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Effects of single-case reading interventions for students with and at-risk of emotional and behavioral disorders in grades K–12: A quantitative synthesis

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Abstract

This study examined the effects of reading interventions from single-case design studies for students with and at-risk of emotional and behavioral disorders in grades K–12 using a quantitative synthesis. Seventeen studies met the selection criteria of having one more dependent variables meeting what works clearinghouse (WWC) design standards with or without reservations. Although students' reading performance significantly improved from baseline to intervention phases ($p < 0.001$), the overall weighted average effect size was weak (Tau-$U = 0.58$, 95% confidence interval = [0.54, 0.63]; $d = 0.29$); smaller effects were found on reading comprehension. Interventions were less effective for students in secondary grades, students with a comorbid disability, and students in substantially separate settings. While no studies meeting the selection criteria were conducted in inclusive settings, the teacher provided interventions were more effective than those provided by researchers suggesting the importance of the student–teacher relationship for reading instruction. Study limitations, areas for future research, and implications for school practices are discussed.

KEYWORDS

quality indicators, quantitative synthesis, reading interventions, single-case research, students with and at risk of emotional and behavioral disorders

1 | INTRODUCTION

The comorbidity of reading and behavior problems of students with and at risk of emotional and behavioral disorders (EBD) is well documented (Gregory, Jill, & Paul, 2008; McIntosh, Sadler, & Brown, 2012; Wei, Blackorby, & Schiller, 2011). Low levels of reading proficiency occur frequently (Hilsmier, Wehby, & Falk, 2016) and contribute to the school and postschool difficulties experienced by this student population (J. D. Garwood, Brunsting, & Fox, 2014). For example, students with and at-risk for EBD are associated with a variety of negative school outcomes including low levels of academic achievement and high rates of school dropout (Bullock & Gable, 2006; US Department of Education, Office of Special Education Programs, 2010). Transition outcomes are also problematic, as evidenced by the prevalence of arrest, substance abuse, and noncompletion of postsecondary training programs (Wagner & Newman, 2012). These aforementioned concerns highlight the necessity for student access to interventions that develop academic skills such as reading proficiency.

Research suggests that reading deficits for many students with EBD are resistant to intervention and result from a complex relationship between the problem behaviors and reading achievement. For example, externalizing problem behaviors and inattention may predict student response to reading intervention (Nelson, Benner, & Gonzalez, 2005) and problem behaviors are associated with underachievement in reading (Hagan-Burke et al., 2011). Furthermore, research suggests that poor readers display higher levels of internalizing and inattentive behaviors compared with competent readers, as indicated by teacher reports (J. D. Garwood, Varghese, & Vernon-Feagans, 2017). Research also suggests that teachers must be proficient in classroom management to improve the reading skills of students with EBD (J. Garwood, Vernon-Feagans, & Family Life Project Key Investigators, 2017). For example, students with EBD may display problem behaviors to avoid or in response to reading tasks (Sanford & Horner, 2013), which may result in the loss of substantial instructional time (J. McKenna & Ciullo, 2016). However, researchers have also theorized that the relationship (e.g., causal, moderating, or mediating) between problem behaviors and academic achievement is distinct across students (Gresham, 2015). As a result, intensive, scientifically based interventions are necessary to improve school and postschool outcomes (Burke, Boon, Hatton, & Bowman-Perrott, 2015; Maggin, Wehby, Farmer, & Brooks, 2016).

Due to federal policies, schools are responsible for using evidence-based practices (EBPs) to improve school performance and to meet mandates associated with providing students with disabilities a free and appropriate public education (FAPE; Pressley, Duke, & Boling, 2004). When selecting EBPs for school implementation, practitioners consider student needs, student characteristics, and other contextual factors to determine the degree to which the available evidence is applicable to their students (Cook & Cook, 2017). This process requires professional expertise and judgment as well as the identification of EBPs through the accumulation of rigorous, peer-reviewed research (Mitchell, Adamson, & McKenna, 2017).

1.1 | Systematic reviews

Systematic reviews of the literature are performed to identify EBPs and areas for future research that are necessary to better inform school practice. When completing reviews, researchers often evaluate the extant literature according to a set of quality indicators to determine the degree to which causal inferences can be made from individual studies and then aggregate findings from those that permit this type of conclusion. By focusing on studies with sufficient rigor (e.g., internal validity) and excluding those that do not meet this criterion, researchers can make more accurate claims regarding intervention effectiveness and recommendations for improving school practice. When conducting systematic reviews, researchers may focus exclusively on single-case intervention studies when identifying EBPs (Bowman-Perrott, Burke, Zaini, Zhang, & Vannest, 2016; Maggin, Briesch, & Chafouleas, 2013; Maggin, Pustejovsky, & Johnson, 2017) as researchers continue to refine conventions for their inclusion in meta-analyses (Moeyaert, Maggin, & Verkuilen, 2016; Shadish, Hedges, Horner, & Odom, 2015). Single-case design studies are particularly salient to the identification of EBPs for student populations that may be difficult

to recruit in sufficient numbers for comparison group investigations (Horner et al., 2005; Shadish et al., 2015). This reliance on single-case intervention studies to inform research and practice is evident in reviews of reading interventions for students with or at-risk for EBD.

1.2 | Systematic reviews of reading interventions for students with EBD

Researchers have recently completed reviews of reading interventions for students with and at-risk for EBD (Burke et al., 2015; J. D. Garwood et al., 2014; J. W. McKenna, Kim, Shin, & Pfannenstiel, 2017). J. D. Garwood et al. (2014) completed a synthesis of fluency and reading comprehension interventions for secondary grade students with EBD who received instruction in resource or self-contained settings. All nine studies that met the researchers' article selection criteria used a single-case design. In this study, the researchers used improvement rate difference (IRD; Parker, Vannest, & Brown, 2009) to quantify intervention effectiveness. Visual analysis is used to determine the ratio of improved data points in the baseline (e.g., meeting or exceeding at least one intervention data point) and intervention phases (e.g., data points exceeding all baseline data points). IRD is calculated by subtracting the baseline phase ratio from the intervention phase ratio. In this study, the researchers reported interventions were effective overall with repeated reading and story mapping interventions identified as promising. Study findings also suggested that teacher provided interventions were more effective than interventions provided by researchers. However, this study did not systematically evaluate studies according to a set of quality indicators and base its findings on only those studies with sufficient rigor. Furthermore, this study did not conduct a moderator analysis, which could be performed to identify possible variations in intervention effects due to the setting, student, and intervention characteristics (Matt & Cook, 2009).

Burke et al. (2015) completed a quantitative synthesis of single case reading intervention studies for secondary grade students with or at risk of EBD. Eleven studies met the article selection criteria. The researchers reported that reading interventions were moderately effective (Tau-U = 0.59) at improving reading outcomes, although there was variability in the magnitude of effects both within and between studies. Burke et al. also reported that most studies investigated the effects of stand-alone reading interventions rather than interventions that included behavioral strategies or supports. Although the researchers used an effect size measure commonly used to aggregate single case studies, moderator and quality indicator analyses were not performed. This study also focused exclusively on students in the secondary grades.

J. W. McKenna et al. (2017) systematically evaluated single case studies investigating the effects of reading interventions for students with and at risk of EBD in grades K–12 by comparing study designs and outcomes to a pre-established set of quality indicators (What Works Clearinghouse [WWC] single case standards; Kratochwill et al., 2010). Thirty studies met article selection criteria. Overall, two-thirds of studies included at least one dependent variable that did not meet WWC design standards. The researchers identified two promising practices for secondary grade students: providing a model of fluent reading before text reading and the use of graphic organizers. Findings from this review also suggested that reading interventions with behavioral strategies were more effective than stand-alone interventions. However, this study relied on visual analysis to determine intervention effectiveness rather than an effect size. As a result, a moderator analysis could not be completed. Furthermore, this review only included studies published up to the year 2015.

1.3 | Purpose

Considering the importance of reading achievement, an updated review of single-case studies that systematically evaluates study rigor before inclusion and quantifies the effectiveness of those studies in which causal inferences are permitted is warranted. A moderator analysis is also necessary to determine possible variability in reading outcomes based on student, setting, intervention, and dependent variable characteristics. This investigation includes four studies not present in J. W. McKenna et al. (2017) and a quality indicator analysis. This study also

employs Tau-U to quantify the effects of single case interventions for students with and at risk of EBD in grades K-12 and to perform a moderator analysis.

This study was guided by the following research questions:

1. What is the overall effect of single-case reading interventions for students with and at-risk for EBD?
2. What are the effects of specific types of reading interventions for this student population?
3. What moderators account for variability in the effects of single-case reading interventions for this student population?

2 | METHOD

A multistep procedure was followed to investigate the effects of single-case reading intervention studies involving students with and at-risk for EBD. This process included (a) a comprehensive literature search to identify single-case reading intervention studies and (b) coding studies that met article selection criteria according to the WWC single-case design standards to create a pool of studies with at least one dependent variable that met WWC design standards with or without reservations. We then used quantitative data analysis methods to determine the overall effect of reading interventions and to identify moderators of effectiveness as indicated by this pool of studies.

2.1 | Literature search

First, a literature search of PsychINFO, Academic Search Complete, and ERIC databases for the years 1970–2017 was performed using the following Boolean phrase: "at-risk" or "behavior problems" or "behavior disorder" or "emotional disturbance" or "emotional and behavioral disorder" and "reading" or "fluency" or "comprehension" or "decoding" or "vocabulary" or "phonemic awareness" or "phonological awareness" or "phonics" or "word recognition." This search revealed a total of 8,629 articles for initial screening.

2.2 | Article selection criteria

Next, we read the titles and abstracts of the 8,629 articles identified in the electronic search to determine if they potentially met the article selection criteria. Studies selected for this quantitative synthesis met the following criteria. First, the articles were published in a peer-reviewed journal between the years 1970 and 2017. Second, researchers reported having at least one participant who was identified as having a serious emotional disturbance (SED), an emotional disturbance (ED), an EBD, a behavior disorder (BD), or considered at risk for development of a disorder consistent with one of the aforementioned designations. Participants with comorbid disabilities were included as long as they also had EBD/ED/BD/SED or were considered at risk by the intervention study's author. Students with an intellectual disability were excluded. Third, participants were in Grades K–12 and attended a school setting (i.e., public, day, or residential school) in the United States. Fourth, the study used at least one single-case design. Fifth, the study included a reading intervention as part of the independent variable and at least one reading-dependent variable. Upon completion of this process, 48 articles were read in their entirety and 8,581 were excluded. Using an exact agreement method, the reliability for initial selection of articles was 98.8% with all disagreements discussed until 100% agreement was obtained.

Of the 48 articles identified in the electronic search that were read in their entirety, 21 were excluded for not meeting article selection criteria. Articles were commonly excluded due to the absence of a single-case design (e.g., failure to repeatedly assess the dependent variable over time according to conventions), a relevant-dependent variable, or relevant participants. Using an exact agreement method, the initial reliability for application of the

article selection criteria was 98.1%. Areas of disagreement concerned the presence of a reading dependent variable that was repeatedly measured over time and participant criteria. All areas of disagreement were discussed until 100% agreement was obtained.

Next, an ancestral search of previous reviews of reading and literacy interventions for students with and at-risk for EBD (G. Benner, Nelson, Ralston, & Mooney, 2010; Burke et al., 2015; Garwood, 2018; J. D. Garwood et al., 2014; Griffith, Trout, Hagaman, & Harper, 2008; J. W. McKenna et al., 2017; Rivera, Al-Otaiba, & Koorland, 2006) and a review of reading interventions with behavioral outcomes (Roberts, Solis, Ciullo, McKenna, & Vaughn, 2015) was performed to obtain articles not identified in the electronic search. This ancestral search revealed three additional articles meeting our selection criteria. Finally, a hand search of the following journals was performed for the years 1970–2017: (a) *Behavioral Disorders*, (b) *Education and Treatment of Children*, (c) *Journal of Emotional and Behavioral Disorders*, (d) *Journal of Special Education*, and (e) *Preventing School Failure*. These journals were selected due to their tendency to publish research on students with and at-risk for EBD, reading instruction, single case research, and professional standing within the field of special education. This hand search revealed an additional four single-case intervention studies from three articles for consideration. In sum, a total of 34 single case studies from 33 articles meeting the selection criteria were identified for WWC design standards coding (Kratochwill et al., 2010).

2.3 | WWC coding

All articles meeting the selection criteria were coded according to the WWC single-case standards (Kratochwill et al., 2010). Quality indicator coding was performed to identify dependent variables that met WWC design standards with or without reservations (see Maggin, Briesch, & Chafouleas, 2013, for a summary of this procedure). We sought to base findings from this quantitative synthesis on dependent variables investigated using single-case designs with sufficient rigor according to WWC design standards. Each dependent variable is evaluated based on their compliance with conventions related to having a sufficient number of study phases, a sufficient number of data points, implementation of the independent variable, and collection of interobserver agreement data. According to WWC conventions, dependent variables meeting design standards without reservations have the following characteristics: the independent variable was systematically manipulated, interassessor agreement data were collected repeatedly over time for at least 20% of data points for each condition, agreement data met minimum thresholds (80% for percentage agreement, 0.60 for κ-statistics), the design included a sufficient number of attempts to demonstrate an intervention effect at different points in time (depending on the design used), and each phase had at least five data points (depending on the design used). Dependent variables meeting design standards with reservations possess most of the previously mentioned characteristics but were assessed in a manner that only met minimum thresholds for the number of data points per study phase. Please see Maggin et al. (2013) for a detailed description of this procedure.

In this investigation, two researchers independently coded each of the 34 studies eligible for design standards coding using a coding sheet adapted from Maggin et al. (2013). Initial reliability for WWC design standards coding was 95.6%, with each area of disagreement discussed until 100% agreement was obtained. Upon completion of WWC coding, 17 studies had at least one dependent variable meeting WWC design standards with or without reservations. Four of these studies were not included in the J. W. McKenna et al. (2017) review. Dependent variables investigated with designs not meeting WWC standards were excluded from data extraction and further analysis due to an inability to make causal inferences regarding the introduction of reading interventions and changes in reading performance. Dependent variables were commonly excluded due to having an insufficient number of phases for the design used, an insufficient number of data points per phase, and a failure to comply with WWC interobserver agreement (IOA) conventions. Figure 1 provides a summary of the aforementioned study identification procedure. Table 1 provides a summary of studies with at least one dependent variable meeting design standards with or without reservations.

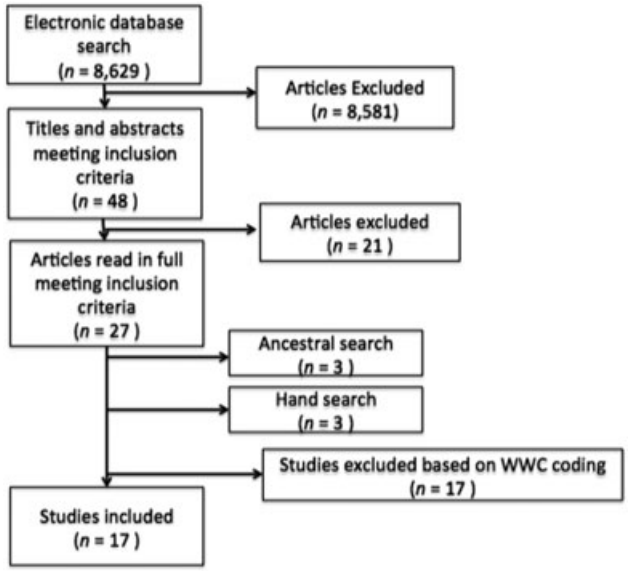

FIGURE 1 Article search and selection procedures

2.4 | Data extraction

Data were extracted from each graph for dependent variables meeting WWC standards with or without reservations according to the following procedure. First, a screenshot of each graph was taken using a snipping tool and saved as a JPEG (image) file. A drag and drop procedure was then used to enter each screenshot into GraphClick (Arizona Software Inc., 2010), a digitizing software shown to be a valid and reliable tool for data extraction from single case graphs (Flower, McKenna, & Upreti, 2016). Minimum and maximum values for the *x* and *y* axes were then entered and individual data points for reading dependent variables were manually digitized by clicking on each data point within the digitized graph. Next, data were exported and saved in an Excel spreadsheet for further analysis. During this process, we quantified all data points for each phase (e.g., baseline phase and intervention phase) for each eligible reading dependent variable (e.g., systematically assessed over time in a manner that met WWC design standards with or without reservations).

2.5 | Data analysis

2.5.1 | Calculation of phase contrast

Tau-*U* (Parker, Vannest, Davis, & Sauber, 2011) was calculated for each contrast between baseline and intervention phases. Tau-*U* provides an index of nonoverlap of all data points between phases while controlling for the undesirable trends in baseline by using a nonparametric effect size derived from Kendall's rank correlation and the Mann–Whitney *U* between groups test. The formula for Tau-U is as follows: Tau-*U* = *S*/number of pairs; *S* represents the number of positive paired comparisons (+) minus the number of negative paired comparisons (−), with all pairwise data comparisons made in a "time-forward" direction. A "+" is assigned for each pairwise comparison in which the later value is larger (an improvement from phase A to B) and a "−" is assigned when the later value is smaller (decline from phase A to B). Tau-*U* was calculated using the following free web tool: http://www.singlecaseresearch.org/calculators/tau-u (Vannest, Parker, Gonen, & Adiguzel, 2016) and a monotonic trend correction was applied when a significant improvement ($p < 0.05$) was noted during the baseline (Parker et al., 2011). According to Parker and Vannest (2009), a Tau-U of 0–0.65 is considered evidence of a weak effect, 0.66–0.92 a medium effect, and 0.93–1.00 a strong effect.

TABLE 1 Reading interventions for students with and at-risk for EBD

References	Quality	Participants			Setting	Instructor	Behavioral strategies	Grouping	Fidelity
		Number, grade level	Disability	Male (%)					
Babyak, Koorland, and Mathes (2000)	Reservations	*n* = 4, elementary	EBD plus	100	Separate school	Researcher	R, response cost	One to one	Yes
Barton-Arwood, Wehby, and Falk (2005)	Standards	*n* = 6, elementary	EBD, EBD plus	67	SC	Researcher, para	R	Other	Yes
Brown, Lignugaris/Kraft, and Forbush (2016)	Standards	*n* = 1, secondary	EBD	100	Resource	Researcher	No	Other	Yes
Cullen, Alber-Morgan, Schnell, and Wheaton (2014)	Standards	*n* = 1, elementary	EBD	0	Resource	Researcher	R	Other	Yes
Dawson, Venn, and Gunter (2000)	Standards	*n* = 4, elementary	EBD	NR	Resource	Teacher	No	One to one	No
Escarpio and Barbetta (2016)	Standards	*n* = 4, secondary	EBD plus	100	Separate school	Researcher	R	One to one	Yes
Hale et al. (2005)	Standards	*n* = 3, secondary	EBD	100	SC	Researcher	R	Other	Yes
Hilsmier et al. (2016)	Standards	*n* = 4, secondary	EBD plus	75	SC	Researcher	R, preference assessment, goal setting, graphing of performance	One to one	Yes
Miller, Miller, Wheeler, and Selinger (1989)	Standards	*n* = 1, secondary	EBD	100	Separate school	Researcher	Self-instruction	One to one	No
Palmer, Boon, and Spencer (2014)	Reservations	*n* = 2, secondary	EBD	50	Resource	Teacher	R	Other	Yes
Rose (1984)	Standards	*n* = 5, elementary, secondary	EBD	100	Resource	Teacher	No	One to one	No
Schmitt, McCallum, Hale, Obeldobel, and Dingus (2009)	Standards	*n* = 4, secondary	EBD plus	75	Separate school	Researcher	R	One to one	Yes

(Continues)

TABLE 1 (Continued)

References	Quality	Participants			Setting	Instructor	Behavioral strategies	Grouping	Fidelity
		Number, grade level	Disability	Male (%)					
Shapiro and McCurdy (1989)	Reservations	*n* = 5, secondary	EBD, EBD plus	NR	Resource	Researcher	R	One to one	Yes
Skinner and Shapiro (1989)	Standards	*n* = 4, secondary	EBD	NR	Resource	Researcher	R	One to one	Yes
Stone, Boon, Fore, Bender, and Spencer (2008)	Reservations	*n* = 4, secondary	EBD	75	SC	Teacher	No	One to one	No
Strong, Wehby, Falk, and Lane (2004)	Standards	*n* = 4, secondary	EBD, EBD plus	100	Separate school	Teacher, researcher	No	Other	Yes
Wood, Mustian, & Cooke (2012)	Standards	*n* = 1, secondary	EBD	0	Resource	Researcher	Taught methods for giving feedback	Other	Yes

Note. EBD: emotional and behavioral disorders; NR: not reported; Para: paraprofessional; R: reinforcement; SC: self-contained.

2.5.2 | Calculation of weighted average

A fixed-effects model was used to calculate the weighted average of Tau-*U* across phases (Bowman-Perrott, Burke, Zhang, & Zaini, 2014; Vannest et al., 2016) from the 17 studies. A fixed-effects model was assumed to share a common effect size among a relatively small number of cases (Borenstein, Hedges, Higgins, & Rothstein, 2009; Greenhouse & Iyengar, 2009). For multiple baseline or multiple probe designs with three subjects, three phase contrasts were calculated, which were then aggregated to derive a weighted average of Tau-U; for an alternating treatment design, individual contrasts comparing a single treatment to another treatment were aggregated to derive a weighted average of Tau-U (Shin, Park, Kim, & Kang, 2016). Tau-U was aggregated by providing inverse variance weights (*w*) for each Tau-U (Lipsey & Wilson, 2001) with the following formula: weighted average of Tau-U = $\sum w \times$ Tau-$U/\sum w$. We then transformed the weighted average of Tau-U into Cohen's d (1988) to compare the magnitude effect size (Bowman-Perrott et al., 2014; Bowman-Perrott et al., 2016). To calculate *d* from Tau-U, the following formula from Parker and Vannest (2009) was used: Cohen's $d = 3.464 \times (1 - \sqrt{(1 - \text{Tau})/0.5})$.

We then conducted moderator analyses using the weighted average of Tau-U for each coded category (Bae & Park, 2018; Ninci et al., 2015). We utilized a rank-based nonparametric test, Kruskal–Wallis *H* test (Kruskal &Wallis, 1952), in SPSS for determining the presence of statistically significant differences between two or more categorical variables on Tau-U using an α level of 0.05 (5%); *p* values are approximated from χ^2 distributions.

2.5.3 | Interrater reliability

Eight potential moderators were investigated because they (a) had been investigated in previous systematic reviews of intervention research or (b) had not been previously investigated but represent relevant aspects of reading interventions, setting characteristics, or student characteristics. The following moderators were investigated: collection of fidelity data, classroom setting, instructional grouping, grade level, disability status, number of intervention sessions, interventionist, reading-independent variable type, the presence of behavioral strategies or positive behavior supports and reading-dependent variable. The first and second authors independently coded each study for all hypothesized moderators. Reliability was calculated by dividing the total number of agreements by the total number of agreements and disagreements. Initial reliability across variables ranged from 81.25% to 100%. When disagreements occurred, the first and second authors reread the article, recoded the study aspect, and discussed the articles until 100% agreement was obtained.

2.5.4 | Fidelity characteristics

Dependent variables were analyzed to determine if there were differences in reading outcomes that could be explained by the presence or absence of formal fidelity data (e.g., a percentage, number of components implemented as intended, etc.). Although fidelity data is not included in the WWC design standards, its importance in special education research has long been noted (Swanson, Wanzek, Haring, Ciullo, & McCulley, 2013). Dependent variables were dummy coded as either "reporting" or "not reporting" formal fidelity data (e.g., a percentage obtained through direct assessment).

2.5.5 | Setting and student characteristics

Dependent variables were also analyzed according to setting and student characteristics. Each dependent variable was coded as assessed in either a resource room, a self-contained classroom, or a classroom located in a substantially separate school. General education was not coded due to the absence of investigations in this setting that met WWC standards with or without reservations. Dependent variables were coded based on the student grouping method used: One to one instruction and "other" (e.g., pairs, small group, small group, and pairs).

Two student characteristics were also analyzed: grade level and disability status. Grade level was coded in the following manner: students in grades K–5 as "elementary," students in grades 6–12 as "secondary," and presence of students in both grade levels as "elementary and secondary." Disability status was coded in the following manner: the presence of students with an emotional or behavioral disorder was coded as "EBD" (e.g., special education services for ED or its equivalent, diagnosis consistent with EBD), the presence of students identified with an EBD and a comorbid disability (e.g., LD and ADHD) was coded as "EBD plus," and the presence of students with EBD and students with EBD and a comorbid disability were coded as "EBD & EBD plus," and the presence of students considered at risk for the development of an EBD was coded as "at risk."

2.5.6 | Intervention characteristics

The number of intervention sessions (e.g., number of times students received instruction or intervention) for each contrast were coded as "less than 10" or "greater or equal to 10." Interventionist variables were coded according to the type of professionals who directly provided the reading interventions (e.g., interventionist). Each dependent variable was assigned one of the following codes: "researcher," "researcher plus school staff" (which includes classroom teachers and classroom support personnel), or "teacher." Dependent variables were coded according to specific intervention types. The following categories were used for this analysis: graphic organizers, listening while reading (LWR), multicomponent, repeated reading (RR), and word analysis. Dependent variables were also coded according to the presence or absence of a behavioral component (e.g., positive reinforcement, direct instruction in class expectations).

2.5.7 | Reading outcome characteristics

Finally, dependent variables were coded according to the type of reading-dependent variable: comprehension (e.g., recall of text as indicated by answers to literal comprehension questions), fluency (e.g., words read correctly per minute), phonemic awareness (e.g., manipulation of sounds), vocabulary (e.g., recall of meanings of instructed words), and word reading (e.g., reading word list). The dependent variable type was included as a moderator to identify potential differences in effectiveness for specific reading outcomes. We sought to determine the effectiveness of interventions to improve reading comprehension and their relation to the other core components of reading conceptualized as basic reading skills (e.g., phonemic awareness and phonics) and linguistic comprehension (e.g., fluency and vocabulary; Hoover & Gough, 1990). Our rationale for this approach is based on reading comprehension being the ultimate goal of reading and it is based on the development of a variety of other competencies (Perfetti & Stafura, 2014).

3 | RESULTS

A total of 17 studies, 13 meeting WWC standards and four meeting standards with reservations, were included in the analysis. The majority of studies were conducted in secondary settings (n = 12; 70.5%) A total of 57 students meeting selection criteria were included. Studies were conducted in resource classrooms (n = 8), substantially separate schools (n = 5), and self-contained classrooms (n = 4). No studies were conducted in inclusive settings. The majority of studies had researchers as the sole interventionists (n = 11), reported formal fidelity data (n = 13), and included behavioral strategies as part of the independent variable (n = 12).

3.1 | Overall effect of single-case reading interventions

The data comprised 164 Tau-*U* phase contrasts clustered within the 17 studies. As shown in Table 2, the overall effect of reading interventions was 0.58 (SE = 0.02, 95% confidence interval [CI] = [0.54, 0.63], p < 0.001). The

TABLE 2 Effects of reading interventions on outcomes for students with and at-risk for EBD

References	Contrast	Tau-*U* (95% CI)	*D*	*SE*	Dependent variables	Independent variable
Babyak et al. (2000)	4	0.77 (0.49–1.00)*	1.11	0.14	Comprehension	Graphic organizer
Barton-Arwood et al. (2005)	12	0.65 (0.50–0.80)*	0.57	0.08	Phonemic awareness	Multicomponent
Barton-Arwood et al. (2005)	12	0.57 (0.42–0.72)*	0.25	0.08	Fluency	Multicomponent
Barton-Arwood et al. (2005)	6	0.74 (0.53–0.95)*	0.97	0.11	Word reading	Multicomponent
Brown et al. (2016)	4	1.00 (0.65–1.00)*	3.46	0.18	Vocabulary	Word analysis
Cullen et al. (2014)	2	0.87 (0.48–1.00)*	1.70	0.20	Comprehension	Multicomponent
Dawson et al. (2000)	4	0.86 (0.54–1.00)*	1.63	0.16	Fluency	LWR
Escarpio & Barbetta (2016)	16	0.55 (0.41–0.69)*	0.18	0.07	Fluency	Repeated reading
Escarpio & Barbetta (2016)	8	0.83 (0.64–1.00)*	1.44	0.10	Comprehension	Repeated reading
Hale et al. (2005)	8	0.37 (0.15–0.58)*	−0.42	0.11	Comprehension	LWR
Hilsmier et al. (2016)	8	0.48 (0.30–0.66)*	−0.07	0.09	Fluency	Repeated reading
Miller et al. (1989)	2	0.89 (0.42–1.00)*	1.84	0.24	Fluency	Word analysis
Palmer et al. (2014)	4	1.00 (0.58–1.00)*	3.46	0.22	Vocabulary	Graphic organizer
Rose (1984)	20	0.37 (0.25–0.48)*	−0.42	0.06	Fluency	LWR
Schmitt et al. (2009)	16	0.26 (0.13–0.40)*	−0.75	0.07	Comprehension	LWR
Shapiro and McCurdy (1989)	10	0.40 (0.24–0.56)*	−0.33	0.08	Word reading	LWR
Shapiro and McCurdy (1989)	10	0.41 (0.25–0.57)*	−0.30	0.08	Fluency	LWR
Skinner and Shapiro (1989)	8	0.93 (0.69–1.00)*	2.17	0.12	Fluency	LWR
Stone et al. (2008)	4	0.93 (0.52–1.00)*	2.17	0.21	Comprehension	Graphic organizer
Strong et al. (2004)	4	0.53 (0.24–0.83)*	0.11	0.15	Fluency	Multicomponent
Wood, Mustian, & Cooke (2012)	2	0.25 (−0.12 to 0.62)	−0.78	0.19	Vocabulary	Word analysis
Overall	164	0.58 (0.54–0.63)*	0.29	0.02		

Note. CI: confidence interval; Contrast: number of phase contrasts; LWR: listening while reading; *SE*: standard error.
*$p < 0.001$.

weighted average of Tau-U effect sizes for each reading-dependent variable within each study ranged from 0.25 (d = −0.78) to 1.00 (d = 3.46). Taking this into consideration, the finding for the first research question was that interventions had a small effect on reading outcomes. This overall weighted average of Tau-U corresponds with a Cohen's d of 0.29.

3.2 | Moderator analysis

Table 3 reports the moderator analysis findings for fidelity, setting, student, intervention, and reading outcome characteristics. Of the 10 moderator analyses, seven were statistically significant.

3.2.1 | Fidelity characteristics

The Kruskal–Wallis analysis indicated statistically significant differences between cases based on the fidelity moderator (χ^2 = 7.75, df = 1, p < 0.01). Studies that did not report formal fidelity data yielded a larger weighted average of the Tau-U effect size (0.74, SE = 0.05, 95% CI = [0.64, 0.84]; d = 0.97) than studies that did (0.55, SE = 0.02, 95% CI = [0.51, 0.60]; d = 0.18).

3.2.2 | Setting characteristics

The Kruskal–Wallis analysis showed statistically significant differences between cases based on the classroom setting moderator (χ^2 = 8.42, df = 2, p < 0.05). Interventions provided in resource classrooms had a higher weighted average of Tau-U effect size (0.63, SE = 0.04, 95% CI = [0.56, 0.70]; d = 0.48) than interventions in self-contained settings (0.58, SE = 0.04, 95% CI = [0.51, 0.66]; d = 0.29) and substantially separate schools (0.53, SE = 0.04, 95% CI = [0.45, 0.61]; d = 0.11). The Kruskal–Wallis analysis indicated no statistically significant difference between cases based on the grouping moderator (χ^2 = 0.73, df = 1, p > 0.05). Reading interventions using a grouping method other than one to one instruction (0.61, SE = 0.04, 95% CI = [0.54, 0.69]; d = 0.40) outperformed one to one interventions (0.57, SE = 0.03, 95% CI = [0.52, 0.62]; d = 0.25).

3.2.3 | Student characteristics

The Kruskal–Wallis analysis indicated no statistically significant difference between cases based on the grade moderator (χ^2 = 3.75, df = 2, p > 0.05). Studies involving students in elementary and secondary grades yielded a higher weighted average of the Tau-U effect size (0.70, SE = 0.06, 95% CI = [0.58, 0.81]; d = 0.78) than those with students in elementary grades (0.67, SE = 0.04, 95% CI = [0.59, 0.75]; d = 0.65) and secondary grades (0.52, SE = 0.03, 95% CI = [0.47, 0.58]; d = 0.07).

The Kruskal–Wallis analysis showed statistically significant differences between cases based on disability status (χ^2 = 20.76, df = 3, p < 0.001). Studies with students with EBD (0.72, SE = 0.04, 95% CI = [0.64, 0.80]; d = 0.87) outperformed those with students at-risk (0.55, SE = 0.09, 95% CI = [0.38, 0.71]; d = 0.18), students with EBD and a comorbid disability (0.54, SE = 0.04, 95% CI = [0.47, 0.62]; d = 0.14), and students with a comorbid disability (0.52, SE = 0.04, 95% CI = [0.44, 0.60]; d = 0.07).

3.2.4 | Intervention characteristics

The Kruskal–Wallis analysis generated no statistically significant difference between cases based on the intervention session moderator (χ^2 = 1.37, df = 1, p > 0.05). Studies with intervention sessions less than 10 yielded a slightly higher weighted average of Tau-U effect size (0.61, SE = 0.04, 95% CI = [0.53, 0.70]; d = 0.40) than those with intervention sessions equal or greater than 10 (0.57, SE = 0.03, 95% CI = [0.53, 0.62]; d = 0.25).

TABLE 3 Moderator analysis results

Moderator	Contrasts	Tau-*U* (95% CI)	*d*	*SE*	χ^2 (*df*)
Fidelity characteristics					
Fidelity					
Yes	134	0.55 (0.51–0.60)	0.18	0.02	7.75 (1)**
No	30	0.74 (0.64–0.84)	0.97	0.05	
Setting characteristics					
Classroom					
Resource	64	0.63 (0.56–0.70)	0.48	0.04	8.42 (2)*
Self-contained	50	0.58 (0.51–0.66)	0.29	0.04	
Separate school	50	0.53 (0.45–0.61)	0.11	0.04	
Grouping					
One to one	110	0.57 (0.52–0.62)	0.25	0.03	0.73 (1)
Other	54	0.61 (0.54–0.69)	0.40	0.04	
Student characteristics					
Grade					
Elementary	40	0.67 (0.59–0.75)	0.65	0.04	3.75 (2)
Elementary + Secondary	20	0.70 (0.58–0.81)	0.78	0.06	
Secondary	104	0.52 (0.47–0.58)	0.07	0.03	
Disability status					
At-risk	8	0.55 (0.38–0.71)	0.18	0.09	20.76 (3)***
EBD	58	0.72 (0.64–0.80)	0.87	0.04	
EBD plus	44	0.52 (0.44–0.60)	0.07	0.04	
EBD + EBD plus	54	0.54 (0.47–0.62)	0.14	0.04	
Intervention characteristics					
Intervention session					
<10	52	0.61 (0.53–0.70)	0.40	0.04	1.37 (1)
≥10	112	0.57 (0.53–0.62)	0.25	0.03	
Interventionist					
Researcher	98	0.53 (0.47–0.58)	0.11	0.03	12.98 (2)**
Researcher + staff	34	0.62 (0.53–0.70)	0.44	0.04	
Teacher	32	0.74 (0.64–0.84)	0.97	0.05	
Type of intervention					
Graphic organizer	12	0.86 (0.67–1.00)	1.63	0.10	19.99 (4)**
Listening while reading	76	0.51 (0.45–0.57)	0.03	0.03	
Multicomponent	36	0.63 (0.55–0.72)	0.48	0.04	
Repeated reading	32	0.61 (0.52–0.71)	0.40	0.05	
Word analysis	8	0.71 (0.50–0.93)	0.83	0.11	
Behavioral component					
Yes	128	0.55 (0.50–0.59)	0.18	0.02	9.66 (1)**
No	36	0.73 (0.64–0.83)	0.92	0.05	
Reading outcomes					
Comprehension	42	0.52 (0.43–0.60)	0.07	0.04	12.75 (4)*
Fluency	84	0.61 (0.55–0.67)	0.40	0.03	
Phonemic awareness	12	0.64 (0.49–0.78)	0.52	0.07	
Vocabulary	10	0.75 (0.54–0.96)	1.01	0.11	
Word reading	16	0.52 (0.39–0.64)	0.07	0.06	

Note. CI: confidence interval; Contrast: number of phase contrasts; EBD: emotional and behavioral disorders; SE: standard error.

*$p < 0.05$.

**$p < 0.01$.

***$p < 0.001$.

The Kruskal–Wallis analysis showed statistically significant differences between cases based on the interventionist moderator ($\chi^2 = 12.98$, $df = 2$, $p < 0.01$). Teacher provided interventions (0.74, $SE = 0.05$, 95% CI = [0.64, 0.84]; $d = 0.97$) outperformed interventions provided by researchers and school based staff (0.62, $SE = 0.04$, 95% CI = [0.53, 0.70]; $d = 0.44$) and researchers (0.53, $SE = 0.03$, 95% CI = [0.47, 0.58]; $d = 0.11$).

The Kruskal–Wallis analysis indicated that there were statistically significant differences between cases based on the intervention type moderator ($\chi^2 = 35.97$, $df = 4$, $p < 0.01$). Analysis of reading intervention subtypes yielded the following weighted average of Tau-*U* effect sizes: Graphic organizers (0.86, $SE = 0.10$, 95% CI = [0.67, 1.00]; $d = 1.63$), word analysis (0.71, $SE = 0.11$, 95% CI = [0.50, 0.93]; $d = 0.83$), multicomponent (0.63, $SE = 0.04$, 95% CI = [0.55, 0.72]; $d = 0.48$), repeated reading (0.61, $SE = 0.05$, 95% CI = [0.52, 0.71]; $d = 0.40$), and listening while reading (0.51, $SE = 0.03$, 95% CI = [0.45, 0.57]; $d = 0.03$).

The Kruskal–Wallis analysis presented statistically significant differences between cases based on the behavioral component moderator ($\chi^2 = 9.66$, $df = 1$, $p < 0.01$). Namely, stand-alone reading interventions (0.73, $SE = 0.05$, 95% CI = [0.64, 0.83]; $d = 0.92$) outperformed interventions that included a behavioral component (0.55, $SE = 0.02$, 95% CI = [0.50, 0.59]; $d = 0.18$).

3.2.5 | Reading outcome characteristics

Finally, the Kruskal–Wallis analysis found statistically significant differences in dependent variable type ($\chi^2 = 12.75$, $df = 4$, $p < 0.05$). Reading interventions were more effective at improving vocabulary knowledge (0.75, $SE = 0.11$, 95% CI = [0.54, 0.96]; $d = 1.01$) compared with phonemic awareness (0.64, $SE = 0.07$, 95% CI = [0.49, 0.78]; $d = 0.52$), fluency (0.61, $SE = 0.03$, 95% CI = [0.55, 0.67]; $d = 0.40$), word reading (0.52, $SE = 0.06$, 95% CI = [0.39, 0.64]; $d = 0.07$), and comprehension (0.52, $SE = 0.04$, 95% CI = [0.43, 0.60]; $d = 0.07$).

4 | DISCUSSION

The purpose of this study was to investigate the effects of reading interventions for K-12 students with and at-risk of EBD as indicated by rigorous single case design studies. We also sought to investigate potential moderators of intervention effectiveness. Overall, reading interventions were moderately effective at improving reading performance. This is an encouraging finding, particularly when one considers concerns in the literature regarding the reading deficits of this student population as well as the challenges associated with their remediation (G. Benner et al., 2010; Vaughn, Levy, Coleman, & Bos, 2002).

The limited number of studies with dependent variables meeting WWC standards with or without reservations precludes the identification of EBPs for reading instruction. For example, the use of graphic organizers was associated with strong reading gains (Tau-*U* = 0.86, $d = 1.63$). This finding is similar to J. W. McKenna et al. (2017), which used visual analysis to determine intervention effectiveness. However, this finding should also be viewed with caution due to the few numbers of investigations ($k = 3$) that included graphic organizers as part of the independent variable. Similarly, word analysis interventions yielded strong effect sizes (Tau-*U* = 0.71, $d = 0.83$) but were investigated in few studies ($k = 4$), calling into question the robustness of these findings.

Similar to J. D. Garwood et al. (2014), repeated reading interventions were associated with small but positive gains in reading (Tau-*U* = 0.61, $d = 0.40$). It should be noted that researchers have more recently investigated the effects of repeated reading interventions using single case designs that permitted causal inferences according to WWC design standards. These more recent studies were not included in the McKenna et al. review, which did not identify repeated reading as promising reading practice.

4.1 | Fidelity characteristics

Findings from this quantitative synthesis indicate that studies without formal fidelity (Tau-*U* = 0.74, *d* = 0.97) yielded larger effect sizes than those with formal data (Tau-*U* = 0.55, *d* = 0.18). Previous syntheses (e.g., Kim, McKenna, & Park, 2017; Swanson et al., 2013) have commented on the absence of fidelity data as a concern in special education research. Fidelity data establishes the degree to which independent variables are provided as intended (e.g., documents the presence of the independent variable; Swanson et al., 2013). Findings from this study highlight the importance of considering intervention effectiveness in concert with fidelity data to address potential concerns with false positives or overestimation of intervention effects. For studies with stronger effects that did not report fidelity data, we are unable to determine the degree to which interventionists adhered to intervention procedures and thus the degree to which changes in dependent variables can be attributed to reading interventions. As a result, findings from studies that did not report formal fidelity data may not provide reliable estimates of intervention effects.

4.2 | Setting characteristics

The majority of studies meeting article selection criteria could be considered secondary (Tier 2) or tertiary (Tier 3) level supports within a multitiered system of support (MTSS). MTSS instructional frameworks are thought of as being essential for students with EBD to make effective progress in school (G. J. Benner, Kutash, Nelson, & Fisher, 2013). The relative effectiveness of these studies (e.g., those conducted in resource classrooms; Tau-*U* = 0.63, *d* = 0.48) is an encouraging finding. When provided more intensive instruction, reading performance improves across a variety of dependent variables of reading. Of important note is the absence of studies investigating the effects of reading interventions for students with EBD during core reading instruction (e.g., taking place in general education classrooms). Considering that students with and at risk for EBD are educated in general education settings to the maximum extent that is appropriate, the absence of single case studies conducted in this setting is a concern.

Reading interventions in substantially separate schools were less effective than those conducted in resource and self-contained classrooms (Tau-*U* = 0.53, *d* = 0.11). Only 53% of intervention data points showed improvement compared with baseline. An accumulation of findings from research brings to light concerns regarding the academic performance of students who are educated in substantially separate schools (J. McKenna & Ciullo, 2016; Wilkerson, Afacan, Perzigian, Justin, & Lequia, 2016). Students who attend substantially separate schools tend to receive instruction in these setting for 1–3 years and then move on to less restrictive settings (Gagnon & Leone, 2006). To better prepare students for success in less restrictive settings, it is essential to provide high quality behavioral and academic supports that are informed by EBPs. Findings from this investigation point to the need to identify effective reading interventions for those students whose needs warrant placement in substantially separate settings. Students with the most intensive needs are candidates for data-based interventions focusing on explicit skill-based instruction, self-regulation training, as delivered through carefully sequenced activities and focused routines of explicit instruction (Smith, Poling, & Worth, 2018).

4.3 | Student characteristics

Consistent with syntheses focusing on students with LD, reading interventions provided to secondary grade students had smaller effects than those provided to elementary grade students (Wanzek et al., 2013; Wanzek & Vaughn 2007). We also found reading interventions to be slightly less effective for secondary grade students (Tau-*U* = 0.52, *d* = 0.07) than those reported by Burke and colleagues (Tau-*U* = 0.59), which did not base their analysis on only those studies that met WWC standards with or without reservations. These findings highlight the need to identify effective intensive reading interventions for students in the secondary grades. Secondary grade

students may be multiple years below grade level in reading and these deficits may progress over time (Lane, Barton-Arwood, Nelson, & Wehby, 2008; Nelson, Benner, Lane, & Smith, 2004; Wei et al., 2011). Longitudinal studies of reading intervention provided as part of multitiered systems of support indicate that students who do not receive intensive reading intervention over multiple years continued to fall further behind when compared with students who did receive intervention (Solis, Miciak, Vaughn, & Fletcher, 2014). This need may be particularly critical for students who have comorbid reading and behavioral difficulties such as students with and at risk of EBD.

Findings from this quantitative synthesis also point to a need to identify effective interventions for students with EBD with comorbid disabilities as interventions provided to this student population yielded smaller effects compared with those for students with EBD. Participants with more complex profiles were more resistant to intervention. Only 52% of intervention data points showed improvement compared with baseline.

Similar to J. D. Garwood et al. (2014), findings from this study suggest that teacher provided interventions (Tau-U = 0.74, d = 0.97) are more effective than those involving researchers as interventionists. This finding contrasts with research investigating the effects of reading interventions for students with LD, which suggests that researcher provided interventions are more effective than those by school staff (Edmonds et al., 2009; Scammacca, Roberts, Vaughn, & Stuebing, 2015; Wanzek, Wexler, Vaughn, & Ciullo, 2010). As stated by J. D. Garwood et al. (2014), "Researchers may know the intervention, but teachers know their students." (p.10). It is also possible that teachers develop strong, positive relationships with their students, which can then be leveraged during reading instruction. If relationships contribute to the effectiveness of reading interventions, teachers must work in conditions that permit them to establish, develop, sustain, and leverage positive relationships to promote more positive school and transition outcomes. Researchers have previously noted the importance of relationships when conceiving effective reading interventions, particularly for students who may have previously experienced failure in reading and display challenging behaviors such as students with EBD (Scammacca et al., 2016). Although it is essential that interventionists working with students with and at risk of EBD adhere to core intervention components and implement them with sufficient quality, study findings suggest the value added of teacher-provided interventions.

4.4 | Intervention characteristics

Surprisingly, stand-alone reading interventions (Tau-U = 0.73, d = 0.92) had stronger effects on reading outcomes than those that included behavioral strategies or positive behavior supports (Tau-U = 0.55, d = 0.18). This finding conflicts with the findings from a previous synthesis (J. W. McKenna et al., 2017) and seems counterintuitive. Positive behavior supports and behavioral strategies can promote on-task behavior, prevent the occurrence of challenging behavior and provide a means to effectively respond when these behaviors occur. This finding could be due to the type of behavioral strategies used in studies meeting selection criteria. For example, self-monitoring practices were rarely used despite their effectiveness, particularly when paired with some form of reinforcement (Bruhn, McDaniel, & Kreigh, 2015). Studies included in this quantitative synthesis also did not include function-based supports, which have shown to be effective for students with and at risk of EBD (Gage, Lewis, & Stichter, 2012). However, it should also be noted that fidelity data was infrequently reported in studies investigating the effects of stand-alone reading interventions. As a result, the degree to which stand-alone reading interventions were provided as intended is largely unknown. It is also possible that behavioral strategies were used in these studies, such as school-wide positive behavior supports, but were not reported by the researchers. It is also possible that participants who received stand-alone reading interventions had less severe problem behaviors.

4.5 | Reading outcome characteristics

Reading interventions meeting WWC standards with or without reservations tended to focus on fluency or comprehension. A small number of contrasts (range = 10–16) were calculated for phonemic awareness, vocabulary,

and word reading outcomes. As a result, it is difficult to determine the effectiveness of interventions for these dependent variables. Interventions included in this review had a small effect on improving reading fluency (Tau-*U* = 0.61, *d* = 0.40). Fluent readers are able to accurately decode text with automaticity, read more complex text, and have higher levels of comprehension (Chard, Vaughn, & Tyler, 2002). However, improving reading comprehension appears to be elusive (Tau-U = 0.52, *d* = 0.07). Only 52% of intervention data points demonstrated improvement. This may be due to the difficulties inherent in improving the reading comprehension of this student population. This finding may also stem from the need to identify reading interventions that are specifically effective for students with or at-risk for EBD or interventions that are effective for students with different behavior profiles (e.g., predominately externalizing, internalizing, or comorbid subtype).

4.6 | Limitations

Some limitations are associated with this investigation. First, this study relied exclusively on single case design studies with at least one reading dependent variable meeting WWC standards with or without reservations. Although removing quality indicator coding from the selection criteria would have increased the number of eligible studies and dependent variables, we were interested in quantifying the effectiveness of reading interventions that permitted causal inferences. Findings from this investigation may have differed if we used less rigorous inclusion criteria for single case design studies. Although inclusion of comparison group studies also would have increased the number of studies and dependent variables, the field continues to lack agreement on methods for integrating findings from single case and comparison group studies. We also only included studies that underwent peer review. Although including gray literature may have increased our overall sample, we sought to use the peer-review process as an additional safety net to make certain we only included rigorous studies.

4.7 | Implications for practice

Findings from this quantitative synthesis point to four suggestions for school practice. Due to an inability to identify EBPs for reading (e.g., recommend a specific reading intervention as an EBP, based on WWC criteria for replication), educators should continue to use the available empirical evidence, professional judgment, and information on student strengths and areas for development to select instructional practices (Cook, Tankersley, & Landrum, 2013). Until an accumulation of evidence exists for students with and at-risk for EBD, practitioners should rely on EBPs that have been identified more broadly (Foorman et al., 2016; Kamil et al., 2008). Second, teachers should use progress monitoring data to make timely instructional adjustments to improve contextual fit and target student needs (Fuchs, 2017; Fuchs, Fuchs, & Vaughn, 2014; Kauffman, 2015; Maggin et al., 2016). When students inadequately respond to intervention, practitioners should first consider the degree to which the practice or intervention was implemented as intended (e.g., fidelity of implementation; Lewis, 2016). Third, providers of reading instruction should be provided ongoing support in the form of professional development and coaching with performance feedback to high levels of fidelity (Lewis, 2016; McKenna & Ciullo, 2016). Finally, considering the complexity associated with using data to inform instructional adjustments (Fuchs, 2017), school-based professionals should engage in collaborative problem-solving discussions to continually refine student services including reading instruction.

4.8 | Future research

In consideration of the limited number of studies meeting selection criteria, additional single case studies across grade levels, settings, and dependent variables are warranted. Clearly, there continues to be a need to identify reading practices and interventions that are effective as well as feasible for school practice. Teachers must be trained in evidence-based reading instructional practices to improve school and transition outcomes (Lane, 2004).

Researchers should continue to use quality indicators such as the WWC to inform study design so that causal inferences can be made regarding reading interventions and student outcomes. Furthermore, researchers should adhere to conventions regarding fidelity assessment to document the degree to which reading interventions are provided as intended. Researchers can use this information to provide performance feedback in instances in which the assessed fidelity is low. Student outcomes can then be interpreted in regard to fidelity data.

Considering the complexity of the relationship between problem behaviors and academic performance, researchers should continue to investigate the effects of integrated reading and behavioral interventions. This line of research should include a broader range of behavioral practices such as self-management and other cognitive behavioral techniques. Researchers should also investigate the differential effects of reading interventions for students with different behavioral profiles (e.g., externalizing, internalizing, or comorbid subtype) to inform practitioner efforts to meet the specific needs of their students. Finally, studies should investigate the relative effectiveness and feasibility of small group and one to one interventions as well as the characteristics of students that require one to one intervention. Although findings from this quantitative synthesis suggest that one to one interventions were somewhat less effective than those implemented using another type of grouping method, one to one interventions may be essential for those students who have the most significant reading and behavioral needs. For example, students may frequently engage in problem behavior during small group instruction (J. McKenna & Ciullo, 2016) and may benefit from the more frequent opportunities to respond, reinforcement, explicit feedback, targeted instruction, and behavioral support that can be provided one to one.

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REFERENCES[1]

Arizona Software Inc. (2010). GraphClick 3.0.2. (http://www.arizona-software.ch/graphclick/)

*Babyak, A. E., Koorland, M., & Mathes, P. G. (2000). The effects of story mapping instruction on the reading comprehension of students with behavior disorders. *Behavioral Disorders*, *25*, 239–258. https://doi.org/10.1177/019874290002500301

Bae, B.-D., & Park, E.-Y. (2018). Meta-analysis of the effect on communication intervention for students with severe and multiple disabilities: Based on single-subject research designs. *AAC Research & Practice*, *6*, 41–77. https://doi.org/10.14818/aac.2018.6.6.1.41

*Barton-Arwood, S. M., Wehby, J. H., & Falk, K. B. (2005). Reading instruction for elementary age students with emotional and behavioral disorders: Academic and behavioral outcomes. *Exceptional Children*, *72*, 7–27. https://doi.org/10.1177/001440290507200101

Benner, G., Nelson, J., Ralston, N., & Mooney, P. (2010). A meta-analysis of the effects of reading instruction on the reading skills of students with or at-risk of behavioral disorders. *Behavioral Disorders*, *35*, 86–102.

Benner, G. J., Kutash, K., Nelson, J. R., & Fisher, M. B. (2013). Closing the achievement gap of youth with emotional and behavioral disorders through multi-tiered systems of support. *Education and Treatment of Children*, *36*, 15–29. https://doi.org/10.1353/etc.2013.0018

Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2009). *Introduction to meta-analysis*. Chichester: Wiley.

Bowman-Perrott, L., Burke, M. D., Zaini, S., Zhang, N., & Vannest, K. (2016). Promoting positive behavior using the Good Behavior Game: A meta-analysis of single-case research. *Journal of Positive Behavior Interventions*, *18*, 180–190. https://doi.org/10.1177/1098300715592355

Bowman-Perrott, L., Burke, M. D., Zhang, N., & Zaini, S. (2014). Direct and collateral benefits of peer tutoring on social and behavioral outcomes: A meta-analysis of single-case research. *School Psychology Review*, *43*(3), 260–285.

*Brown, S. H., Lignugaris/kraft, B., & Forbush, D. E. (2016). The effects of morphemic vocabulary instruction on prefix vocabulary and sentence comprehension for middle school students with learning disabilities. *Education and Treatment of Children*, *39*, 301–338. https://doi.org/10.1353/etc.2016.0014

[1]References marked with an asterisk indicate studies included in the synthesis.

Bruhn, A., McDaniel, S., & Kreigh, C. (2015). Self-monitoring interventions for students with behavior problems: A systematic review of current research. *Behavioral Disorders*, *40*, 102–121. https://doi.org/10.17988/bd-13-45.1

Bullock, L., & Gable, R (2006). Programs for children and adolescents with emotional and behavioral disorders in the United States: A historical overview, current perspectives, and future directions. *Preventing School Failure*, *50*(2), 7–13.

Burke, M. D., Boon, R. T., Hatton, H., & Bowman-Perrott, L. (2015). Reading interventions for middle and secondary students with emotional and behavioral disorders: A quantitative review of single-case studies. *Behavior Modification*, *39*, 43–68. https://doi.org/10.1177/0145445514547958

Chard, D. J., Vaughn, S., & Tyler, B. J. (2002). A synthesis of research on effective interventions for building reading fluency with elementary students with learning disabilities. *Journal of Learning Disabilities*, *35*, 386–406. https://doi.org/10.1177/00222194020350050101

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

Cook, B., & Cook, L. (2017). Do research findings apply to my students? Examining study samples and sampling. *Learning Disability Research & Practice*, *32*, 78–84. https://doi.org/10.1111/ldrp.12132

Cook, B., Tankersley, M., & Landrum, T. (2013). Evidence-based practices in learning and behavioral disabilities: The search for effective instruction. In B. Cook, M. Tankersley, & T. Landrum (Eds.), *Evidence-based practices* (pp. 1–20). Bingley: Emerald Publishing Limited.

*Cullen, J. M., Alber-Morgan, S. R., Schnell, S. T., & Wheaton, J. E. (2014). Improving reading skills of students with disabilities using headsprout comprehension. *Remedial and Special Education*, *35*, 356–365. https://doi.org/10.1177/0741932514534075

*Dawson, L., Venn, M. L., & Gunter, P. L. (2000). The effects of teacher versus computer reading models. *Behavioral Disorders*, *25*, 105–113. https://doi.org/10.1177/019874290002500202

Edmonds, M. S., Vaughn, S., Wexler, J., Reutebuch, C., Cable, A., Tackett, K. K., & Schnakenberg, J. W. (2009). A synthesis of reading interventions and effects on reading comprehension outcomes for older struggling readers. *Review of Educational Research*, *79*, 262–300. https://doi.org/10.3102/0034654308325998

*Escarpio, R., & Barbetta, P. M. (2016). Comparison of repeated and non-repeated readings on the reading performances of students with emotional and behavioral disorders. *Journal of Emotional and Behavioral Disorders*, *24*, 111–124. https://doi.org/10.1177/1063426615574337

Flower, A., McKenna, J. W., & Upreti, G. (2016). Validity and reliability of GraphClick and DataThief III for data extraction. *Behavior Modification*, *40*, 396–413. https://doi.org/10.1177/0145445515616105

Foorman, B., Beyler, N., Borradaile, K., Coyne, M., Denton, C., Dimino, J., & Wissel, S. (2016). *Foundational skills to support reading for understanding in kindergarten through 3rd grade (NCEE 2016-4008)*. Washington, DC: NCEE and Regional Assistance Institute of Education Sciences, US Department of Education.

Fuchs, D., Fuchs, L. S., & Vaughn, S. (2014). What is intensive instruction and why is it important? *Teaching Exceptional Children*, *46*, 13–18. https://doi.org/10.1177/0040059914522966

Fuchs, L. (2017). Curriculum-based measurement as the emerging alternative: Three decades later. *Learning Disabilities Research & Practice*, *32*(1), 5–7. https://doi.org/10.1111/ldrp.12127

Gage, N. A., Lewis, T. J., & Stichter, J. P. (2012). Functional behavioral assessment-based intervention for students with or at risk for emotional and/or behavioral disorders in school: A hierarchical linear modeling meta-analysis. *Behavioral Disorders*, *37*, 55–77. https://doi.org/10.1177/019874291203700201

Gagnon, J., & Leone, P. (2006). Elementary day and residential schools for children with emotional and behavioral disorders: Characteristics of educators and students. *Education and Treatment of Children*, *29*, 51–78. https://doi.org/10.1177/07419325050260030201

Garwood, J. (2018). Literacy interventions for secondary students formally identified with emotional and behavioral disorders: Trends and gaps in the research. *Journal of Behavioral Education*, *27*(1), 23–52.

Garwood, J., Vernon-Feagans, L., & Family Life Project Key Investigators (2017). Classroom management affects literacy development of students with emotional and behavioral disorders. *Exceptional Children*, *83*, 123–142. https://doi.org/10.1177/0014402916651846

Garwood, J. D., Brunsting, N. C., & Fox, L. C. (2014). Improving reading comprehension and fluency outcomes for adolescents with emotional-behavioral disorders: Recent research synthesized. *Remedial and Special Education*, *35*, 181–194. https://doi.org/10.1177/0741932513514856

Garwood, J. D., Varghese, C., & Vernon-Feagans, L. (2017). Internalizing behaviors and hyperactivity/inattention: Consequences for young struggling readers, and especially boys. *Journal of Early Intervention*, *39*, 218–235. https://doi.org/10.1177/1053815117706524

Greenhouse, J. N., & Iyengar, S. (2009). Sensitivity analysis and diagnostics. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta-analysis* (pp. 417–433). New York, NY: Russell Sage Foundation.

Gregory, J. B., Allor, J. A., & Paul, M. (2008). An investigation of the academic processing speed of students with emotional and behavioral disorders served in public school settings. *Education and Treatment of Children*, 307–332. https://doi.org/10.1353/etc.0.0006

Gresham, F. (2015). Evidence-based social skills interventions for students at risk of EBD. *Remedial and Special Education*, *36*, 100–104. https://doi.org/10.1177/0741932514556183

Griffith, A. K., Trout, A. L., Hagaman, J. L., & Harper, J. (2008). Interventions to improve the literacy functioning of adolescents with emotional and/or behavior disorders: A review of the literature between 1965 and 2005. *Behavioral Disorders*, *33*, 124–140. https://doi.org/10.1177/0741932508321013

Hagan-Burke, S., Kwok, O., Zou, Y., Johnson, C., Simmons, D., & Coyne, M. D. (2011). An examination of problem behaviors and reading outcomes in kindergarten students. *The Journal of Special Education*, *45*, 131–148. https://doi.org/10.1177/0022466909359425

*Hale, A. D., Skinner, C. H., Winn, B. D., Oliver, R., Allin, J. D., & Molloy, C. C. M. (2005). An investigation of listening and listening-while reading accommodations on reading comprehension levels and rates in students with emotional disorders. *Psychology in the Schools*, *42*, 39–51. https://doi.org/10.1002/pits.20027

*Hilsmier, A., Wehby, J., & Falk, K. (2016). Reading fluency interventions for middle school students with academic and behavioral disabilities. *Reading Improvement*, *53*, 53–64.

Hoover, W. A., & Gough, P. B. (1990). The simple view of reading. *Reading and Writing*, *2*(2), 127–160.

Horner, R. H., Carr, E. G., Halle, J., McGee, G., Odom, S., & Wolery, M. (2005). The use of single-subject research to identify evidence-based practices in special education. *Exceptional Children*, *71*, 165–179. https://doi.org/10.1177/001440290507100203

Kamil, M., Borman, G., Dole, J., Kral, C., Salinger, T., & Torgesen, J. (2008). *Improving adolescent literacy: Effective classroom and intervention practices: A Practice Guide (NCEE#2008-4027)*. Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, US Department of Education.

Kauffman, J. M. (2015). Opinion on recent developments and the future of special education. *Remedial and Special Education*, *36*, 9–13. https://doi.org/10.1177/0741932514543653

Kim, M., McKenna, J. W., & Park, Y. (2017). The use of computer-assisted instruction to improve the reading comprehension of students with learning disabilities: An evaluation of the evidence base according to the What Works Clearinghouse standards. *Remedial & Special Education*, *38*, 233–245. https://doi.org/10.1177/0741932517693396

Kratochwill, T., Hitchcock, J., Horner, R., Levin, J., Odom, S., Rindskoph, D., & Shadish, W. (2010). Single-case designs technical documentation. *Psychological Methods*, *15*, 124–144. Retrieved from. http://ies.ed.gov/ncee/wwc/Docs/ReferenceResources/wwc_scd.pdf

Kruskal, W. H., & Wallis, W. A. (1952). Use of ranks in one-criterion variance analysis. *Journal of the American Statistical Association*, *47*, 583–621. https://doi.org/10.1080/01621459.1952.10483441

Lane, K. (2004). Academic instruction and tutoring interventions for students with emotional/behavioral disorders: 1990 to present. In R. Rutherford, M. Quinn, S. Mathur, & F. Wood (Eds.), *Handbook of research in emotional and behavioral disorders* (pp. 462–486). New York, NY: Guilford Press.

Lane, K. L., Barton-Arwood, S. M., Nelson, J. R., & Wehby, J. (2008). Academic performance of students with emotional and behavioral disorders serving students in a self-contained setting. *Journal of Behavioral Education*, *17*, 43–62. https://doi.org/10.1007/s10864-007-9050-1

Lewis, T. J. (2016). Does the field of EBD need a distinct set of "Intensive" interventions for more systemic intensity within a continuum of social/emotional supports. *Journal of Emotional and Behavioral Disorders*, *24*, 187–190. https://doi.org/10.1177/1063426616652866

Lipsey, M., & Wilson, D. (2001). *Practical meta-analysis*. Thousand Oaks, CA: SAGE.

Maggin, D. M., Briesch, A. M., & Chafouleas, S. M. (2013). An application of the What Works Clearinghouse standards for evaluating single-subject research: Synthesis of the self-management literature base. *Remedial and Special Education*, *34*, 44–58. https://doi.org/101177/0741932511435176

Maggin, D. M., Pustejovsky, J. E., & Johnson, A. H. (2017). A meta-analysis of school-based group contingency interventions for students with challenging behavior: An update. *Remedial and Special Education*, *38*, 353–370. https://doi.org/10.1177/0741932517716900

Maggin, D. M., Wehby, J. H., Farmer, T. W., & Brooks, D. S. (2016). Intensive interventions for students with emotional and behavioral disorders: Issues, theory, and future directions. *Journal of Emotional and Behavioral Disorders*, *24*(3), 127–137. https://doi.org/10.1177/1063426616661498

Matt, G., & Cook, T. (2009). Threats to the validity of generalized inferences. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta-analysis* (2nd ed., pp. 538–5578). New York, NY: Sage.

McIntosh, K., Sadler, C., & Brown, J. A. (2012). Kindergarten reading skill level and change as risk factors for chronic problem behavior. *Journal of Positive Behavior Interventions*, *14*, 17–28. https://doi.org/10.1177/1098300711403153

McKenna, J., & Ciullo, S. (2016). Typical reading instructional practices provided to students with emotional and behavioral disorders in a residential and day treatment settings: A mixed methods study. *Residential Treatment for Children & Youth*, *33*, 225–246. https://doi.org/10.1080/0886571x.2016.1207217

McKenna, J. W., Kim, M. K., Shin, M., & Pfannenstiel, K. (2017). An evaluation of single-case reading intervention study quality for students with and at risk for emotional and behavioral disorders. *Behavior Modification*, *41*, 868–906. https://doi.org/10.1177/0145445517701896

*Miller, M., Miller, S. R., Wheeler, J., & Selinger, J. (1989). Can a single-classroom treatment approach change academic performance and behavioral characteristics in severely behaviorally disordered adolescents: An experimental inquiry. *Behavioral Disorders*, *14*, 215–225. https://doi.org/10.1177/019874298901400404

Mitchell, B. S., Adamson, R., & McKenna, J. W. (2017). Curbing our enthusiasm: An analysis of the check-in/check out literature using the Council for Exceptional Children's evidence-based practice standards. *Behavior Modification*, *41*, 343–367. https://doi.org/10.1177/0145445516675273

Moeyaert, M., Maggin, D., & Verkuilen, J. (2016). Reliability, validity, and usability of data extraction programs in single-case research designs. *Behavior Modification*, *40*, 874–900. https://doi.org/10.1177/0145445516645763

Nelson, J. R., Benner, G. J., & Gonzalez, J. (2005). An investigation of the effects of early literacy intervention on the phonological awareness skills of children at risk of emotional disturbance. *Journal of Emotional and Behavioral Disorders*, *13*, 3–12. https://doi.org/10.1177/10634266050130010101

Nelson, J. R., Benner, G., Lane, K., & Smith, B. (2004). *Exceptional Children*, *71*(1), 59–73.

Ninci, J., Neely, L. C., Hong, E. R., Boles, M. B., Gilliland, W. D., Ganz, J. B., … Vannest, K. J. (2015). Meta-analysis of single-case research on teaching functional living skills to individuals with ASD. *Review Journal of Autism and Developmental Disorders*, *2*, 184–198. https://doi.org/10.1007/s40489-014-0046-1

*Palmer, J., Boon, R., & Spencer, V. (2014). Effects of concept mapping instruction on the vocabulary acquisition skills of seventh-graders with mild disabilities: A replication study. *Reading & Writing Quarterly: Overcoming Learning Difficulties*, *30*, 165–182. https://doi.org/10.1080/10573569.2013.818890

Parker, R. I., & Vannest, K. (2009). An improved effect size for single case research: Nonoverlap of all pairs. *Behavior Therapy*, *40*, 357–367. https://doi.org/10.1016/j.beth.2008.10.006

Parker, R. I., Vannest, K. J., & Brown, L. (2009). The improvement rate difference for single-case research. *Exceptional Children*, *75*, 135–150. https://doi.org/10.1177/001440290907500201

Parker, R. I., Vannest, K. J., Davis, J. L., & Sauber, S. B. (2011). Combining nonoverlap and trend for single-case research: Tau-U. *Behavior Therapy*, *35*, 202–322. https://doi.org/10.1016/j.beth.2010.08.006

Perfetti, C., & Stafura, J. (2014). Word knowledge in a theory of reading comprehension. *Scientific Studies of Reading*, *18*, 22–37. https://doi.org/10.1080/10888438.2013.827687

Pressley, M., Duke, N., & Boling, E. (2004). The educational science and scientifically based instruction we need: Lessons from reading research and policymaking. *Harvard Educational Review*, *74*, 30–61. https://doi.org/10.17763/haer.74.1.5445104446530382

Rivera, M. O., Al-Otaiba, S., & Koorland, M. A. (2006). Reading instruction for students with emotional and behavioral disorders and at-risk of antisocial behaviors in primary grades: A review of literature. *Behavioral Disorders*, *31*, 323–337. https://doi.org/10.1177/019874290603100306

Roberts, G. J., Solis, M., Ciullo, S., McKenna, J. W., & Vaughn, S. (2015). Reading interventions with behavioral and social skills outcomes: A synthesis of research. *Behavior Modification*, *39*, 8–42. https://doi.org/10.1177/0145445514561318

*Rose, T. L. (1984). Effects of previewing on the oral reading of mainstreamed behaviorally disordered students. *Behavioral Disorders*, *10*, 33–39. https://doi.org/10.1177/019874298501000110

Sanford, A. K., & Horner, R. H. (2013). Effects of matching instruction difficulty to reading level for students with escape-maintained problem behavior. *Journal of Positive Behavior Interventions*, *15*, 79–89. https://doi.org/10.1177/1098300712449868

Scammacca, N. K., Roberts, G., Vaughn, S., & Stuebing, K. K. (2015). A meta-analysis of interventions or struggling readers in grades 4-12: 1980–2011. *Journal of Learning Disabilities*, *48*, 369–390. https://doi.org/10.1177/0022219413504995

Scammacca, N. K., Roberts, G. J., Cho, E., Williams, K. J., Roberts, G., Vaughn, S. R., & Carroll, M. (2016). A century of progress: Reading interventions for students in grades 4-12, 1914–2014. *Review of Educational Research*, *86*, 756–800. https://doi.org/10.3102/0034654316652942

*Schmitt, A., McCallum, E., Hale, A., Obeldobel, E., & Dingus, K. (2009). Can text-to speech assistive technology improve the reading comprehension of students with severe reading and emotional disabilities? *Journal of Evidence-Based Practices for Schools*, *10*, 95–119.

Shadish, W., Hedges, L., Horner, R., & Odom, S. (2015). *The role of between-case effect size in conducting, interpreting, and summarizing single-case research (NCER 2015-002)*. Washington, DC: National Center for Education Research, Institute of Education Sciences, US Department of Education.

*Shapiro, E. S., & McCurdy, B. L. (1989). Effects of a taped-words treatment on reading proficiency. *Exceptional Children*, *55*, 321–325. https://doi.org/10.1177/001440298905500406

Shin, M., Park, E., Kim, Y., & Kang, J. (2016). Reading interventions for improving phonological awareness and word recognition of students with disabilities: A meta-analysis of single-subject research designs. *The Journal of Special Children Education*, *18*, 45–75. https://doi.org/10.21075/kacsn.2016.18.2.45

*Skinner, C., & Shapiro, E. (1989). A comparison of taped-words and drill interventions on reading fluency in adolescents with behavior disorders. *Education and Treatment of Children*, *12*, 123–133.

Smith, S. W., Poling, D. V., & Worth, M. R. (2018). Intensive intervention for students with emotional and behavioral disorders. *Learning Disabilities Research and Practice*, *33*(3), 168–175. doe. https://doi.org/10.1111/ldrp12174

Solis, M., Miciak, J., Vaughn, S., & Fletcher, J. M. (2014). Why intensive interventions matter: Longitudinal studies of adolescents with reading disabilities and poor reading comprehension. *Learning Disability Quarterly*, *37*, 218–229. https://doi.org/10.1177/0731948714528806

*Stone, R., Boon, R., Fore, C., Bender, W., & Spencer, V. (2008). Use of text maps to improve the reading comprehension skills among students in high school with emotional and behavioral disorders. *Behavioral Disorders*, *33*, 87–98.

*Strong, A., Wehby, J., Falk, K., & Lane, K. (2004). The impact of a structured reading curriculum and repeated reading on the performance of junior high students with emotional and behavioral disorders. *School Psychology Review*, *33*, 561–581.

Swanson, E., Wanzek, J., Haring, C., Ciullo, S., & McCulley, L. (2013). Intervention fidelity in special and general education research. *The Journal of Special Education*, *47*, 3–13. https://doi.org/10.1177/0022466911419516

U.S. Department of Education, Office of Special Education Programs. (2010). 29th annual report to Congress on the implementation of the Individuals With Disabilities Education Act. Washington, DC: Author.

Vannest, K. J., Parker, R. I., Gonen, O., & Adiguzel, T. (2016). *Single Case Research: web based calculators for SCR analysis. (Version 2.0) [Web-based application]*. College Station, TX: Texas A&M University.

Vaughn, S., Levy, S., Coleman, M., & Bos, C. S. (2002). Reading instruction for students with LD and EBD: A synthesis of observation studies. *Journal of Special Education*, *36*, 2–13. https://doi.org/10.1177/00224669020360010101

Wagner & Newman (2012): , Wagner, M., & Newman, L. (2012). Longitudinal transition outcomes of youth with emotional disturbances. *Psychiatric Rehabilitation Journal*, *35*(3), 199–208.

Wanzek, J., & Vaughn, S. (2007). Research-based implications from extensive early reading interventions. *School psychology review*, *36*, 541–561.

Wanzek, J., Vaughn, S., Scammacca, N. K., Metz, K., Murray, C. S., Roberts, G., & Danielson, L. (2013). Extensive reading interventions for students with reading difficulties after grade 3. *Review of Educational Research*, *83*, 163–195. https://doi.org/10.3102/0034654313477212

Wanzek, J., Wexler, J., Vaughn, S., & Ciullo, S. (2010). Reading interventions for struggling readers in the upper elementary grades: A synthesis of 20 years of research. *Reading & Writing*, *23*, 889–912. https://doi.org/10.1007/s11145-009-9179-5

Wei, X., Blackorby, J., & Schiller, E. (2011). Growth in reading achievement of students with disabilities, ages 7 to 17. *Exceptional Children*, *78*, 89–106. https://doi.org/10.1177/001440291107800106

Wilkerson, K., Afacan, K., Perzigian, A., Justin, W., & Lequia, J. (2016). Behavior-focused alternative schools: Impact on student outcomes. *Behavioral Disorders*, *41*(2), 81–94.

*Wood, C., Mustian, A., & Cooke, N. (2012). Comparing whole-word and morphograph instruction during computer-assisted peer tutoring on students' acquisition and generalization of vocabulary. *Remedial and Special Education*, *33*(1), 39–47.

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