects.

Overall, these reviews collectively underscore the urgent need for additional research in the area of reading interventions for students with EBD. The existing literature remains limited and primarily concentrated on alphabets, leaving significant gaps in knowledge regarding effective interventions for vocabulary, text comprehension, and other crucial aspects of reading development for this student population. Further research is essential to provide educators and practitioners with more comprehensive guidance on how to support the reading skills of students with EBD.

### ***Evidence-Based Practices and Standards***

No one study can determine what constitutes an evidence-based practice. Rather, a body of research is needed. Cook and Cook (2011) provided a cogent overview of the issues associated with identifying evidence-based practices. They defined them “as practices that are supported by multiple, high-quality studies that utilize research designs from which causality can be inferred and that demonstrate meaningful effects on student outcomes” (p. 73). The field of special education has focused on evidence-based practices and developed standards for assessing design quality to aid in such reviews. Consideration is also given to whether the research conducted uses experimental designs that can demonstrate causality, that are implemented with methodological rigor, and result in a line of high-quality studies (Cook & Cook, 2011). This focus on evidence-based interventions is prompting special education researchers to take a critical look at the quality of the research that underlies practice as reflected in the development of quality standards for SCR designs (Cook & Odom, 2013; Cook et al., 2009).

Two sets of criteria have been advanced in the literature as being important for an intervention to be considered an evidence-based practice. First, to qualify as an evidence-based practice using group designs, Gersten et al. (2005) tentatively put forward the criterion that an intervention should be considered evidence-based using group methods only after four acceptable quality or two high-quality quasi-experimental or experimental group designs have documented its outcomes. Second, Horner et al. (2005) advanced the criteria that to be considered evidence-based using SCR methods, a practice should be: (a) backed by at least five studies of high quality, (b) published in peer-reviewed journals, (c) conducted in at least three geographical locations by three different researchers/research teams, and (d) include at least 20 participants. Both of these sets of criteria have greatly influenced the discussions regarding what is considered research-based, especially within the What Works Clearinghouse (WWC), a federal agency that is setting standards for what should be considered an evidence-based intervention (Kratochwill et al., 2013).

### ***Single-Case Research***

In the discussion of evidence-based practices, randomized treatment control group designs (RCTs) are considered the gold standard for determining evidence-based practices (Odom et al., 2005). However, SCR is an alternative approach that can be used to identify such practices (Horner et al., 2005). Key characteristics of SCR are: (a) the use of the individual as the primary unit of analysis, (b) repeated measures during the baseline and intervention phases, (c) operationally defined dependent measures, (d) within subject and cross participant replication, and (e) visual analysis of results (Horner et al., 2005). Horner et al. did not specify use of meta-analytic procedures or make recommendations regarding specific effect sizes that should be used in quantifying SCR designs. However, meta-analysis and review approaches are well-suited for synthesizing SCR studies. In addition, by quantitatively aggregating multiple SCR studies, meta-analysis provides an approach for overcoming the traditional limitations of SCR designs, which individually, have high internal validity but low external validity and generalizability (Horner et al., 2005).

### ***Rationale and Research Questions***

Kauffman (2000) proposed that we need more studies on teaching students with EBD academic as well as behavioral skills more effectively. Moreover, in the area of special education and behavioral disorders, evidence and instruction should be a central issue (Kauffman & Badar, 2014). Behavior that negatively impacts academic progress is a contributing factor for determination of special education services for many students with ED (Campbell et al., 2018). The co-morbid impacts of academic and behavioral deficits are particularly pronounced in reading (Chitiyo et al., 2020). SCR has a long tradition within special education and can be used to inform evidence-based practices by demonstrating a functional relationship or causality between implementation of an intervention and improvements on dependent variables (Horner et al., 2005). Systematic reviews and quantitative syntheses of the research literature are an approach for “collat[ing] evidence that fits pre-specified eligibility criteria in order to answer a specific research question” (Cochrane.org). Rarely does a single study inform the field, especially for SCR methods. Most often, a line of studies representing replications in a particular area must be considered, each with its own unique strengths and limitations, to determine whether a practice is evidence-based. The goal of this systematic review and quantitative synthesis is to examine the reading intervention research for elementary students with or at-risk for EBD within the SCR literature. Specific studies of reading interventions for students with EBD are often excluded from mainstream reviews of reading interventions around LD, as EBD is categorically different despite co-morbidity between the two. It is critical that evidence-based practices in reading are identified for this population of individuals with disabilities. The research questions were:

1. What is the overall effect of reading interventions implemented?
2. What is the effect of individual reading interventions reviewed?
3. What are the study characteristics of reading interventions being used?
4. What are the indicators of design quality for the SCR designs used?

## **METHOD**

### ***Inclusion Criteria***

Studies satisfying the following criteria were eligible for inclusion in the current review: (a) studies that included students with or at-risk of EBD, (b) included a reading intervention (independent variable; IV), (c) reading outcome measures (dependent variable; DV), (d) conducted in an elementary school setting (Grades K-5), (e) published between January 1975 to December 2020, (f) written in English, (g) implemented in the United States, (h) used an SCR design, and (i) met the WWC design standards for SCR with or without reservations.

### ***Literature Search***

A search of reading interventions for elementary students with or at-risk of EBD that met conditions (a) thru (i) of the inclusionary criteria was conducted. The authors implemented a multi-tiered process to conduct a comprehensive search of the literature. To begin the search, an electronic search of ERIC, Academic Search Ultimate, Education Source, and PsycINFO was performed. The following descriptors

were used and divided into three categories: (a) *participants* (“emotional behavior disorder”, “EBD at-risk”, “behavioral problems”, “behavior disorders”, “emotional disturbances”, “emotional problems”, “disruptive behavior”, “challenging behavior”, “ADD”, and “ADHD”), (b) *reading interventions* (“phonemes”, “reading programs”, “reading instruction”, “literacy education”, “phonological awareness”, “phonics”, “reading fluency”, “reading comprehension”, “vocabulary development”, “oral reading”, “phonology”, “word recognition”, or “decoding”), and (c) *reading outcomes* (“reading skills”, “reading difficulties”, and “remedial reading”).

This initial search yielded a pool of 849 articles. The articles were downloaded from *RefWorks* and entered into *Rayyan*, a web-based software program used to summarize and synthesize literature reviews. After the duplicate studies were removed and discarded from the pool, a total of 496 articles remained. Next, a title and abstract screening of these articles was conducted to establish which of the studies potentially met the criteria for inclusion yielding 35 potential studies. Full-text review of the studies produced a pool of 24 studies that satisfied conditions (a) to (i) of the inclusion criteria.

After completion of the electronic search, previous reviews and meta-analyses of the literature on reading interventions for students with EBD were screened (e.g., Benner et al., 2010; Coleman & Vaughn, 2000; Rivera et al., 2006) to locate potential articles that met our inclusion criteria. Additionally, a search of OnlineFirst (for 2020) and a hand-search of the following prominent journals in special education was conducted, including those with a focus on students with EBD (*Behavioral Disorders*, *Behavior Modification*, *Beyond Behavior*, *Emotional and Behavioural Difficulties*, *Exceptional Children*, *Journal of Behavioral Education*, *Journal of Emotional and Behavioral Disorders*, *Journal of Positive Behavior Interventions*, *Remedial and Special Education*, and *The Journal of Special Education*). Last, the introductions and reference lists of the identified articles were reviewed to locate further studies. Thirteen articles were located using these additional search procedures. A total of 37 articles were found than met conditions (a) thru (i) of the inclusion criteria.

### **WWC SCR Design Standards**

The methodological quality of the 37 eligible studies were evaluated according to the WWC SCR design standards (Kratochwill et al., 2010, 2014) to select the studies to be included in this review. The quality indicators assessed in the WWC SCR design standards are as follows: (QI<sub>1</sub>) systematic manipulation of the independent variable, (QI<sub>2A</sub>) each dependent variable must be measured over time by more than one assessor, (QI<sub>2B</sub>) inter-assessor agreement (IAA) must be systematically collected in each phase and at least 20% of data points in each baseline and intervention condition, (QI<sub>2C</sub>) IAA must be at or above the minimal threshold (i.e., 80% for percentage agreement indices and .60 for kappa measures or higher), and (QI<sub>3</sub>) must have a minimum number of attempts to demonstrate an intervention effect over time, specifically, for reversal-withdrawal designs at least four phases per case are required, six phases for multiple baseline/probe designs, (QI<sub>4</sub>) must have a minimum number of data points per phase for multiple baseline/probe and reversal-withdrawal designs, and alternating treatments designs must have a sufficient number of repetitions of the alternating sequence, with a minimum number of data points per condition, and

at most two data points per phase (Kratochwill et al., 2013).

Quality indicators  $QI_1$  thru  $QI_3$  were coded as “Meets” or “Does Not Meet.” Quality indicator  $QI_4$  was coded as follows: (1) “Meets” for multiple baseline/probe and reversal designs with at least five data points in each phase, and alternating treatments designs with a minimum of five data points per condition with at most two data points per phase, (2) “Meets with Reservations” for multiple baseline/probe and reversal designs with at least three data points per phase, and alternating treatments designs with four data points per condition with at most two data points per phase, and (3) “Does Not Meet,” otherwise. A study was rated as (a) “Meets Standards” if all the quality indicators  $QI_1$  to  $QI_4$  were coded as “Meets,” (b) “Meets the Standards with Reservations” if quality indicators  $QI_1$  to  $QI_3$  were coded as “Meets” and quality indicator  $QI_4$  was coded as “Meets with Reservations,” and (c) “Does Not Meet Standards,” if any of the quality indicators  $QI_1$ - $QI_4$  was coded as “Does Not Meet.”

The WWC SCR design standards evaluation yielded seven studies that met the standards with or without reservations and were included in this review. Five of the seven studies met the WWC SCR design standards (Bassette & Taber-Doughty, 2016; Dawson et al., 2000; Gunter et al., 2003; Skinner et al., 1994; Staubitz et al., 2005), and two studies met the standards with reservations (Cullen et al., 2014; Locke & Fuchs, 1995).

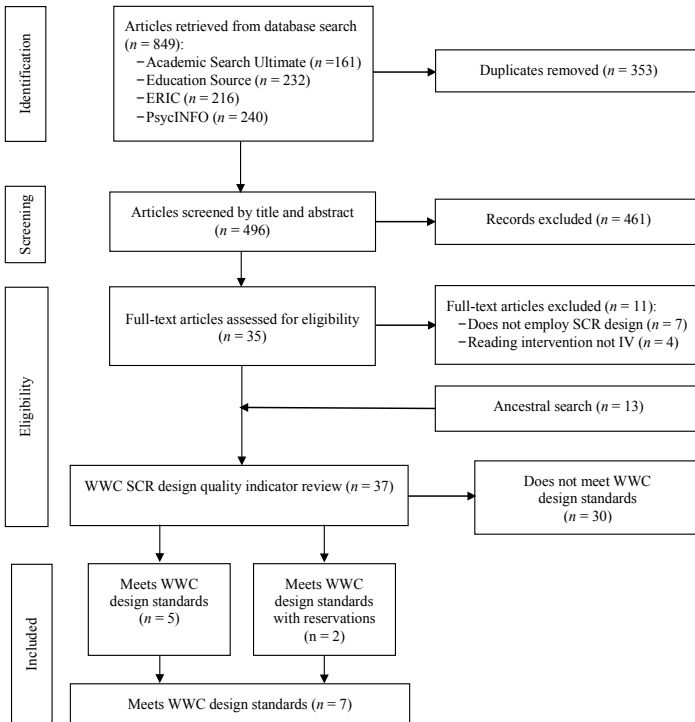


Figure 1. Flowchart of Search Procedures

**Table 1. *WWC SCR Design Standards Evaluation***

Study	QI <sub>1</sub> Manipulation of independent variable	QI <sub>2A</sub> Systematic measure of DV over time by more than one assessor	QI <sub>2B</sub> IAA collected at least 20% across conditions	QI <sub>2C</sub> IAA meets minimal threshold	QI <sub>3</sub> Sufficient number of attempts to demonstrate effect over time	QI <sub>4</sub> Minimum data points per phase	QI <sub>Overall</sub> review of WWC design standard
Bassette & Taber-Doughty, 2016	Meets	Meets	Meets	Meets	Meets	Meets	Meets
Cullen et al., 2014	Meets	Meets	Meets	Meets	Meets	Meets with Reservations	Meets with Reservations
Dawson et al., 2000	Meets	Meets	Meets	Meets	Meets	Meets	Meets
Gunter et al., 2003	Meets	Meets	Meets	Meets	Meets	Meets	Meets
Locke & Fuchs, 1995	Meets	Meets	Meets	Meets	Meets	Meets with Reservations	Meets with Reservations
Skinner et al., 1994	Meets	Meets	Meets	Meets	Meets	Meets	Meets
Staubitz et al., 2005	Meets	Meets	Meets	Meets	Meets	Meets	Meets

*Note.* DV = Dependent Variables, IAA = Inter-assessor Agreement, QI = Quality Indicator.

### ***Data Extraction***

Descriptive data of the seven selected studies were coded in the following two categories: (a) participants information and (b) intervention characteristics. Participant characteristics included: number of students per primary and secondary disabilities, age range, grade level range, gender, ethnicity, intelligence quotient (IQ) information, and participants pre-intervention reading performance. Interventions were coded using the following twelve study characteristics: name of intervention(s), intervention agent(s), SCR design, target skills, dependent measures, setting, format, behavioral supports, intervention dosage (frequency, length, and number of sessions), treatment fidelity information (assessment method, percentage of treatment fidelity sessions, and range of treatment fidelity), social validity instruments, and inter-observer reliability (IOA) information (assessment method, percentage of IOA sessions, and range of IOA).

Available data series were extracted from the articles to compute effect sizes. Data points from data series displayed in figures were extracted using the following four steps. First, data series charts were saved as a JPG image. Second, data point values in data series charts were extracted from the JPG image using the GetData Graph Digitizer software program (2012). Third, data point values obtained in the second step were saved in Excel worksheets. Finally, data points were then labeled as baseline, interventions, maintenance, and generalization, accordingly. Data series presented in a table format were entered manually into an Excel worksheet.

### ***Reliability***

All 37 studies identified by the literature search were independently evaluated and coded according to the WWC SCR design standards by the second and fourth authors. WWC SCR design standards coding by both coders was compared on a point-by-point basis. IOA was computed as the number of agreements divided by agreements plus disagreements and multiplied by 100. The initial IOA for the WWC SCR design standards evaluation was 95.71%. Disagreements were fully discussed until a resolution was made. The same coders also extracted and double-coded the descriptive information of the seven studies that met the WWC SCR design standards. IOA for descriptive information coding across all variables was 100%.

### ***Effect Size Calculation***

Baseline Corrected Tau (BC-Tau; Tarlow, 2016) effect sizes were calculated for baseline-to-intervention (A-B) contrasts in multiple baseline and multiple probe designs. In ABAB reversal designs, BC-Tau was calculated using both A1-B1 and A2-B2 contrasts. In alternating treatments designs with a baseline and two or more treatments, BC-Tau effect sizes were computed for each baseline-to-treatment contrast (e.g., A-B and A-C). In alternating treatments design studies in which one of the treatments acted as a control treatment, BC-Tau was computed for each contrast between the control treatment (B) and each intervention (C, D, etc.). Effect sizes for baseline to maintenance and generalization contrasts were not calculated. Within-study BC-Tau effect sizes were calculated by aggregation of the BC-Tau values across all cases and dependent variables within each study. BC-Tau effect sizes of academic outcomes was aggregated to yield an overall academic BC-Tau effect size. Likewise, an



overall behavior outcome BC-Tau was calculated. An omnibus BC-Tau was computed by aggregating BC-Tau ES across studies. Computation of BC-Tau ES was performed employing an R-syntax implementation (Tarlow, 2018) of the method proposed by Tarlow (2016). An R-syntax implementation (Tarlow, 2018) of the standard random-effects models (Borenstein et al., 2009) was used to aggregate effect sizes. The *Q-test* for heterogeneity was employed to test the presence of heterogeneity among effect sizes within and between studies. A significant *Q* statistic indicates variability in effect sizes is larger than would be expected by chance. The Higgins' *I*<sup>2</sup> statistic represents the proportion of dispersion not due to random error. The statistic *I*<sup>2</sup> ranges from 0 to 1, with larger values indicating a greater level of heterogeneity. A *I*<sup>2</sup> statistic below or at 0.25 was considered a negligible heterogeneity, from 0.26 to 0.50 low, moderate if between 0.51 and 0.75, and large if greater than 0.75 (Higgins et al., 2003).

## RESULTS

Demographic information for participants across the seven studies included in this review is depicted in Table 2. Table 3 presents a summary of the intervention characteristics in the studies.

**Table 2. Participants' Demographic Information**

Study	Disability/EBD Risk	Age (year/month)	Grade Level	Gender	Ethnicity	IQ	Reading Performance
Bassette & Taber-Doughty, 2016	N = 4 n = 1 ED, n = 1 EBD, SLD n = 1 EBD, SLD/LI n = 1 OHI, SLD	10-13	5	n = 4 M	n = 3 C n = 1 H	WISC-IV: 83-87 (n = 3) K-BIT2: 76 (n = 1)	BDIBS WR GLE: 1-4 BDIBS OR GLE: 1-5 BDIBS RC GLE: 1-4
Cullen et al., 2014	N = 6 n = 1 EBD n = 4 LD n = 1 OHI	NR	3 & 5	n = 2 M n = 4 F	n = 5 AA n = 1 C	NR	WRMT Reading GLE: 2.0-3.1 WRMT RC GLE: 2.0-3.2
Dawson et al., 2000	N = 4 n = 4 EBD	7.6-8.6	1 & 2	n = 3 M n = 1 F	NR	80-85	ITBS GLE: 1.3-1.6
Gunter et al., 2003	N = 1 n = 1 SEBD	9	3	n = 1 F	NR	K-BIT: 106	WIAT Reading Composite: 115
Locke & Fuchs, 1995	N = 3 n = 2 SED n = 1 SED, ADHD, ODD	11	5	n = 3 M	NR	WISC-R: 78-85	PIAT GLE: 3 (n = 1) WJPEB GLE: 1-4.9 (n = 2)
Skinner et al., 1994	N = 3 n = 1 CD, MDD n = 2 MMR, ADHD, ODD, CD	9.2-11.6	NR	n = 2 M n = 1 F	NR	70-79	Standard reading assessments GLE: 1-2
Staubitz et al., 2005	N = 6 n = 3 ED n = 1 ED, ADHD n = 1 ED, BPD, ADHD n = 1 LD at-risk of ED	9.10-11.10	4 & 5	n = 4 M n = 2 F	n = 5 AA n = 1 C	NR	WJ-III LWI GLE: 1.9-3.3 WJ-III RF GLE: 2.1-5.0 WJ-III RC GLE: 1.3-3.0 WJ-III WA GLE: 1.6-2.7

**Note. Disability:** ADHD = Attention Deficit Hyperactivity Disorder, BPD = Bipolar Disorder, CD = Conduct Disorder, EBD = Emotional and Behavioral Disorder, ED = Emotional Disturbance, LD = Learning Disability, LI = Language Impairment, MDD = Mild Depressive Disorder, MMR = Mild Mental Retardation, ODD = Oppositional Defiant Disorder, OHI = Other Health Impairment, SED = Serious Emotional Disturbance, SLD = Specific Learning Disability.

**Gender:** F = Female, M = Male.

**Ethnicity:** AA = African American, C = Caucasian, H = Hispanic.

**IQ:** K-BIT = Kaufman Brief Intelligence Test, K-BIT2 = Kaufman Brief Intelligence Test (2<sup>nd</sup> Ed.), WISC IV = Wechsler Intelligence Scale for Children (4<sup>th</sup> Ed.), WISC-R = Wechsler Intelligence Scale for Children-Revised.

**Reading Performance:** GLE = Grade Level Equivalent, LWI = Letter-Word Identification, OR = Oral Reading, RC = Reading Comprehension, RF = Reading Fluency, WA = Word Attack, WR = Word Recognition, BDIBS = Brigance Diagnostic Inventory of Basic Skills, ITBS = Iowa Test of Basic Skills, PIAT = Peabody Individual Achievement Test, WIAT = Wechsler Individual Achievement Test, WJ-III = Woodcock-Johnson III Tests of Achievement, WJPEB = Woodcock-Johnson Psycho-Educational Battery, WRMT = Woodcock Reading Mastery Test.  
NR = Not Reported.

**Table 3. Reading Intervention Descriptions**

Study	Intervention(s) Intervention Agent(s)	SCR Design	Target Skills	Graphed Dependent Measures <sup>1</sup>	Setting/ Format	Behavioral Supports	Treatment duration, session dosage, session length, #sessions	TF (Method, %age, %TF)	Social Validity Instrument	IOA <sup>1</sup> (Method, %age, %IOA)
Bassette & Taber-Doughty, 2016	T <sub>1</sub> : Repeated Reading (3 times) with Error Correction & Performance Feedback with Researcher T <sub>2</sub> : Repeated Reading (3 times) with Error Correction & Performance Feedback with Therapy Dog	ATD	F & C	a. Words read correctly per minute b. Words read in error per minute c. Percent of comprehension questions answered correctly d. Percent of components identified correctly	In-class (SPED classroom)/ 1:1	NR	6 weeks NR NR B:0-5 T <sub>1</sub> : 10 T <sub>2</sub> : 10	DO, 40% <sup>0</sup> , 100%	Modified elementary reading student attitude survey	AT, 40 - 50%, 97 - 100%
Cullen et al., 2014	Researcher T: <i>Headsprout Comprehension</i> with a Basal Reading Instruction Program	MBP	C	a. Ohio Achievement Assessment Points Earned b. AIMSweb Maze Number Correct	In-class (SPED resource classroom & computer lab)/ Computer-based instruction	Token Economy	NR 4 x day (2 SPED classroom & 2 Lab classroom) NR T: 7	AT, 25-100%, 96-100%	Student questionnaires (ranked and open-ended questions) Teachers' interviews	PP, 34 - 37%, 98 - 99.5%
Dawson et al., 2000	T <sub>1</sub> : Computer Model T <sub>2</sub> : Teacher Model SPED Teacher	ATD	F	a. Correct words per minute b. Percent of words correct	Pull-out (Resource classroom)/ 1:1	NR	10 weeks 3 days a week T <sub>1</sub> , T <sub>2</sub> : 3-6 min. T <sub>1</sub> , T <sub>2</sub> : 7	NR	NR	AT, 20%, 99.5 - 99.75%

Gunter et al., 2003	T: Self-Graphing SPED Teacher	ABAB	F	a. Correct words per minute	In-class (SPED classroom in a psycho-educational center)/ 1:1	NR	30 days daily NR T: 30	DO, 100%, 100%	NR	DO, 100%, 100%
Locke & Fuchs, 1995	T: Peer-Mediated Instruction SPED Teacher & Researcher	ABAB	B	a. Percent of on-task behaviors b. Percent of positive social interactions	In-class (Self-contained)/ Dyads	NR	8-9 days daily T: 30 min. T: 8-9	NR	External observers (on-task behaviors and social interactions questionnaire)	DO, 50%, 89 - 100%
Skinner et al., 1994	T <sub>1</sub> : Intertrial Intervals - Immediate T <sub>2</sub> : Intertrial Intervals with a 5-Second Delay Researcher (Doctoral Student)	AATD	S	a. Number of sight words mastered	Pull-out/ 1:1	Token Economy	24 days daily NR T <sub>1</sub> : 24 T <sub>2</sub> : 24	DO, 46%, 100%	NR	DO, 33 - 50% <sup>CFD</sup> , 99.82%
Staubitz et al., 2005	T: Peer-Mediated Repeated Reading Instruction Researcher (Experimenter)	MBP	F & C	a. Words read per minute	Pull-out/ Dyads	NR	NR NR 10-15 min. T: 11-35	DO, NEI, 63.8-100%	Student, Teacher, & Parent Questionnaires (Likert-scale & open-ended items)	DO, 33% <sup>2</sup> , 97%

Note. ATD = Alternating Treatments Design, AATD = Adapted Alternating Treatments Design, ABAB = ABA Withdrawal Design, MBP = Multiple Baseline across Participants, CFD = Computed from Data, IO = Intervention Only, IOA = Interobserver Agreement, NEI = Not Enough Information, NR = Not Reported, SPED = Special Education, TF = Treatment Frequency, AT = Audio-Tape, DO = Direct Observation, PP = Permanent Product, B = Behavior, C = Comprehension, F = Fluency, S = Sight Word Acquisition.

<sup>1</sup>Percentage of IOA sessions per condition, unless reported otherwise. <sup>2</sup>Overall percentage of IOA sessions across conditions reported in the study. T1 = Treatment 1, T2 = Treatment 2.

## **Participant Characteristics**

**Disability.** A total of 27 participants were included across the seven studies. Of these, 12 students were identified with ED as their sole disability. Eight students had an EBD with several other comorbid disorders. These comorbid disorders included attention deficit hyperactivity disorder, bipolar disorder, learning disabilities, mild depressive disorder, mild intellectual disabilities, and speech language impairment. Five students were classified with LD, of which, one was at-risk for EBD. Lastly, another two students were receiving special education services under other health impaired, of whom one had an LD as well.

**Age, grade, gender, ethnicity, IQ, and reading ability.** Six of the studies reported the students' age. Overall students' ages ranged from 7 years 6 months to 13 years old, with a mean age of 10 years and 3 months. In particular, the average age for students with or at-risk of EBD was 10 years and 2 months. Participants were enrolled in the first through fifth grades, with a mean grade of 4.13. Eighteen of the students in the sample were males and nine were females. Of those studies that provided information on student ethnicity, ten students were identified as African American, five Caucasian, and one Hispanic. IQ scores of the participants, of those that were reported in the studies, ranged from 70 to 106. A majority of the participants demonstrated a pre-study performance below grade-level in reading as assessed by the different assessments used across the studies to evaluate students reading achievement.

## **Reading Intervention(s) Characteristics**

**Independent Variables.** A variety of reading interventions were employed across the seven studies including repeated reading with error correction and performance feedback to a therapy dog versus repeated reading with error correction and performance feedback to a researcher (Bassette & Taber-Doughty, 2016), *Headsprout Comprehension* - an online, computerized reading program, in combination with regular basal reading instruction (Cullen et al., 2014), reading aloud after listening to a computer model (Computer Model condition) compared to reading aloud after listening to a teacher model (Teacher Model condition; Dawson et al., 2000), self-graphing of words read correctly per minute on a computer versus teacher-graphing of words read correctly per minute on a computer, with error correction procedures after a period of 5-seconds from the teacher (Gunter et al., 2003), peer-mediated instruction (Locke & Fuchs, 1995), immediate versus 5-second delay intertrial intervals (Skinner et al., 1994), and peer-mediated repeated reading instruction (Staubitz et al., 2005).

**Intervention agent(s).** Reading interventions in four studies were implemented by researchers; special education teachers were interventionists in two studies. In the final study, the intervention was administered by a special education teacher and researcher.

**Research designs.** Three types of SCR designs were employed across the seven studies. Two studies used a multiple baseline across participants design (Cullen et al., 2014; Staubitz et al., 2005), three employed an alternating treatments design (Bassette & Taber-Doughty, 2016; Dawson et al., 2000; Skinner et al., 1994), and two used an ABAB design (Gunter et al., 2003; Locke & Fuchs, 1995).

**Target skills.** Reading interventions in four of the studies focused on reading fluency outcomes (Bassette & Taber-Doughty, 2016; Dawson et al., 2000; Gunter et al., 2003; Staubitz et al., 2005). Reading comprehension was measured in three studies (Bassette & Taber-Doughty et al.; Cullen et al., 2014; Staubitz et al.). One study (Locke & Fuchs, 1995) examined students' behavioral outcomes; the authors evaluated students' on-task behaviors and social interactions. The final study (Skinner et al., 1994) reported sight word acquisition. None of the studies measured both reading and behavioral outcomes.

**Setting and format.** In terms of setting and instructional format, four of the studies were conducted in-class in either a self-contained classroom, resource, or computer lab, using a 1:1, 2:1 format or dyads, and computer-aided instruction, the other three studies were performed in a pull-out setting in a 1:1 format or in a dyad format. Intervention duration ranged from 8 days to 10 weeks. Intervention sessions were administered to the students from 4 times a day to 3 days a week, with sessions lasting between 3 to 30 minutes. The number of intervention sessions across studies ranged from 8 to 30.

**Behavioral supports.** Two of the seven studies included a behavioral support system consisting of token economies (Cullen et al., 2014; Skinner et al., 1994).

**Treatment duration, session dosage, session length, and number of sessions.** Of the five studies reporting treatment duration, the range was from 8-9 days to 10 weeks. Regarding session dosage, of the five studies reporting these data, reading intervention session dosage ranged from daily (viz., five days per week) to four times per day. For the three studies reporting session length, the range was 3 minutes to 30 minutes (per session). The number of reading intervention sessions was reported across all seven studies – the range was 7 to 35 sessions.

**Treatment fidelity.** Treatment fidelity measures were reported in five of the studies. Of those studies, four studies used direct observation (Bassette & Taber-Doughty, 2016; Gunter et al., 2003; Skinner et al., 1994; Staubitz et al., 2005) and one study employed audio-tape recording (Cullen et al., 2014). Treatment fidelity was conducted for 25 - 100% of the instructional sessions. The percentage of overall treatment fidelity ranged from 63.8 - 100%.

**Social validity.** Social validity measures were administered in four of the studies (Bassette & Taber-Doughty, 2016; Cullen et al., 2014; Locke & Fuchs, 1995; Staubitz et al., 2005). Of those studies that conducted social validity, an assortment of instruments were used across the studies. Included were a student reading attitude survey (Bassette & Taber-Doughty, 2016), student questionnaires and teacher interviews (Cullen et al., 2014), student teacher and parent questionnaires (Staubitz et al., 2005), and an on-task behavior and social interaction survey for external observers (Locke & Fuchs, 1995).

**Inter-observer agreement.** Six studies provided information on the percent of IOA sessions for baseline and intervention conditions (Bassette & Taber-Doughty, 2016; Cullen et al., 2014; Dawson et al., 2000; Gunter et al., 2003; Locke & Fuchs, 1995; Skinner et al., 1994), and one study reported overall percentage of IOA sessions across conditions (Staubitz et al., 2005). Four of the studies used direct observation to record IOA measures (Gunter et al., 2003; Locke & Fuchs, 1995; Skinner et al., 1994; Staubitz et al., 2005), two employed the use of audio-tape recording (Bassette

& Taber-Doughty, 2016; Dawson et al., 2000), and one study utilized a permanent product (Cullen et al., 2014). IOA was conducted in 20 - 100% of the sessions, with IOA percentages ranging from 89 - 100%.

### ***Effect Sizes***

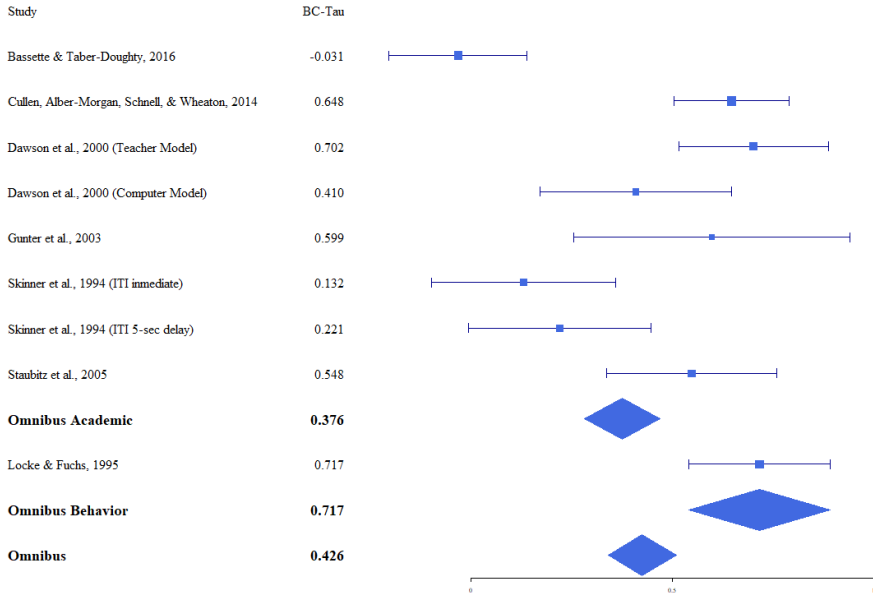
Studies were grouped according to the focus of the dependent variables in two categories: reading outcomes only studies and behavior outcomes only studies. For interventions targeting reading outcomes, study-level effect sizes ranged from -0.031 to 0.702, with all effect sizes, except one (Bassette & Taber-Doughty, 2016) in the positive range. The larger effect size was reported for a teacher model intervention in one study (Dawson et al., 2000). Five of the eight study-level effect sizes reported were statically significant at the 0.001 level. They included Cullen et al. (2014), Gunter et al. (2003), Staubitz et al. (2005), and Dawson et al. (Computer-Model and Teacher-Model interventions). Heterogeneity was not significant across studies, with  $I^2$  statistics in the low range. The omnibus effect size for interventions targeting only reading outcomes was 0.376,  $CI_{95}$  [0.282, 0.470], with a significant heterogeneity statistic  $Q$  ( $Q = 97.160, p < 0.001$ ) and low  $I^2$  statistics ( $I^2 = 0.444$ ). The effect size for the study focusing on behavior outcomes was 0.717 ( $p < 0.001$ ). For this study, heterogeneity  $Q$  was not statistically significant ( $Q = 1.333, p = 0.999$ ), and the  $I^2$  statistic was zero. The omnibus effect size for all the studies was 0.426,  $CI_{95}$  [0.341, 0.510],  $p < 0.001$ ), with a statistically significant heterogeneity  $Q$  ( $Q = 110.569, p < 0.001$ ) and a  $I^2$  statistics ( $I^2 = 0.403$ ) in the low range.



**Table 4. Within-Study Random-Effects using BC-Tau**

Study	Intervention(s)	Contrast	Cases	#Contrasts	BC-Tau	95% CI	Q	I <sup>2</sup>
<u>Academic Outcomes</u>								
Bassette & Taber-Dougherty, 2016	Repeated Reading with Error Correction and Performance Feedback with a Therapy Dog or Researcher	BC	4	16	-0.031	[-0.203, 0.140]	20.578	0.271
Cullen et al., 2014	Headsprout <i>Comprehension</i> with a Basal Reading Instruction Program	AB	6	12	0.648***	[0.505, 0.791]	2.180	0.000
Dawson et al., 2000	Teacher Model	AB	4	8	0.702***	[0.516, 0.889]	0.169	0.000
Dawson et al., 2000	Computer Model	AC	4	8	0.410***	[0.172, 0.648]	0.453	0.000
Gunter et al., 2003	Self-Graphing	A1B1, A2B2	1	2	0.599***	[0.256, 0.941]	0.540	0.000
Skinner et al., 1994	Intertrial Intervals - Immediate	AB	3	3	0.132	[-0.097, 0.360]	0.454	0.000
Skinner et al., 1994	Intertrial Intervals with a 5-Second Delay	AC	3	3	0.221	[-0.006, 0.448]	2.094	0.045
Staubit et al., 2005	Peer-Mediated Repeated Reading	AB	3	3	0.548***	[0.337, 0.759]	1.832	0.000
Omnibus Academic Outcomes			28	55	0.376***	[0.282, 0.470]	97.160***	0.444
<u>Behavioral Outcomes</u>								
Locke & Fuchs, 1995	Peer-Mediated Instruction	A1B1, A2B2	3	6	0.717***	[0.541, 0.893]	1.333	0.000
Omnibus Behavioral Outcomes			3	6	0.717***	[0.541, 0.893]	1.333	0.000
Omnibus Across Studies			31	61	0.426***	[0.341, 0.510]	110.569***	0.402

*Note.* \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$   
 In Staubit et al. (2005) only cases that met standards were included. Contrast refers to the baseline and intervention phase contrasts in studies using single-case research designs.



**Figure 2. Forest Plot for Effects of Reading Interventions on Academic and Behavioral Outcomes**

**DISCUSSION**

**Main Findings**

A primary finding of this systematic review and quantitative synthesis was that a coherent body of work in improving reading outcomes for students with EBD has not yet emerged. Only seven studies were found from the literature focused on students with or characterized as at-risk for EBD. It is puzzling that a more robust literature base has not been developed. One solution would be to acknowledge that many students with EBD have unidentified LD and begin to utilize the much more substantial body of work on improving academic outcomes from the LD literature.

Learning to read in school is critical. It is a powerful protective factor against social-behavioral risk. However, as students move upwards through the grades, the emphasis shifts from “learning to read” to “reading to learn” and students will receive less opportunities for explicit instruction. Perhaps due to the impairments associated with EBD, overall positive, but modest effects were found. An omnibus effect size of .376 with a  $CI_{95} = [.28, .47]$  across studies was obtained for reading. There was a range of interventions that focused on improving reading outcomes.

These reading interventions included: (a) repeated reading with error correction and performance feedback with a therapy dog, (b) *Headsprout Comprehension* with a basal reading instruction program, (c) teacher model, (d) computer model, (e) self-graphing, (f) intertrial intervals, (g) immediate intertrial intervals with a 5-second delay, and (h) peer-mediated repeated reading. Within the range of effect sizes,

teacher modeling had the largest effect size, and repeated reading with error correction and performance feedback with a therapy dog or researcher the smallest. Locke and Fuchs (1995) focused on peer-mediated instruction and was the only study that included behavior measures, that resulted an overall effect size of .71 with an  $CI_{.95} = [.54, .64]$ . Outcomes for students at-risk for EBD resulted in a larger effect size than the other categories that involved other comorbid disabilities. Perhaps the characteristics associated with additional disability areas contributed to lack of responsiveness. Effect sizes were larger for younger students in the 7 to 9-year-old range. Larger effect sizes were also found for female students. Regarding instructional settings, pull-out programs yielded a larger effect. Interestingly, the dyad group and computer-assisted instruction (CAI) yielded higher effect sizes than a 1:1 group format. For the intervention agent, teacher implemented instruction yielded higher effect sizes. Last, the highest effect size was found for comprehension outcomes, followed by fluency, and sight words.

### ***Limitations***

There are several limitations that should be considered, when interpreting the results. First, the WWC SCR quality standards applied in this review were used as part of the inclusionary/exclusionary criteria. Thus, we did not include all 37 studies found in our review of the literature, but rather the seven that met the criteria for inclusion. Perhaps including all the studies would have yielded different effect size estimates. Second, the most frequent reasons for exclusion based on quality standards were studies that: (a) failed to have at least three attempts to demonstrate an intervention effect at three different points in time ( $QI_3$ ), (b) did not have the minimum number of data points per phase and/or condition ( $QI_4$ ), and (c) did not measure IAA across dependent variables per phase and for at least 20% of data points in each baseline and intervention condition ( $QI_{2B}$ ). Third, there were nine different intervention conditions across the seven included studies. However, there wasn't a "corpus" of work in any one intervention area precluding statements from being made regarding "what works."

### ***Implications for Research and Practice***

One of the striking aspects of this review is the lack of robust overall reading intervention effects. This is perhaps due to the interfering problem behaviors, however, there is a reciprocal relationship between the academic and behavior domain, and it is difficult to tease out which causes which (Kauffman, 2010). One of the noticeable aspects of this review was that only one study (Locke & Fuchs, 1995) met inclusion criteria implemented focused on behavioral outcomes. Likewise, only two studies (Cullen et al., 2014; Skinner et al., 1994) included behavioral supports along with the reading intervention. Students with EBD often have problem behaviors that interfere with learning academic tasks. Moreover, correlational research is demonstrating that attention issues often mediate learning to read. It seems prudent to embed behavioral supports into the curriculum or reading intervention to promote attention to relevant reading tasks. However, more studies are needed to demonstrate how these curricular and instructional modifications may occur.

Given the significance of reading difficulties in exacerbating emotional/behavioral problems, early intervention is crucial, especially in the context of multi-tiered approaches to prevention and intervention. Identifying students at-risk of EBD and reading difficulties at an early stage can help provide appropriate support and interventions, reducing the likelihood of long-term academic and emotional challenges. Moreover, addressing the complex needs of students with EBD and reading difficulties requires a multi-domain and multi-disciplinary approach. Collaboration between educators in special and general education settings as well as other relevant professionals in the case of students who are English learners (ELs) is essential to design and implement effective interventions. Also, individualized interventions are needed, as many students with EBD are likely to be non-responders in at least one or more domains. Recognizing that students with EBD may have unique learning profiles, interventions should be tailored to individual needs to yield more significant improvements in both academic and behavioral outcomes. Last, teachers need specialized training to work effectively with students with EBD and reading difficulties. Professional development programs that equip educators with the necessary evidence-based knowledge and strategies can contribute to better outcomes for these students.

### **Conclusion**

In sum, while the available literature base is limited, this systematic review indicates that interventions targeting reading outcomes for students with or at-risk of EBD at the elementary school level can yield positive results. However, further research is needed, and the findings emphasize the importance of addressing reading difficulties to mitigate associated emotional and behavioral challenges in this population. Students with EBD often have overlapping learning, academic and behavior problems, and disorders. These interrelated problems within both the behavior and the academic domains makes intervention especially problematic for this group of students with disabilities. Non-responsiveness to reading interventions could be related to diagnosed or undiagnosed LD, with accentuates issues in the behavior domain. Or the problem of non-responsiveness could be due to problems in the behavior domain that makes access to instruction problematic. Effective interventions are needed for both the academic and behavior domains to improve outcomes for students with EBD. This systematic review and quantitative synthesis confirms that much more work is needed in this area to unpack effective targeted intervention approaches.

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