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Effects of a Reading and Reading Plus Behavior Intervention for Students With Autism: A Secondary Analysis of an Alternating Treatment Study

A Dissertation submitted in partial satisfaction
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Zaira Jimenez

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Dissertation Committee:
Dr. Michael Solis, Chairperson
Dr. Cathy Lussier
Dr. Garrett Roberts

The Dissertation of Zaira Jimenez is approved:

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Committee Chairperson

University of California, Riverside

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ABSTRACT OF THE DISSERTATION

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by

Zaira Jimenez

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Dr. Michael Solis, Chairperson

Problem behavior, such as non-engagement, impacts academic outcomes (McIntosh et al., 2008; Morgan et al., 2008; Nelson et al., 2003; Roberts et al., 2015). Theories examining the relationship between problem behavior and academics suggest the following regarding the directionality of the relationship: (a) academic challenges lead to problem behavior, (b) problem behavior leads to academic challenges, (c) academic challenges and problem behavior co-occur, and (d) attention related challenges lead to academic challenges and problem behavior (Hinshaw, 1992; McIntosh et al., 2008; Morgan et al., 2008). Additionally, they emphasize the importance of addressing problem behavior concurrently with academics. This is crucial for students with autism, seeing that academic challenges (e.g., reading comprehension) and problem behavior have been consistently reported as challenges for students with autism (Belardinelli et al., 2016; Huemer & Mann, 2010; Solis et al., 2016; Volkmar et al., 2014). However, there is limited research on reading comprehension and behavior interventions for students with autism focused on behavior interventions and outcomes. To address this gap in research, the present study analyzed levels of engagement through a secondary analysis of an

alternating treatment single-case design study (N = 3) that was entirely implemented via a distance learning platform during Covid-19. This secondary analysis sought to compare the relative effects of a pre-developed reading intervention (Solis et al., 2022) to a reading intervention that embedded behavior supports (i.e., behavior expectations, visual schedule) on student engagement levels. Study effects were analyzed through a visual analysis (WWC, 2022). The results indicated that the reading intervention that embedded the behavior supports was not more effective than the reading intervention that did not embedded the behavior supports. Engagement levels increased for one out of three participants during the reading plus behavior intervention. For the additional two participants, engagement levels slightly increased during the reading plus behavior intervention. Surprisingly, engagement levels were high across participants and interventions, despite using a distance learning platform. The percentage of intervals with engagement ranged from 66% to 99% in the reading only intervention and from 75% to 100% in the reading plus behavior intervention. Social validity results indicated a preference for the reading plus behavior intervention. This study provides insight into the engagement of students with autism and the use of distance learning to implement interventions.

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Chapter 1: Introduction

Proficiency in reading comprehension is key for academic, educational, and social success (Caspi et al., 1998; Daniel et al., 2006; Lyon, 1998; McLaughlin et al., 2014). Higher reading comprehension levels are associated with better adult outcomes, including higher college enrollment and employment rates, increased independence, and quality of life (Lyon, 1998; McLaughlin et al., 2014). For students with autism, increasing reading comprehension levels is crucial, as postsecondary outcomes are a major concern (Mazurek & Kanne, 2010; Narendorf et al., 20111; VanBergeijk et al., 2008; Volkmar et al., 2014). However, students with autism have persistent challenges in reading comprehension (Bailey & Arciuli; 2020; El Zein et al., 2014; Finnegan & Mazin, 2016; McIntyre et al., 2017; Williamson et al., 2012). Research findings show that reading comprehension outcomes for students with autism are far below expected levels (Finnegan & Mazin, 2016; Nation et al., 2006; Volkmar et al. 2014; Williamson et al., 2012). When compared to other academic areas (e.g., phonics, phonological awareness), reading comprehension outcomes are lower (Nation et al., 2006; Whitby & Mancil, 2009). Although, research on reading comprehension has identified instructional approaches that positively impact the reading comprehension levels of students with autism, proficiency in reading comprehension continues to be a challenge for students with autism (Bailey & Arciuli, 2020; El Zein et al., 2014; Finnegan & Mazin, 2016; Huemer & Mann, 2010; Klingner et al., 2007; Shanahan, 2005; Solis et al., 2012; Williamson et al., 2012).

An explanation for the persistent challenges in reading comprehension highlights behavior problems (Cook et al., 2012; Fleury et al., 2014; McIntosh et al., 2008; Morgan et al., 2008; Nelson et al., 2003). While problem behavior is not a key marker of autism (American Psychiatric Association, 2013), it has been well document in students with autism (Alberto & Troutman, 2013; American Psychiatric Association, 2013; Belardinelli et al., 2016; Hall, 2018; Marks et al., 2003; Volkmar et al., 2014). In fact, the comorbidity between autism and behavior problems is common (Belardinelli et al., 2016; Volkmar et al., 2014). Examples of problem behavior observed in students with autism include aggression, repetitive behavior, and attention difficulties (Belardinelli et al., 2016; Volkmar et al., 2014). The presence of problem behavior poses a concern as it may interfere with academic instruction and achievement, thus leaving students with autism at a disadvantage (Cook et al., 2012; Fleury et al., 2014; McIntosh et al., 2008; Morgan et al., 2008; Nelson et al., 2003). A growing body of research has focused on examining the impacts of problem behavior on academics (e.g., reading; Cook et al., 2012; Morgan et al., 2008; Nelson et al., 2003; Roberts et al., 2020; Roberts et al., 2021; Roberts et al., 2019; Roberts et al., 2015; Solis et al., 2016). Findings from these studies show promise in approaches to intervention that simultaneously address reading and problem behavior. As the prevalence rates of children identified with autism continues to grow, from 1 in 88 in 2008 to 1 in 59 in 2014 to 1 in 44 in 2018 (Centers for Disease Control and Prevention, n.d.), the relevance and importance of examining reading comprehension and behavior problems also increases to ensure that students with autism receive the best possible interventions (Bailey & Arciuli, 2020; Roberts et al., 2020).

Co-occurrence of Behavior Problems and Reading Difficulties

A substantial number of research studies suggest an existing relationship between academics and problem behavior (Cook et al., 2012; Fleming et al., 2004; Hinshaw, 1992; Lim & Kim, 2011; Morgan et al., 2008; Nelson et al., 2003; Roberts et al., 2015; Wanzek et al., 2006). Four models explaining the relationship between reading achievement and problem behavior have been identified: (a) reading difficulties lead to problem behavior, (b) problem behavior leads to reading difficulties, (c) co-occurrence of reading difficulties and problem behavior, and (d) attending challenges lead to reading difficulties and problem behavior (Hinshaw, 1992; McIntosh et al., 2008; Morgan et al., 2008).

The first model discusses that reading difficulties, especially persistent reading difficulties, evoke frustration or problem behavior to escape the task or activity. Hence, problem behavior serves an escape function. For example, a student struggling during reading instruction begins to feel frustrated and engages in problem behavior (e.g., verbal protesting) to escape the reading instruction. The second model explains that problem behavior leads to challenges in reading. Engaging in problem behavior takes attention and time away from the instruction, thus resulting in low academic engagement and reduced access to instruction. For example, a student engaging in problem behavior (e.g., talking to classmates) will most likely have his/her attention on the classmates rather than the reading instruction.

The third model describes the relationship between reading difficulties and problem behavior as occuring at the same time. For example, a student who is at high risk

for reading difficulties will also be at high risk for problem behavior. The final model states that attention specific problems lead to reading difficulties and problem behavior (McIntosh et al., 2008; Morgan et al., 2008). For example, a student who has challenges attending may experience frustration as a result of not being able to attend during reading instruction leading to problem behavior (e.g., verbal protesting) and reduced access to the reading instruction. Although all four models include a different hypothesis on the directionality of the relationship between reading and problem behavior, they all highlight the importance of considering problem behavior when developing reading instruction and interventions.

Theoretical Frameworks

The Simple View of Reading (SVR) suggests that reading comprehension is the product of two components (Catts et al., 2003; Gough & Tunmer, 1986; Klingner et al., 2007). The first being word recognition, translating printed text and words, which requires skills in phonics (e.g., sounding letters) and phonological awareness (e.g., decoding). The second being language comprehension, understanding text when it is heard, which requires skills in vocabulary (e.g., meaning and appropriate use of words) and inference-making (e.g., mental pictures). According to the SVR, challenges in one of both components lead to poor reading comprehension (Catts et al., 2003).

Research studies of students with autism consistently suggest the following reader profiles which align with the heuristic of the SVR: (a) average to above average decoding and low reading comprehension, and (b) low decoding and reading comprehension, where decoding was measured by word recognition assessments and reading

comprehension was measured by linguistic and comprehension measures (McIntyre et al., 2017; Nation et al., 2006; Ricketts, 2013). As with many areas (e.g., academics, social skills), the reading strengths and weaknesses of students with autism is heterogeneous (McIntyre et al., 2017), however several research studies support the SVR model for students with autism (Huemer & Mann, 2010; Lucas & Norbury 2014; McIntyre et al., 2017; Nation et al., 2006; Randi et al., 2010; Ricketts, 2013). The reader profiles of students with autism highlight challenges in decoding (measured by word recognition assessments) and/or reading comprehension (measured by linguistic assessments) and the importance of considering language skills when assessing reading comprehension, all consistent with the SVR.

Another theoretical framework that provides insight into reading comprehension challenges is the cognitive theory of Weak Central Coherence (WCC), which addresses the processing style observed in students with autism (Happe & Frith, 2006). Since the early observations of autism, a tendency to focus on details rather than the larger picture has been described as a characteristic of autism (Kanner, 1943). The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) autism criteria aligns with this observation and includes restricted and repetitive patterns of behavior, interests, or activities as a core symptom of autism, which can be manifested by fixated interests or focus on an object or topic (American Psychiatric Association, 2013). For example, a student with autism might focus on learning the names of all the dinosaurs (Happe & Frith, 2006). The detailed oriented cognitive process, therefore, poses a challenge when it comes to processing information for meaning (Happe & Frith, 2006). According to WCC,

rather than focusing on the global picture, a student with autism will focus on smaller details.

SVR and WCC theoretical frameworks are often applied to students with autism (Happe & Frith, 2006; Huemer & Mann, 2010; Lucas & Norbury 2014; McIntyre et al., 2017; Nation et al., 2006; Randi et al., 2010; Ricketts, 2013). SVR provides a framework for understanding reading comprehension, specifically the components that are key for proficiency in reading comprehension, whereas WCC provides a framework for understanding the unique cognitive processing challenges experienced by students with autism, that impact a task, such as reading comprehension which requires the ability to identify key concepts and discern them from extraneous details (Catts et al., 2003; Happe & Frith, 2006).

Significance of the Study

Several research studies have examined reading comprehension interventions for students with disabilities (Asberg et al., 2010; Bailey et al., 2017; Bethune & Wood, 2013; Ganz & Flores, 2009; Reutebuch et al., 2015; Solis et al., 2016). Findings from research have provided an empirical base for the use of (a) vocabulary instruction, (b) fluency instruction, (c) sentence level and multi-paragraph reading comprehension instruction, (d) question generating, and (e) graphic organizers to improve reading comprehension (Asberg et al., 2010; Bailey et al., 2017; Bethune & Wood, 2013; Ganz & Flores, 2009; Reutebuch et al., 2015; Solis et al., 2016; Solis et al., 2022). The National Reading Panel (NPR) recommends and supports the use of these instructional approaches to improve the reading comprehension skills of students with diverse needs (Shanahan,

2005). While a smaller quantity of research has examined the efficacy of these strategies at improving the reading comprehension levels of students with autism, systematic reviews of reading interventions for students with autism conducted over the last decade reinforce the use of vocabulary instruction, fluency instruction, sentence level and multi-paragraph reading comprehension instruction, question generating, and graphic organizers (Bailey & Ariciuli, 2020; Chiang & Lin, 2007; El Zein, Finnegan & Mazin, 2016; Knight et al., 2013; Knight & Sartini, 2015; Senokossoff, 2016; Solis et al., 2014; Whalon et al., 2009). Preliminary findings from group design and single-case design studies further support the efficacy of the strategies at increasing the reading comprehension levels of students with autism (Asberg et al., 2010; Bailey et al., 2017; Bethune & Wood, 2013; Ganz & Flores, 2009; Reutebuch et al., 2015; Solis et al., 2016).

More current reading comprehension research is examining the impacts of adding a behavior component (Bailey et al., 2017; Drill & Bellini, 2021; Reutebuch et al., 2015; Roberts et al., 2021; Solis et al., 2016). To achieve this research studies are embedding behavior interventions with reading interventions and/or including a behavior outcome measure. Studies focused on students with autism fall in one of the following categories: (a) reading plus behavior intervention and reading outcomes (Bailey et al., 2017; Drill & Bellini, 2021; Howorth et al., 2016; Kamps et al., 2016), (b) reading intervention only and reading plus behavior outcomes (Kamps et al., 1994; Reutebuch et al., 2015), and (c) reading plus behavior intervention and reading plus behavior outcomes (Kamps et al., 1995; Solis et al., 2016). The few studies including a behavior intervention and outcome measure have indicated that embedding a behavior intervention may result in positive

outcomes for both reading and/or behavior (Bailey et al., 2017; Drill & Bellini, 2021; Howorth et al., 2016; Kamps et al., 2016; Kamps et al., 1995; Solis et al., 2016). Examples of the behavioral strategies resulting in positive behavior and/or reading outcomes include visual schedules, verbal and social reinforcement, and point systems. It should be noted that the majority of the studies utilized a single-case design, included students in the elementary grades, and placed a focus on reading interventions and outcomes. Research focused on embedding a behavior component, both as an intervention and outcome measure, is lacking. Practitioners may benefit from future research assessing the impacts of embedding a behavior intervention within a reading intervention on the behavior of students with autism. This study seeks to contribute to the research in this area of education by investigating different approaches to intervention through a comparison of a reading only intervention and a reading plus behavior intervention.

Study Purpose

The purpose of this secondary analysis was to analyze student engagement levels for an alternating treatment single-case design study (N = 3) that was conducted in Spring 2021 via a distance learning platform (i.e., Zoom) during Covid-19. At the time of the study, the participants were transitioning to in-person instruction. Communication was prioritized to ensure that parents and school personnel were aware of the details of the study and to reduce any confusion and/or miscommunication stemming from distance learning (Baweja et al., 2021; Pokhrel & Chhetri, 2021).The study sought to compare the relative effects of a pre-developed reading intervention (Solis et al., 2022) to a reading

intervention that embedded behavior supports into the instruction to determine whether levels of engagement would improve with the addition of the behavior supports and to answer the following research question: What are the effects of integrating behavior supports into a reading intervention on student engagement levels relative to a reading intervention without behavior supports? Based on findings from research, it was hypothesized that embedding behavior supports into a reading intervention would improve student engagement levels (Bruhn & Watt, 2012; Roberts et al., 2021; Sinclair et al., 2019; Solis et al., 2016).

Chapter 2: Synthesis of Research

This chapter includes a synthesis of research addressing reading comprehension and behavior interventions and/or outcomes for students with autism and other disabilities that often have difficulty with attending to tasks during academic instruction. Only reading comprehension interventions and outcomes are discussed and analyzed, although some of the studies included multicomponent reading interventions consisting of different reading components and assessed different reading outcomes (e.g., word recognition, fluency). For the purposes of this paper, a reading comprehension intervention was defined as instruction focused on reading text, summarization, prediction, tracking information, and/or discussing main idea and/or reading comprehension questions (e.g., who, what; Shanahan, 2005). A reading comprehension measure included measures assessing the understanding of text by answering questions, developing questions, filling-in the blank, and/or identifying information. A behavior intervention was defined as strategies implemented contingent on desired behavior (e.g., reading text, eyes on the teacher, following rules) and/or problem behavior (e.g., protesting, leaving seat; Roberts et al., 2020; Roberts et al., 2015). A behavior outcome measure included measures assessing desired behavior (e.g., engagement levels) and/or problem behavior (e.g., protesting levels).

Due to limited research including students with autism as participants (Bailey et al., 2017; Roberts et al., 2019; Solis et al., 2016) the criterion for the participant disability category was generally established to increase the corpus of studies reviewed. Studies including students with disabilities, such as but not limited to learning disabilities (LD),

behavioral disorders (BD), and at-risk for reading difficulties were included. The inclusion criteria, search procedures, and data analysis procedures are outlined below followed by an overview of the study features.

Inclusion Criteria

Studies were included if they met the following criteria: (a) published in a peer-reviewed journal from 1975 to 2021, (b) utilized an experimental, quasi-experimental or single-case research design, (c) participants were in grades K-12 or ages 5-18, (d) included participants with or at risk of a disability such as, but not limited to autism, LD, at-risk of reading difficulties, and BD (e) included a reading intervention with a reading comprehension component, (f) included a behavior intervention and/or a behavior outcome measure, and (g) was conducted and reported in English. Studies reporting pre- and post-test outcomes for one condition and/or treatment group (Chavez et al., 2015; Strayhorn & Bickel, 2002), AB single-case design studies, and dissertations were excluded.

Search Procedures

First, a computer-assisted search using Educational Resources Information Center (ERIC) and PsycINFO was completed. The key terms used included reading, reading interventions, reading comprehension, problem behavior, reinforcement, and behavior supports. This search resulted in 2,421 hits that were reviewed. Second, an ancestral review of four relevant systematic reviews (Bailey & Arciuli, 2020; El Zein et al., 2013; Finnegan & Mazin, 2016; Roberts et al., 2015) and one meta-analysis (Roberts et al., 2020) addressing reading interventions, reading outcomes, behavior interventions, and/or

behavior outcomes was completed. This search resulted in 72 studies that were reviewed to identify if they met the inclusion criteria and to eliminate double listings. An additional four studies were identified.

Data Analysis

The following information was identified and coded for all studies: (a) study design, (b) sample size, (c) age, (d) grade, (e) student disability, (f) duration of the intervention, (g) intervention implementor, (h) treatment fidelity, (i) social validity, (j) interventions, and (k) outcome measures. Additionally, the What Works Clearinghouse (WWC) Procedures and Standards Handbook (version 5.0) was used to provide a brief evaluation of the studies, specifically an evaluation of the quality of the interventions and outcome measures (WWC, 2022).

For group design studies, effect sizes were calculated using Hedge's *g*. Effect size values from 0.20 to 0.50 represented small effect sizes, 0.50 to 0.80 represented medium effect sizes, and 0.80 and above represented large effect sizes (Cooper & Hedges, 1994). A total of two studies (Gest & Gest, 2005; Jenkins et al., 1994) did not include the necessary information (e.g., means) to calculate the effect sizes. Hedge's *g* was used considering that many of the studies had small sample sizes and that the calculation of this effect size provides a more conservative estimate of the magnitude of effect.

For single-case design studies, a visual analysis including an investigation of level, trend, variability, immediacy of effect, and overlap was completed. Additionally, Tau-U was calculated by utilizing a web-plot digitizer (Rohatgi, 2022) and an online single-series calculator (Pustejovsky et al., 2022). Tau-U values from 0 to .20 represented

small changes, 0.20 to 0.60 represented moderate changes, 0.60 to 0.80 represented large changes, and 0.80 and above represented very large changes (Parker et al., 2011). A total of five studies (Barton-Arwood et al., 2005; Harris et al., 2009; Hilsmier et al., 2016; Kamps et al., 1995; Staubitz et al., 2005) did not include the necessary information to conduct a visual analysis and calculate Tau-U. Tau-U was selected considering that it has been used in other single-case design studies to attain more details about overlap, is well-suited for small data sets, and has an agreed upon categorization of small, moderate, and large effects (Harrison et al., 2019; Parker et al., 2011; Roberts et al., 2021; Vannest & Ninci, 2015).

Overview of Study Features

A total of 21 studies met the inclusion criteria, six group design and 15 single-case design studies. Of the six group design studies, four were experimental and two were quasi-experimental. All the group design studies included a comparison condition with the exception of one study (Orkin et al., 2018). The additional study compared two different treatments. Of the single-case design studies, 10 were multiple-baseline, four were withdrawal, and one was an alternating treatment design. Of the 21 studies, eight included the behavior component as an intervention, six included it as an outcome measure, and seven included it as both an intervention and outcome measure. The total number of intervention sessions ranged from 3-130.

The reading comprehension interventions across the studies included anaphoric cueing, computer-assisted reading comprehension (e.g., prediction, sequencing) instruction, peer mediated learning, precorrection, question development, read-model-

read, story mapping, think before, during, and after reading, and/or video self-modeling. Some of the studies employed commercially published products including Cooperative Integrated Reading and Composition (CIRC), Collaborative Strategic Reading (CSR), Great Leaps Reading Program, Horizon Fast Track Reading Program, Open Court Reading, RAVE-O, READ 180, Read Naturally, Reader Theater, Reading Mastery, Responsive Reading Instruction, Sonday System, Voyager Passport and/or the Wilson Reading Program. The behavior interventions included behavior expectations, point systems (e.g., token economy, class-wide point system), perseverative interest, response-cost system, self-monitoring, sticker chart, social skills instruction, verbal and social reinforcement, and/or visual schedules.

A total of 435 students were represented in the studies. Sample sizes ranged from 1 to 155. Of the studies 11 focused on students in grades K-4, nine focused on grades 5-8, and one focused on grades 9-11. Out of the 21 studies, eight included students with autism, six included students with or at risk of RD and BD or ADHD, five included students with varying disabilities (e.g., LD, ID, BD), and two included students with or at-risk of RD only. One of the studies did not provide information to clarify if part of the sample had a disability eligibility (Jenkins et al., 1994). The intervention implementers included researchers (10 studies), teachers (9 studies), teachers and researchers (1 study), and peers (1 study). Of the 21 studies, 16 reported treatment fidelity and nine reported social validity. A majority of the studies that reported treatment fidelity and social validity were single-case design studies. Summaries of the study features are presented in tables 1 and 2.

Table 1
Group Design Study Features

Study	Study Design	*N*	Age	Grade	Student Disability	Duration	Implementer	Treatment Fidelity	Social Validity
Reading plus Behavior and Reading Outcomes									
Bailey et al. (2017)	Experimental	20	5-11 years	NR	ASD	13 weeks (26 sessions)	Researcher	Yes*	No
Denton et al. (2013)	Experimental	72	7.7-7.8 years (*M)*	2	RD	24-26 weeks (120-130 sessions)	Teacher	Yes	No
Kamps et al. (2016)	Quasi-experimental	62	5-7 years	NR	ASD	2 years (129 sessions (*M*))	Teacher	Yes	No
Reading and Behavior Outcomes									
Gest & Gest (2005)	Experimental	17	NR	K-2	At-risk of RD and BD	NR (32-37 sessions)	Researcher and Teacher	No	No
Jenkins et al. (1994)	Quasi-experimental	860	NR	1-6	LD = 52 ID = 3 BD = 3 UD = 95	NR	Teacher	Yes	No

Table 1 Continued

Study	Study Design	*N*	Age	Grade	Student Disability	Duration	Implementer	Treatment Fidelity	Social Validity
Reading plus Behavior and Behavior Outcomes									
Orkin et al. (2018)	Experimental	47	7-10 years	1-4	At-risk of RD Co-occuring Disabilities: Anxiety (n = 2) ADHD (n = 8) Dyslexia (n = 21) Communication (n = 9) PDD (n = 4)	5 weeks (NR)	Teacher	No	No

Note. ASD = Autism Spectrum Disorder; ADHD = Attention-Deficit Hyperactivity Disorder; BD = Behavior Difficulties/Disorder; ID = Intellectual Disability; LD = Learning Disability; *M* = Mean; NR = Not Reported; PDD = Pervasive Developmental Disorder; RD = Reading Difficulties; UD = Unidentified Disability.

*Evidence of treatment fidelity for the computer-led tasks were described. Evidence for the instructor-led instruction was not collected.

Table 2

Single-Case Design Study Features

Study	Study Design	*N*	Age	Grade	Student Disability	Implementer	Treatment Fidelity	Social Validity
Reading plus Behavior and Reading Outcomes								
Drill & Bellini (2021)	Multiple Baseline	3	12-14 years	5-8	ASD, SI ASD, LI ASD, LI	Researcher	Yes	Yes
Harris et al. (2009)	Multiple Baseline	8	6-7 years	1	At-risk for BD and RD	Teacher	Yes	Yes
Hilsmier et al. (2016)	Multiple Baseline	4	12-13 years	6-8	LD LD ADHD LI, ADHD	Researcher	Yes	No
Howorth et al. (2016)	Multiple Baseline	4	10-11 years	5-6	ASD	Researcher	Yes	Yes
Staubitz et al. (2005)	Multiple Baseline	6	9-11 years	4-5	ED, BPD, ADHD ED ED, ADHD SLD, ED ED	Researcher	Yes	Yes

Table 2 Continued

Study	Study Design	*N*	Age	Grade	Student Disability	Implementer	Treatment Fidelity	Social Validity
Reading and Behavior Outcomes								
Kamps et al. (1994)	Multiple Baseline	3	8-9 years	2-3	ASD	Student	No	No
Miao et al. (2002)	Multiple Baseline	6	7-8 years	1	At-risk for BD and RD	Researcher	No	No
Reutebuch et al. (2015)	Multiple Baseline	3	15-17 years	9-11	ASD	Researcher	Yes	Yes
Wehby et al. (2003)	Multiple Baseline	8	7-9 years	2-4	EBD HI, EBD EBD EBD, LD HI, SL EBD, SL LD, SL ID	Researcher	Yes	No
Reading plus Behavior and Behavior Outcomes								
Barton-Arwood et al. (2005)	Multiple Baseline	6	8 years	3	ED, LI ED OHI, LD, SLI LD, OHI, SLI ED ED, LD	Teacher	Yes	No

Table 2 Continued

Study	Study Design	*N*	Age	Grade	Student Disability	Implementer	Treatment Fidelity	Social Validity
Reading plus Behavior and Behavior Outcomes								
Bruhn & Watt (2012)	Withdrawal	2	NR	7-8	RD, BD RD, BD, ADHD	Teacher	Yes	Yes
Kamps et al. (1995); Study 1	Withdrawal	1	8 years	3	ASD	Teacher	No	Yes
Kamps et al. (1995); Study 2	Withdrawal	2	12-13 years	5	ASD	Teacher	No	Yes
Roberts et al. (2021)	Withdrawal	3	10 years	4	At-risk for BD and RD	Researcher	Yes	Yes
Sinclair et al. (2019)	Withdrawal	1	13 years	8	At-risk for BD and RD	Teacher	Yes	Yes
Solis et al. (2016); Study 1	Alternating Treatment	2	12-13 years	5	ASD, ADHD, SI ASD, SI	Researcher	Yes	No
Solis et al. (2016); Study 2	Alternating Treatment	2	10 years	3	ASD, SI	Researcher	Yes	No

Note. ADHD = Attention-Deficit Hyperactivity Disorder; ASD = Autism Spectrum Disorder; BD = Behavioral Disorder; BPD = Bipolar Disorder; DV = Dependent Variable; ED = Emotional Disturbance; EBD = Emotional and Behavioral Disorder; HI = Health Impairment; IV = Independent Variable; LD = Learning Disability; LI = Language Impairment; OHI = Other Health Impairment; RD = Reading Difficulties; SI = Speech Impairment; SL = Speech and Language; SLD = Specific Learning Disability.

Next, summaries focused on interventions, outcome measures, and findings will be provided beginning with group design studies. Studies will be disaggregated into the following categories (a) reading plus behavior and reading outcomes, (b) reading and behavior outcomes, and (c) reading plus behavior and behavior outcomes. The first category titled reading plus behavior and reading outcomes includes studies with a reading comprehension intervention, behavior intervention, and a reading comprehension outcome measure. The second category titled reading and behavior outcomes includes studies with a reading comprehension intervention and a behavior outcome measure. Some of the studies in this category include a reading comprehension outcome measure in addition to the behavior outcome measure (one group design and two single-case design studies). The third category titled reading plus behavior and behavior outcomes includes studies with a reading comprehension intervention, behavior intervention, and behavior outcome measure. Similarly, to the second category, some of the studies in this category include a reading comprehension outcome measure in addition to the behavior outcome measure (one group design and two single-case design studies). Summaries of interventions, outcomes and measures are presented in tables 3 and 4.

Group Design Studies

Reading plus Behavior and Reading Outcomes

This section summarizes studies in which the behavior component was present only as the intervention. Thus, the following components are discussed: (a) reading comprehension intervention, (b) behavior intervention, and (c) reading comprehension

outcome measures. Of the three studies two were experimental (Bailey et al., 2017; Denton et al., 2013) and one was quasi-experimental (Kamps et al., 2016).

Bailey et al. (2017) matched students with autism (N = 20) ages 5-11 on reading and adaptive abilities and then randomly assigned them to either the intervention or control group. Students in the intervention group (n = 11) received in-home 1:1 multicomponent computer-assisted reading instruction for 13 weeks. The reading comprehension instruction consisted of vocabulary, summarization, prediction, and story elements. Additionally, students in the intervention group received rewards including pictures/short videos (e.g., someone scoring in a hockey-themed picture) on the computer screen during the reading sessions and a free choice activity (e.g., Legos) at the end of the session to increase participation and engagement. Students in the control group followed their typical school schedules and activities (n = 9). The analysis of variance (ANOVA) revealed a statistically significant interaction between time and group favoring the intervention group for the Neale Analysis of Reading Ability (NARA-3). However, Hedges *g* revealed a small difference ($g = 0.30$) between the intervention and control group for the NARA-3.

In Denton et al. (2013) second grade students (N = 72) with reading difficulties (RD) were randomly assigned to the intervention (n = 47) or control (n = 25) group. The main reading intervention program was an adapted version of Responsive Reading Instruction (RRI). Students in the intervention group received instruction on different reading components for approximately 24 weeks.

Table 3

Group Design Studies: Summary of Interventions, Measures, and Outcomes

Study	Reading Comprehension Intervention	Behavior Intervention	Reading Comprehension Measure(s)	Behavior Measure(s)	Findings
Reading plus Behavior and Reading Outcomes					
Bailey et al. (2017) Comparison-BAU	T1: Multicomponent computer-assisted intervention including summarization, prediction, and story elements.	T1: Rewards (e.g. Lego time, picture of shots in a hockey-themed picture).	NARA-3	NA	T1 vs. C, *ES*= 0.31
Denton et al. (2013) Comparison- BAU	T1: Responsive Reading Instruction	Point system	WJ III: PC GM: RC	NA	T1 vs. C, *ES*= 0.07 T1 vs. C, *ES*= 0.40
Kamps et al. (2016) Comparison- BAU	T1: Reading Mastery	T1: Verbal praise	WRMT: PC	NA	T1 vs. C, *ES*= -0.03
Reading and Behavior Outcomes					
Gest & Gest (2005) Comparison- BAU	T1: Multicomponent intervention including reading and discussing text.	NA	NA	Direct observation of on-task and off-task behavior	NA

Table 3 Continued

Study	Reading Comprehension Intervention	Behavior Intervention	Reading Comprehension Measure(s)	Behavior Measure(s)	Findings
Reading and Behavior Outcomes					
Jenkins et al. (1994) Comparison- BAU	T1: Reading Mastery, Cooperative Integrated Reading and Composition, and Peer-tutoring	NA	MAT GM: RC	SSCSA	NA
Reading plus Behavior and Behavior Outcomes					
Orkin et al. (2018)	T1: RAVE-O, Wilson Reading Program T2: RAVE-O, Wilson Reading Program	T1: Motivational strategies T2: Token economy	SRI: PC	OPALS- Modified	SRI-PC: T1 vs. T2, *ES*= 0.51 OPALS: T1 vs. T2, *ES*= 0.78

Note. C = Comparison; ES = Effect size calculation using Hedge's *g;* GM = Gates-MacGinitie; MAT = Metropolitan Achievement Test; NA = Not Applicable and/or lacking the necessary data to calculate effect size; NARA = Neale Analysis of Reading Ability; OPALS = Observing Patterns of Adaptive Learning Survey; PC = Passage Comprehension; RC = Reading Comprehension; SRI = Standardized Reading Inventory; SSCSA = Walker McConnell of Social Competence and School Adjustment; T1 = Treatment One; T2 = Treatment Two; WJ = Woodcock Johnson; WRMT = Woodcock Reading Mastery Test.

Table 4

Single-Case Design Studies: Summary of Interventions, Measures, and Outcomes

Study	Intervention(s)	Reading Comprehension Measure(s)	Behavior Measure(s)	Outcomes (Tau-U)
Reading plus Behavior and Reading Outcomes				
Drill & Bellini (2021)	Reading: Reader Theater, Story Mapping, Video Self-Modeling Behavior: Visual schedule, Reinforcement	CQP	NA	CQP: 0.84; 0.67; 0.32
Harris et al. (2009)	Reading: Harcourt Trophies, Sonday System, and Great Leaps Reading Program Behavior: Response-cost system	NA	NA	NA
Hilsmier et al. (2016)	Reading: Read-Model-Read Behavior: Reinforcement	SRA comprehension measure	NA	NA
Howorth et al. (2016)	Reading: TWA Strategy Behavior: Reinforcement	Comprehension questions	NA	Comprehension questions: 1.06; 0.87; 0.92; 0.92

Table 4 Continued

Study	Interventions	Reading Comprehension Measure(s)	Behavior Measure(s)	Outcomes (Tau-U)
Reading plus Behavior and Reading Outcomes				
Staubitz et al. (2005)	Reading: Peer-mediated reading Behavior: Verbal praise, Sticker chart	Fill-in the blank WJ-III: PC	NA	NA
Reading and Behavior Outcomes				
Kamps et al. (1994)	Reading: CWPT Behavior: NA	Comprehension questions	SIC	Comprehension questions: 0.64; 0.80; 0.43 SIC: 0.78; 0.69; 0.78
Miao et al. (2002)	Reading: Reading Mastery and Precorrection Behavior: NA	NA	Direct observation of engagement	Engagement: 1.10; 1.13; -0.12
Reutebuch et al. (2015)	Reading: CSR Behavior: NA	Comprehension questions	Direct observation of challenging behavior, social initiations, social responding	Comprehension questions: 0.90; 0.38; 0.98 CB: 0.30; 0.67; 1.52 SI: 0.68; -0.29; 0.77 SR: 0.92; 0.29; 0.82

Table 4 Continued

Study	Interventions	Reading Comprehension Measure(s)	Behavior Measure(s)	Outcomes (Tau-U)
Reading and Behavior Outcomes				
Wehby et al. (2003)	Reading: Open Court Reading and PALS Behavior: NA	NA	MOOSES	MOOSES AE: 0.03; -0.12; 0.41; 0.30; 0.56; -0.17; 0.24; 0.39 MOOSES IB: 0.16; 0.17; -0.09; -0.25; 0, -0.39, 0, 0.06
Reading plus Behavior and Behavior Outcomes				
Barton-Arwood et al. (2005)	Reading: Horizons Fast Track Reading Program and PALS Behavior: Point system	NA	MOOSES	MOOSES: NA
Bruhn & Watt (2012)	Reading: READ 180 Behavior: Self-monitoring and Reinforcement	NA	Direct observation of engagement and disruptive behavior	Engagement: 1.06; 1.00 Disruptive behavior: 1.00; 0.69
Kamps et al. (1995): Study 1	Reading: CLG Behavior: Social skills instruction, Verbal praise, and Sticker chart	Comprehension questions	CISSAR MOOSES	Comprehension questions: 1.06 CISSAR: NA MOOSES: NA

Table 4 Continued

Study	Interventions	Reading Comprehension Measure(s)	Behavior Measure(s)	Outcomes (Tau-U)
Reading plus Behavior and Behavior Outcomes				
Kamps et al. (1995); Study 2	Reading: CLG Behavior: Social skills instruction, Verbal praise, and Sticker chart	Comprehension questions	CISSAR MOOSES	Comprehension questions: 0.58; 0.54 CISSAR: NA MOOSES: NA
Roberts et al. (2021)	Reading: Voyager Passport Behavior: Behavior expectations, Verbal praise, and Point system	NA	Direct observation of engagement	Engagement: 0.81; 0.93; 0.53
Sinclair et al. (2019)	Reading: PALS Behavior: Class-wide point system	NA	Direct observation of engagement and disruptive behavior	Engagement: 1.37 Disruptive behavior: 1.42

Table 4 Continued

Study	Interventions	Reading Comprehension Measure(s)	Behavior Measure(s)	Outcomes (Tau-U)
Reading plus Behavior and Behavior Outcomes				
Solis et al. (2016); Study 1	Reading: Question development Behavior: Token economy and Perseverative interest	CBM reading probes	Direct observation of engagement	CBM: 0.38; 0.80 Engagement: 0.75; 1.00
Solis et al. (2016); Study 2	Reading: Anaphoric cueing Behavior: Token economy and Perseverative interest	CBM reading probes	Direct observation of engagement	CBM: 0.88; 0.38 Engagement: 1.12; 1.12

Note. CB = Challenging Behavior; CBM = Curriculum Based Measures; CISSAR = Code for Instructional Structure; CSR = Collaborative Strategic Reading; CQP = Comprehension Quiz Protocol; CLG = Cooperative Learning Groups; CWPT = Class-wide Peer Tutoring; DV = Dependent Variable; IV = Independent Variable; MOOSES = Multiple Option Observation System for Experimental Studies; NA = Not Applicable; PALS = Peer Assisted Learning Strategies; SI = Social Initiation; SIC = Social Interaction Code; SR = Social Responses; TWA = Think Before, Think While, Think After; WJ PC = Woodcock Johnson Passage Comprehension.

The reading comprehension component focused on reading text, discussing comprehension related questions, and identifying if sentences made sense. The behavior intervention consisted of a behavior game in which teachers and students received points. Students received points for following rules and participating. Teachers received points when students did not follow rules and/or participated. On days in which the students had more points than the teacher, they received stickers and/or small prizes. Students in the control group continued their typical school instruction. Based on the ANOVA analysis, the researchers detected a statistically significant interaction between time and group favoring the intervention group for the Woodcock Johnson Passage Comprehension (WJ-III), but not the Gates-MacGinitie Reading Comprehension (GM). Hedges *g* indicated small differences between the intervention and control group on both the WJ-III (g = 0.07) and the GM (g = 0.40).

A study by Kamps et al. (2016) included students with autism ages 5-7 (N = 62) that were assigned to either the intervention or control group. The intervention group (n = 32) received small-group instruction for an average of 129 sessions and utilized lessons from Reading Mastery. The reading comprehension lessons included reading text and completing comprehension activities from workbooks. The behavior intervention included delivering continuous verbal praise during the reading sessions. Alternatively, the comparison group received the business-as-usual reading instruction provided by the school. While the multilevel model analysis revealed improvements in word reading, improvements were not statistically significant for the Woodcock Reading Mastery Test

Passage Comprehension. Hedges *g* (*g* = -0.03) reinforces the findings: No differences between groups on reading comprehension.

Summary of Reading plus Behavior and Reading Outcomes Studies. Overall, there were no similarities on the behavior intervention implemented across the studies. Further, based on the WWC quality indicators of group design studies (WWC, 2022), the description of the behavior interventions among the studies lacked clarity and detail. The intervention components, instructional materials and/or procedures were not described. Additionally, an operationalized definition for the target behaviors (e.g., participation) was not included. Of the three studies, Denton et al. (2013) provided the most detailed definition for the behavior intervention implemented. Additionally, there were no commonalities on the outcome measures used, however Hedge's *g* revealed small to no differences between the intervention and comparison groups across the studies. Effect sizes ranged from *g* = -0.03 to *g* = 0.40, suggesting that reading interventions embedding behavior supports moderately impact the reading comprehension of students with disabilities (i.e., ASD, RD; Bailey et al., 2017; Denton et al., 2013; Kamps et al., 2016).

Reading and Behavior Outcomes

This section summarizes studies in which the behavior component was present as an outcome measure only. The following components are discussed: (a) reading comprehension intervention, (b) behavior outcome measures, and (c) reading comprehension outcome measures. The final component is present for one of the studies (Jenkins et al., 1994). Of the two studies one was experimental (Gest & Gest, 2005) and

one was quasi-experimental (Jenkins et al., 1994). Hedges *g* was not calculated for the studies because the necessary information was not available.

Gest & Gest (2005) matched students at risk of RD and BD in grades K-2 (N = 17) on grade, sex, and teacher ratings of academic skills and aggression and then randomly assigned students to one of the two groups. The intervention group (n = 10) received a multicomponent reading intervention for 32-37 sessions. Part of the intervention focused on reading comprehension activities involving reading and discussing the text. The control group (n = 7) received their typical class instruction. To collect on-task and off-task behaviors, the researchers utilized a 12-second time sampling recording system. Student data was collected during the first six seconds of every 12-second interval by researchers who were blind to the experimental conditions. On-task behavior was defined as looking at the assignment, (passive) engaging in motor-activity (active) and volunteering relevant information (initiating). Examples of the three types of on-task behaviors included looking at the worksheet, responding to the teacher, and raising hand to answer a question respectively. A definition of off-task behavior was not provided. A comparison of the average percentage of time on-task revealed that most of the students in the intervention group increased their time on-task. Gest & Gest (2005) reported that all students in the intervention group with the exception of two students increased their time on task while only one of the students in the control group slightly increased their time on-time.

In Jenkins et al. (1994) students in grades 1-6 from one elementary school served as the experimental school (n = 332) while students from a second elementary school

served as the control school (n = 528). The participants included typically developing students as well as students with disabilities. Of the 153 students receiving remedial or special educations services 52 were identified as having LD, 3 as having ID, and 3 as having a BD. The study did not provide disability information for the participants receiving remedial services (n = 95). The intervention consisted of lessons from Reading Mastery (RM) and Cooperative Integrated Reading and Composition (CIRC). Peer-tutoring was also embedded in the intervention. The reading comprehension lessons entailed reading text, predicting, summarizing information, and identifying the main idea. The behavior measure included the Walker McConnell of Social Competence and School Adjustment (SSCSA). The SSCSA is a five-point rating scale ranging from never to frequently completed by teachers. The rating scale included a total of 43 items measuring peer-related skills, social behavior, and adaptive behavior. The reading comprehension measure included the Metropolitan Achievement Test (MAT) and the Gates-MacGinitie: Reading Comprehension (GM). A multivariate analysis of variance (MANOVA) revealed the following: (a) no significant change from the first to the second ratings on the SSCSA, (b) significantly larger gains for the students in the experimental school on the MAT, and (c) significantly larger gains for the students in the experimental school who received remedial education on the GM. Outcomes for the GM were not reported for all participants.

Summary of Reading and Behavior Outcomes Studies. Overall, there were no similarities among the behavior outcome measures used. Both studies provided a clear and detailed description of the behavior outcome measure (WWC, 2022). Hedges *g* could

not be calculated for Gest & Gest (20015) and Jenkins et al. (1994) due to missing information (e.g., means), thus inferences about the impact of reading comprehension interventions on the behavior of students with disabilities could not be made.

Reading plus Behavior and Behavior Outcomes

This final section focused on group design studies provides a summary of the only study including a behavior intervention and an outcome measure. In addition to a behavior outcome measure, the study also included a reading comprehension outcome measure. The following components are discussed: (a) reading comprehension intervention, (b) behavior intervention, (c) behavior outcome measure, and (d) reading comprehension outcome measure. The study was experimental and compared two different treatments.

Orkin et al. (2018) matched students at-risk of RD ages 7-10 on reading ability to create groups of no more than six students and then randomly assigned groups to one of the intervention groups. Students received intervention sessions for five weeks. The reading programs in both intervention groups were RAVE-O and the Wilson Reading Program. RAVE-O and the Wilson Reading Program are multicomponent reading programs including lessons in word recognition, fluency, and reading comprehension. The reading comprehension lessons consisted of text comprehension strategies. The behavior intervention in the first intervention group (n = 24) consisted of a multicomponent behavior intervention, while the behavior intervention in the second intervention group (n = 23) included a token economy system. The multicomponent intervention consisted of verbal praise, choice, and motivational strategies (e.g.,

understanding challenges and behavior, goal setting). The token economy included the delivery of stickers for completing activities and access to a prize box containing small toys at the end of the lessons.

The behavior measure included a modified version of the Observation Patterns of Adaptive Learning Survey (OPALS), while the reading comprehension measure included the Standardized Reading Inventory (SRI: PC). To complete the OPALS, researchers conducted observations and recorded the frequency of student classroom behavior (e.g., engagement, avoidance). A Mann-Whitney test indicated greater engagement levels for the first intervention group when compared to the second intervention group, but no group differences on levels of avoidance behaviors. MANCOVA showed significantly higher scores on the SRI for the first intervention group when compared to the second intervention group. Additionally, Hedges *g* indicated large differences on the OPALS ($g = 0.78$) and moderate differences between the intervention groups on the SRI: PC ($g = 0.51$).

Through the lens of the WWC quality indicators, the definition of the multicomponent reading intervention was detailed while the definition of the token economy lacked detail, such as a description of the materials (e.g., token economy board) and information on whether a preference assessment was conducted to select the stickers and small prizes. Further, while a thorough description was provided of the behavior outcome measure the specific target behaviors were unclear, and definitions or examples of the target behaviors were not included (WWC, 2022). Overall, findings in this study suggest that reading and behavior interventions have large impacts on the engagement

and moderate impacts on the reading comprehension of students with disabilities. Lastly, findings in Orkin et al. (2018) indicate behavioral interventions differing, with some producing better outcomes for students with disabilities.

Single Case Design

Visual Analysis

This section summarizes the visual analysis for ten studies. A total of three studies (Hilsmier et al., 2016; Kamps et al., 1995; Staubitz et al., 2005) did not report the necessary information to complete a visual analysis (individual data or graphs not reported), one study (Barton-Arwood et al., 2005) did not include visible graphs, and the third study (Harris et al., 2009) did not included a behavior or reading comprehension outcome measure. The visual analysis consisted of analyzing level, trend, variability, immediacy of effect, and overlap. Visual analysis observations are presented for the reading comprehension measures (6 total) first followed by the behavior measures (13 total). See table 5 for the visual analysis.

Visual analysis of level for the reading comprehension measures indicated positive findings in the intervention phase for all measures. A visual inspection of trend demonstrated mixed trends in the baseline phase for all six measures. Of the six measures with mixed trends, four included a combination of neutral and descending trends (Howorth et al., 2016; Kamps et al., 1994; Kamps et al., 1995; Reutebuch et al., 2015) and two included a combination of neutral and ascending trends (Drill & Bellini, 2021; Solis et al., 2016). A visual inspection of trend in the intervention phase revealed (a) five measures with mixed trends (Howorth et al., 2016; Kamps et al., 1994; Kamps et al.,

1995; Reutebuch et al., 2015; Solis et al., 2016) and (b) one measure with an ascending trend (Drill & Bellini, 2021). All the measures with mixed trends included a combination of neutral and ascending trends.

Variability that favored the intervention phase for all participants on reading comprehension measures was observed in one measure (Reutebuch et al., 2015). For the remainder of the measures either variability favoring the baseline phase (Kamps et al., 1995) or mixed variability at the student level was observed (Drill & Bellini, 2021; Howorth et al., 2016; Kamps et al., 1994; Solis et al., 2016). An immediacy of effect inspection suggested that an immediate effect was present across all students in three measures (Howorth et al., 2016; Reutebuch et al., 2015; Solis et al., 2016). A total of six reading comprehension measures were available for an overlap analysis. The pooled overlap was 103/210 (49%), indicating that 49% of the data points during the intervention phase had a greater positive outcome than the greatest positive outcome during the baseline phase.

For the behavior outcome measures, a visual analysis of level indicated: (a) eleven measures with positive findings in the intervention phase (Bruhn & Watt, 2012; Kamps et al., 1994; Miao et al., 2002; Reutebuch et al., 2015; Roberts et al., 2021; Sinclair et al., 2019; Solis et al., 2016) and (b) two measures with results that varied across participants (Wehby et al., 2003). A visual inspection of trend indicated seven measures with mixed trends, five with neutral trends (Reutebuch et al., 2015; Sinclair et al., 2019; Wehby et al., 2003), and one with a descending trend (Bruhn & Watt, 201) in the baseline phase. Of the seven measures with mixed trends, four included a

combination of neutral and descending trends (Kamps et al., 1994; Miao et al., 2002; Roberts et al., 2021; Solis et al., 2016) and three include a combination of neutral and ascending trends (Bruhn & Watt, 2012; Reutebuch et al., 2015; Wehby et al., 2003). For the intervention phase the trend inspection indicated ten measures with mixed trends and three measures with neutral trends (Sinclair et al., 2019; Wehby et al., 2003). Of the ten measures with mixed trends, eight included a combination of neutral and ascending trends (Bruhn & Watt, 2012; Kamps et al., 1994; Miao et al., 2002; Reutebuch et al., 2015; Roberts et al., 2021; Solis et al., 2016; Wehby et al., 2003) and two included a combination of neutral and descending trends (Bruhn & Watt, 2012; Reutebuch et al., 2015). An important consideration for trend is that four measures (Bruhn & Watt, 2012; Reutebuch et al., 2015; Sinclair et al., 2019; Wehby et al., 2003) assessed behaviors in which the goal was to decrease rather than to increase them (e.g., inappropriate behavior). As such, a descending trend was ideal.

Variability that favored the intervention phase for all or almost all students on behavioral measures was observed in five measures (Bruhn & Watt, 2012; Sinclair et al., 2019; Solis et al., 2016). For the remainder of the measures either variability favoring the baseline phase (Kamps et al., 1994; Reutebuch et al., 2015) or mixed variability at the student level was observed (Miao et al., 2002; Reutebuch et al., 2015; Roberts et al., 2021; Wehby et al., 2003). An immediacy of effect analysis suggested that an immediate effect was present across all students in nine behavior measures (Bruhn & Watt, 2012; Kamps et al., 1994; Miao et al., 2002; Reutebuch et al., 2015; Sinclair et al., 2019; Solis et al., 2016). A total of 13 behavior outcome measures were available for an overlap

analysis. The pooled overlap was 179/446 (40%) suggesting that 40% of the data points during the intervention phase had a greater positive outcome than the greatest positive outcome during the baseline phase. See table 5 for the complete visual analysis. Next, summaries focused on interventions, outcome measures, and findings are provided for the single-case design studies.

Reading plus Behavior and Reading Outcomes

This section summarizes five studies in which the behavior component was present only as the intervention. The following components are discussed: (a) reading comprehension intervention, (b) behavior intervention, and (c) reading comprehension outcome measures. The final component was not present for one of the studies (Harris et al., 2009). All the studies utilized a multiple baseline design. Of the five studies, two studies (Hilsmier et al., 2016; Staubitz et al., 2005) did not report individual participant data and/or graphs for the reading comprehension outcome measure, therefore Tau-U could not be calculated.

Drill & Bellini (2021) assessed the impact of a reading and behavior intervention on the reading outcomes of three students with autism ages 12-14. The reading intervention consisted of Reader Theater, story mapping, and video self-modeling. As a package, the reading intervention focused on reading comprehension (e.g., reading, tracking information, conveying the story). The behavior intervention included a visual schedule and reinforcement. The visual schedule listed each component that would be covered during the session. Reinforcement included the delivery of small items (e.g., candy, bouncy ball) at the end of each session for completing the session components.

Table 5
Single-Case Design Studies: Visual Analysis

Study	Outcome Measure(s)	Level	Trend	Variability	Immediacy of Effect	Overlap
Reading plus Behavior and Reading Outcomes						
Drill & Bellini (2021)	CQP	Higher in intervention than baseline	Baseline: Neutral or ascending Intervention: Ascending across all	Lower in intervention than baseline for 2 participants; Lower in baseline than intervention for 1 participant	Yes for 2 participants; Low for 1 participant	15/17; 6/12; 5/6
Harris et al. (2009)	NA	NA	NA	NA	NA	NA
Hilsmier et al. (2016)	SRA comprehension measure	NA	NA	NA	NA	NA
Howorth et al. (2016)	Comprehension questions	Higher in intervention than baseline	Baseline: Neutral or descending Intervention: Neutral or ascending	Lower in intervention than baseline for 2 participants; Equal variability across phases for 2 participants	Yes	5/6; 4/6; 5/9; 6/6
Staubitz et al. (2005)	Fill-in the blank	NA	NA	NA	NA	NA
	WJ-III: PC	NA	NA	NA	NA	NA

Table 5 Continued

Study	Outcome Measure(s)	Level	Trend	Variability	Immediacy of Effect	Overlap
Reading and Behavior Outcomes						
Kamps et al. (1994)	Comprehension questions	Higher in intervention than baseline except for one phase where baseline is slightly higher than intervention	Baseline: Neutral or descending Intervention: Neutral or ascending	Mixed across phases	Mixed across phases	6/35; 17/31; 0/14
	SIC	Higher in intervention than baseline	Baseline: Neutral or descending Intervention: Neutral or ascending	Lower in baseline than intervention	Yes, exception 2 phases	28/40; 10/31; 14/15
Miao et al. (2002)	Engagement	Higher in intervention than baseline	Baseline: Neutral or descending Intervention: Neutral or ascending	Slightly lower in baseline than intervention for 2 groups; Lower in intervention than baseline for 1 group	Yes	15/15; 7/9; 1/4

Table 5 Continued

Study	Outcome Measure(s)	Level	Trend	Variability	Immediacy of Effect	Overlap
Reading and Behavior Outcomes						
Reutebuch et al. (2015)	Comprehension questions	Higher in intervention than baseline*	Baseline: Neutral or descending Intervention: Neutral or ascending	Lower in intervention than baseline	Yes*	2/4; 0/3; 0/4
	Challenging behavior	Lower in intervention than baseline	Baseline: Neutral or ascending Intervention: Neutral or descending	Lower in intervention than baseline for 2 participants; Lower in baseline than intervention for 1 participant	Yes for 1 participant; No for 2 participants	2/4; 1/3; 4/4
	Social initiations	Higher in intervention than baseline*	Baseline: Neutral across all Intervention: Neutral or ascending	Lower in baseline than intervention*	Yes*	5/5; 0/3; 5/5
	Social responding	Higher in intervention than baseline*	Baseline: Neutral across all Intervention: Neutral or ascending	Lower in baseline than intervention*	Yes*	5/5; 0/3; 5/5

Table 5 Continued

Study	Outcome Measure(s)	Level	Trend	Variability	Immediacy of Effect	Overlap
Reading and Behavior Outcomes						
Wehby et al. (2003)	MOOSES- AE	Higher in intervention than baseline for 4 participants; Slightly higher in baseline than intervention for 4 participants	Baseline: Neutral across all Intervention: Neutral across all	Lower in intervention than baseline for 5 participants; Lower in baseline than intervention for 4 participants	No*	0/16; 0/12; 0/15; 0/15; 4/11; 0/9; 0/11; 0/11
	MOOSES- IB	Lower in intervention than baseline for 4 participants; Lower in baseline than intervention for 4 participants	Baseline: Neutral or ascending Intervention: Neutral or ascending	Lower in intervention than baseline for 3 participants; Lower in baseline than intervention for 4 participants; Equal variability for 1 participant	No*	0/16; 0/12; 0/15; 0/15; 0/11; 0/9; 4/11; 0/10

Table 5 Continued

Study	Outcome Measure(s)	Level	Trend	Variability	Immediacy of Effect	Overlap
Reading plus Behavior and Behavior Outcomes						
Barton-Arwood et al. (2005)	MOOSES: AE	NA	NA	NA	NA	NA
	MOOSES: IB	NA	NA	NA	NA	NA
Bruhn & Watt (2012)	Engagement	Higher in intervention than baseline	Baseline: Descending across all Intervention: Neutral or ascending	Lower in intervention than baseline	Yes	9/9; 7/8
	Disruptive behavior	Lower in intervention than baseline	Baseline: Neutral or ascending Intervention: Neutral or descending	Lower in intervention than baseline	Yes; Low for 1 participant	7/9; 2/8
Kamps et al. (1995); Study 1	Comprehension questions	Higher in intervention than baseline	Baseline: Descending Intervention: Ascending	Slightly lower in baseline than intervention	Yes	13/14
	CISSAR	NA	NA	NA	NA	NA
	MOOSES	NA	NA	NA	NA	NA

Table 5 Continued

Study	Outcome Measure(s)	Level	Trend	Variability	Immediacy of Effect	Overlap
Reading plus Behavior and Behavior Outcomes						
Kamps et al. (1995); Study 2	Comprehension questions	Higher in intervention than baseline	Baseline: Neutral or descending Intervention: Neutral across all	Lower in baseline than intervention	Mixed across phases	9/13; 0/13
	CISSAR	NA	NA	NA	NA	NA
	MOOSES	NA	NA	NA	NA	NA
Roberts et al. (2021)	Engagement	Higher in intervention than baseline*	Baseline: Neutral or descending Intervention: Neutral or ascending	Mixed across phases	Mixed across phases	8/9; 6/9; 5/9
Sinclair et al. (2019)	Engagement	Higher in intervention than baseline	Baseline: Neutral Intervention: Neutral	Lower in intervention than baseline	Yes	7/9
	Disruptive behavior	Lower in intervention than baseline	Baseline: Neutral or descending Intervention: Neutral or ascending	Lower in intervention than baseline	Yes	2/9

Table 5 Continued

Study	Outcome Measure(s)	Level	Trend	Variability	Immediacy of Effect	Overlap
Reading plus Behavior and Behavior Outcomes						
Solis et al. (2016); Study 1	CBM reading comprehension probe	Higher in T2 than T1	T1: Ascending across all T2: Neutral or ascending	Lower in T2 than T1	Yes	0/4; 5/5
	Engagement	Higher in T2 than T1	T1: Neutral across all T2: Neutral across all	Lower in T2 than T1	Yes	3/4; 5/5
Solis et al. (2016); Study 2	CBM reading comprehension probe	Higher in T2 than T1	T1: Neutral across all T2: Ascending across all	Slightly lower in T1 than T2 for 1 participant; Equal variability for 1 participant	Yes	3/4; 2/4
	Engagement	Higher in T2 than T1	T1: Neutral or descending T2: Neutral or ascending	Lower in T2 than T1 for 1 participant; Slightly lower in T1 than T2 for 1 participant	Yes	4/4; 4/4

Note. AE = Academic Engagement; CBM = Curriculum Based Measures; CISSAR = Code for Instructional Structure; CQP = Comprehension Quiz Protocol; DV = Dependent Variable; IB = Inappropriate Behavior; IV = Independent Variable; MOOSES = Multiple Option Observation System for Experimental Studies; NA = Not Applicable and/or lacking the necessary information to conduct visual analysis; PC = Passage Comprehension; SIC = Social Interaction Code; T1= Treatment One; T2= Treatment Two.

* = In exception to one participant/comparison

During baseline, students did not receive the intervention. Reading comprehension was measured by the percentage of questions answered correctly on the comprehension quiz protocols (CPQ). The questions on the CPQ included a combination of literal and inference-making questions. Tau-U for the reading comprehension measure indicated very large (0.84), large (0.67), and moderate (0.32) changes for participants one, two, and three respectively.

In Howorth et al. (2016) four students with autism ages 10-11 received reading and behavior intervention sessions consisting of the TWA strategy and reinforcement. The TWA strategy consisted of completing specific steps before, during, and after reading. Examples of the steps included linking prior knowledge to text, rereading, summarizing information read, and identifying the main idea. Reinforcement included stickers and individualized reinforcers for completing the steps of the TWA strategy and reaching a pre-established mastery criterion. The individualized reinforcers were not disclosed. However, researchers identified the reinforcers prior to intervention sessions. During baseline, students did not receive the reading and behavior intervention. Reading comprehension was measured by the percentage of questions answered correctly. After reading a passage, students completed questions targeting text structure, inference-making, main idea, vocabulary, and sentence level syntax. Tau-U indicated very large (1.06, 0.87, 0.92, 0.92) changes from baseline to intervention across participants.

In Hilsmier et al. (2016) four students with LD, ADHD, and/or language impairment (LI) ages 12-13 received no instruction during baseline, a reading intervention following baseline, and a reading plus behavior intervention following the

reading only intervention. The reading intervention, which was the same across the conditions with instruction, consisted of Read-Model-Read (RMR). The focus of the instruction was repeated reading and answering questions. The behavior intervention consisted of delivering reinforcers for meeting reading goals. Reinforcers were identified prior to intervention via a preference assessment in which students were asked to list and rate preferred items. Reading comprehension was measured by the percentage of correct answers on the SRA comprehension measure. For this measure students answered a total of five comprehension questions after reading a passage. Tau-U was not calculated because individual data or graphs were not presented for the measure.

In Staubitz et al. (2005) six students with or at-risk of emotional disturbance, bipolar disorder, ADHD, and/or LD ages 9-11 received a reading and behavior intervention during the intervention phase consisting of peer-mediated reading, error-correction, verbal praise, and stickers. The reading intervention placed a focus on repeated readings and reading comprehension questions. Prior to the intervention phase, students received training on reading appropriately and the error correction procedure (e.g., stop, the word is ___.). Details or examples of the behavior intervention were not provided. During baseline, students engaged in sustained silent reading. The reading comprehension measures included a fill-in the blank activity in which five words were blanked out from a reading passage and the WJ-III Passage Comprehension. Tau-U was not calculated due to missing information (individual data not presented).

Lastly in 2009 Harris et al. provided students at-risk for reading and behavioral difficulties ages 6-7 with small group reading and behavior intervention sessions. The

reading intervention incorporated lessons from the Sonday System and Great Leaps. Both programs include lessons in various reading components targeting word reading, fluency, and reading comprehension. Additionally, a response-cost system in which students and teachers received points was implemented. Students received points for academic engagement (e.g., eye contact, raising hand), reading behaviors, and accuracy (e.g., accuracy on sound cards), while teachers received points when students engaged in non-engagement (e.g., looking around the room). The multicomponent intervention was implemented in addition to the core reading program (i.e., Harcourt Trophies). Students received the core reading program during baseline and the core reading program plus the multicomponent reading intervention during the intervention phase. The study did not include a reading comprehension outcome measure, as such Tau-U findings are not discussed.

Summary of Reading plus Behavior and Reading Outcomes Studies. Of the five studies including the behavior component as the intervention, three included the delivery of reinforcers (e.g., access to preferred item) as the behavior intervention. The additional two studies utilized different behavior interventions. One of the studies included a response-cost system, while the other included verbal praise and a sticker chart. Moreover, based on the WWC quality indicators for single-case design, three studies included a detailed operationalized definition of the behavior intervention, while the remainder two studies lacked clarity and details about the intervention. All the studies were missing a description and/or examples of the materials (e.g., visual schedule) used for the behavior intervention. Further, all studies with exception to one included

answering questions for the reading comprehension measure. The additional study included a fill-in the blank activity and the WJ-III. Based on the studies for which Tau-U could be calculated, Tau-U findings suggest that a reading plus behavior intervention positively impacts the reading comprehension of students with disabilities (Drill & Bellini, 2021; Howorth et al., 2016).

Reading and Behavior Outcomes

This section summarizes four studies including the behavior component only as an outcome measure. The following components are addressed: (a) reading comprehension intervention, (b) behavior outcome measure, and (c) reading comprehension outcome measure. The final component is present in two of the four studies (Kamps et al., 1994; Reutebuch et al., 2015). All four studies used a multiple-baseline design.

Miao et al. (2002) provided six students with or at-risk of BD and RD ages 7-8 with a reading intervention consisting of precorrection strategies and lessons from Reading Mastery. The reading comprehension lessons focused on thinking skills and activating background knowledge. During baseline, students only received lessons from Reading Mastery. Direct observations were completed to collect data on engagement. A 10-second time sampling procedure in which the coder identified if the student was engaged or not engaged at the end of the interval was used. The definition of engagement was not clear. The researchers discussed that the definition of engagement was dependent on the desired behaviors for each of the sessions. Examples of academic engagement included eyes on the teacher or materials and raising hand to answer questions. Tau-U

revealed very large (1.10, 1.13) changes for two participants and no change (-0.12) for one participant.

In Wehby et al. (2003) eight students with EBD, LD, SL, and/or ID ages 7-9 received a multicomponent reading intervention consisting of modified versions of Open Court Reading Program and Peer-Assisted Learning Strategies (PALS) following baseline. The reading comprehension lessons focused on interacting with text and making connections and inferences. During baseline students followed their typical scheduled school activities. To collect data on academic engagement, The Multiple Option Observation System for Experimental Studies (MOOSES), a computer-based observation system, was used during direct observations. Duration recording was used for academic engagement and frequency recording was used for inappropriate behavior. Academic engagement was defined as appropriately working on assigned activities by (a) attending to the material and task, (b) making appropriate motor responses, (c) asking for assistance, and (d) waiting appropriately for the teacher to begin and/or continue the instruction. Alternatively, inappropriate behavior was defined as statements, vocalizations, and gestures made with intent to provoke, annoy, complain, and/or make fun of another. For academic engagement, Tau-U revealed moderate (0.41, 0.30, 0.56, 0.24, 0.39) changes for five participants, small (0.03) changes for one participant, and no (-0.17) change for one participant from baseline to intervention. For inappropriate behavior, Tau-U showed small (0.16, 0.17, 0.06) changes for three participants and no change (-0.09, -0.25, 0, -0.39, 0) for five participants.

Kamps et al. (1994) assessed the impacts of a reading intervention on the reading and social behavior outcomes of three students with autism ages 8-9. During the intervention phase, students received class-wide peer tutoring focused on fluency and reading comprehension. Some of the intervention activities included reading passages, feedback from peers, and reading comprehension questions focused on the five w's. During baseline, students received their typical reading instruction. To measure social behavior researchers utilized the Social Interaction Code (SIC) which is a computerized system to record the duration of social behavior (i.e., initiations, responses, duration of interactions). Initiations were defined as motor or vocal behavior directed to a peer to elicit a social response, while responses were defined as motor or vocal behavior within three seconds to acknowledge an initiation. Reading comprehension was measured by the percentage of correct responses on comprehension questions. Students completed five comprehension questions focused on the five w's (e.g., who, what, where) after completing a timed reading. For the behavior measure, Tau-U revealed large (0.78, 0.69, 0.78) changes across participants from baseline to intervention. For the reading comprehension measure, Tau-U revealed large (0.64, 0.80) changes for two participants and a moderate (0.43) change for one participant.

In Reutebuch et al. (2015) students with autism ages 15-17 received an adapted version of Collaborative Strategic Reading (CSR). The CSR lessons focused on activating student's background knowledge and supporting reading comprehension by implementing specific strategies before (e.g., teaching key words), during (e.g., answering true and false questions), and after (e.g., summarizing reading) reading. The

strategies included both teacher and student strategies. During baseline, students engaged in their typical school activities. Direct observations were conducted to collect data on challenging behavior, social initiations, and social responses. Frequency recording was used to collect data on social initiation and responses across participants, whereas partial interval recording was used for two participants, and frequency recording was used for one participant to collect data on challenging behavior. The definition of challenging behavior was individually defined for each participant.

For the first participant in Reutebuch et al., (2015), challenging behavior included any instance of the following (a) leaving seat, (b) looking away from implementer or materials for longer than three seconds, (c) engaging in an irrelevant activity, and (d) participating in a conversation and/or asking questions irrelevant to the reading topic. For the second participant, it was defined as refusal to engage in a task within five seconds of the implementer's request. For the final participant, it was defined as any instance of scratching, rubbing, or squeezing any area of the skin. Social interactions were defined as motor or vocal behavior directed to a peer to evoke a response, while social responses were defined as motor or vocal behavior within three seconds serving as a reply to an initiation. Reading comprehension was assessed by the percentage of correct multiple-choice responses to reading comprehension questions. No further details were reported for the reading comprehension probe. For challenging behavior Tau-U indicated moderate (0.30), large (0.67) and very large (1.52) changes from baseline to intervention for the first, second, and third participant respectively. For social initiations, Tau-U indicated large (0.68, 0.77) changes for two participants and no (-0.12) change for one

participant. For social responses Tau-U suggested very large (0.92, 0.82) changes for two participants and a moderate (0.29) change for one participant from baseline to intervention. Lastly, for reading comprehension, Tau-U calculations suggested very large (0.90, 0.98) changes for two participants and a moderate (0.38) change for one participant from baseline to intervention.

Summary of Reading and Behavior Outcomes Studies. In summary, all studies with the exception of one study embedded some form of peer-assisted learning for the reading intervention. Aside from this, there were no similarities among the reading interventions. For the behavior measure, all four studies utilized direct observations to collect data on the target behaviors (e.g., academic engagement, inappropriate behavior). Of the four studies, one included a measure of academic engagement, one included a measure of social behavior, and two included measures of academic engagement or social behavior plus inappropriate behavior. Half of the studies used a computer-based system for data collection purposes during direct observations, while the other half used researcher developed data sheets. Additionally, the reading comprehension measure, in the two studies including a reading comprehension measure in addition to the behavior measure, consisted of answering questions. Overall, the four studies reviewed in this section provide evidence that reading interventions can positively impact the academic engagement, social behavior, and inappropriate behavior of students with disabilities (Kamps et al., 1994; Miao et al., 2002; Reutebuch et al., 2015; Wehby et al., 2003).

Reading plus Behavior and Behavior Outcomes

This final section of single-case design studies summarizes research including a behavior intervention and outcome measure. The following components are discussed: (a) reading comprehension intervention, (b) behavior intervention, (c) behavior outcome measure, and (d) reading comprehension outcome measure. The last component was present in two of the six studies (Kamps et al., 1995; Solis et al., 2016). Of the six studies, the research designs included withdrawal (4 studies), multiple baseline (1 study), and alternating treatment (1 study). Tau-U was not calculated for one of the studies because the graphs and data were not clearly visible (Barton-Arwood et al., 2005) or the necessary information was not presented (Kamps et al., 1995).

In Barton-Arwood et al. (2005) six third grade students with ED, LD, and/or SLI received a reading and behavior intervention comprising of Horizons Fast Track Reading Program, Peer-Assisted Learning Strategies (PALS), and a point system. The reading comprehension lessons consisted of reading stories and direct instruction in reading comprehension. The point system included delivering points for completing activities and following rules. Students were able to exchange points for small prizes once a week. Examples of the small prizes were not provided. During baseline, students receive their typical reading instruction consisting of reading worksheets and an adapted version of the Wilson Reading System.

Barton-Arwood et al. (2005) used the Multiple Option Observation System for Experimental Studies (MOOSES) to collect data on academic engagement, nonengagement, and inappropriate behavior. Duration recording was used for academic

engagement and nonengagement and frequency recording was used for inappropriate behavior. Academic engagement was defined as appropriately working on assigned activities demonstrated by the following: (a) attending to the materials, (b) making appropriate motor responses, (c) asking for assistance in an acceptable manner, or (d) siting and quietly waiting for the teacher to begin or continue instruction. Alternatively, nonengagement was defined as not participating in assigned activities demonstrated by (a) looking around the room, (b) out of seat without permission, (c) disrupting others, (d) talking to peers without permission, or (d) sleeping. Inappropriate behavior consisted of negative talk and aggression. Negative talk included statements or vocalizations made with the intent to provoke, annoy, mock, make fun of another, and/or physical threats, arguing with another, and verbally refusing. Aggression was defined as physical contact that is harmful or potentially harmful to self, others, and/or property. Tau-U was not calculated for this study because the data on the graphs could not be accurately decoded. The first and second author were emailed but different versions of the graphs were not provided.

Bruhn & Watt (2012) provided two students with RD, BD, and/or ADHD in grades 7-8 with a reading intervention consisting of lesson from READ 180 and a behavior intervention consisting of self-monitoring and reinforcement. READ 180 included a combination of whole and small-group instruction on different components of reading and writing. The reading comprehension lessons consisted of direct instruction in reading comprehension and structured independent reading. For self-monitoring students tracked and rated positive attitude (e.g., avoid rolling eyes), respectful behavior (e.g.,

raise hand), being prepared and on time (e.g., have all necessary materials), and doing your best (e.g., stay on task) by completing a checklist. After completing the checklist, the teacher reviewed the checklist and provided verbal praise for meeting expectations or corrective feedback to help student's meet the expectations next session. If students met the expectations, they were able to select a lower value reinforcer (e.g., be the classroom helper) at the end of each intervention session and a higher value reinforcer (e.g., pizza for lunch) at the end of the week. The reinforcers were selected by students and teachers. Students developed a list of preferred items and teachers reviewed the student list and developed a final list including approved items. During baseline, students only received lessons from READ 180 (no behavior intervention).

To collect data on academic engagement and disruptive behavior, Bruhn & Watt (2021), conducted direct observations. A 30-second whole interval recording system was used for academic engagement and a partial-interval recording system was used for disruptive behavior. Students were recorded as engaged if they were engaged during the whole interval and recorded as disruptive if they were disruptive at any time during the interval. Academic engagement was defined as attending to the assigned task. An example included eyes oriented towards the teacher during instruction, whereas a non-example included wandering around the classroom. Moreover, disruptive behavior was defined as unruly behavior preventing other students from engaging in the assigned task. Examples included making inappropriate noises and talking to classmates. Non-examples included participating in class when instructed by the teacher and using materials appropriately. Tau-U for academic engagement indicated very large (1.06, 1.00) changes

for both participants from baseline to intervention. For disruptive behavior, Tau-U indicated a very large (1.00) change for one participant and a large (0.69) change for the other participant from baseline to intervention.

In 2021, Roberts et al. assessed the impact of a reading and behavior intervention on the academic engagement of three students aged 10 who were at-risk for BD and RD. During baseline, students received a reading intervention, while in the intervention phase students received a reading plus behavior intervention. The multicomponent reading intervention consisted of lessons from Voyager Passport (same across phases). Reading comprehension lessons focused on previewing text, vocabulary, and checking for understanding through discussion questions, and making connections. The behavior intervention consisted of behavior expectations, verbal praise, precorrections, and a point system. At the beginning of the lesson, behavior expectations and goals were reviewed. Immediately after this a three-minute timer started and continued throughout the lessons. Every three minutes, points were delivered if students were engaging in specific behavior. If students were engaged in the target behavior(s) they received a point paired with verbal praise, however if they were not engaged in the target behavior(s) they received a precorrection. At the end of the lesson, points were tallied and students who met their point goal engaged in a three-minute activity (e.g., Go Fish) with the implementor, while students who did not meet their point goal continued working on the intervention activities.

To collect data on academic engagement, Roberts et al. (2021), completed direct observations consisting of reviewing intervention session video recordings. A 10-second

momentary time sampling recording system was used which entailed recording if the student was engaged or not at the end of the interval. A one was recorded if the student was engaged or a zero if the student was not engaged. Academic engagement was defined as engaging in the following: (a) eyes oriented towards assignment or the teacher during instruction, (b) working on the assigned task, (c) using the materials appropriately, and (d) interacting with teachers or peers about topics related to the assignment. Tau-U calculations indicated a very large (0.81, 0.93) change for two participants and a moderate (0.53) change for one participant.

Sinclair et al. (2019) provided a student aged 13 at-risk for BD and RD with a reading and behavior intervention. The reading intervention consisted of Peer-Assisted Learning Strategies (PALS), whereas the behavior intervention consisted of a class-wide point system. PALS focused on partner reading, retelling, paragraph shrinking, and predicting. For the class-wide point system all the students in the classroom were assigned to one of two teams. During reading instruction, points were awarded. At the end of each week, points were tallied and the team with more points received a reinforcer (e.g., candy bar). During baseline, the student received his business-as-usual reading instruction. Direct observations were conducted to collect data on academic engagement and disruptive behavior. Frequency recording was used for academic engagement, while duration recording was used for disruptive behavior. Academic engagement was defined as observable behaviors following specific instructional stimuli or passively participating in classroom activities by listening or watching. Examples of academic engagement included reading words and answering questions orally. Non-examples included staring

out the window and walking across the room. Alternatively, disruptive behavior was defined as behavior that interrupted or had the potential to interrupt the instruction. Examples of disruptive behavior included speaking out of turn and tapping pencil on the desk, whereas non-examples included raising hand and asking their partner to try again. Tau-U indicated very large (1.37, 1.42) changes for academic engagement and disruptive behavior from baseline to intervention.

Kamps et al. (1995) conducted two studies examining the impact of a reading plus behavior intervention on the reading and behavior outcomes of three students with autism ages 8-13. During baseline, students received their typical reading instruction focused on vocabulary, story concepts, main idea, sequencing, and story mapping. During the intervention phase, students were assigned to Cooperative Learning Groups (CLG) to complete peer tutoring on vocabulary, reading comprehension questions, such as who and what type questions, and an academic game focused on characters from stories. Additionally, a behavior intervention consisting of social skills instruction, verbal praise, and a sticker chart was implemented. The social skills instruction varied across the studies. For study one the social skills instruction consisted of direct instruction focused on specific social skills (e.g., sharing and cooperating), while for study two it focused on providing examples of social behavior necessary for group participation. Verbal praise was delivered as a form of feedback during the lessons and the sticker chart consisted of providing stickers on a chart for engaging in social behavior (e.g., reacting calmly, helping others).

The behavior outcome measures in Kamps et al. (1995) included the Code for Instructional Structure (CISSAR) and a modified version of the Multiple Option Observation System for Experimental Studies (MOOSES). The CISSAR was used to collect data on active academic engagement (e.g., writing, reading aloud), attention to task (e.g., passively listening, observing the lesson), and other nonacademic behavior (e.g., locating materials, transitioning to activities). A 10-second time sampling recording system was used to collect data on all behaviors. Further, a modified version of the MOOSES was utilized to collect data on the frequency of initiations (e.g., motor or vocal behavior directed to a peer) and the duration of responses (e.g., motor or vocal behavior in reply to an initiation). The reading comprehension outcome measure included a series of comprehension questions that students completed at the end of sessions. The questions were literal, factual, and inferential type questions. For reading comprehension, Tau-U indicated moderate (0.54, 0.58) changes for two participants and a very large (1.06) change for one participant from baseline to intervention. Tau-U was not calculated for any of the behavior measures because the necessary information to calculate Tau-U was not reported. The gain scores rather than individual participant scores were presented and discussed for the behavior outcome measures. The data for this study could not be attained because the first author no longer had the data.

Solis et al. (2016) conducted two separate but related studies comparing the impact of two treatments on the reading and behavior outcomes of four students with autism ages 10-13. The reading intervention consisted of either question development (study 1) or anaphoric cueing (study 2). The behavior intervention was the same across

the studies consisting of a token economy and student's perseverative interest. As such, for the first treatment students received the reading intervention only (question development or anaphoric cueing), whereas for the second treatment students received the reading intervention with the addition of the behavior intervention. While the reading interventions shared similarities including the use of a graphic organizer, the question development intervention focused on developing questions based on the context of the text, while anaphoric cueing focused on identifying pronouns in the text. The token economy consisted of delivering tokens on a 5-minute fixed interval schedule and access to reinforcers. Prior to intervention, a preference assessment was conducted to identify the student's interest. This information aided in the selection of the reinforcers and in the identification of reading passages (perseverative interest).

To collect data on academic engagement, Solis et al. (2016) conducted direct observations of intervention video recordings. A 30-second whole interval recording system which entailed recording whether the student was engaged or not during the entire interval was used. Academic engagement was defined as (a) sitting in seat, (b) looking at the assignment or the instructor, (c) using instructional materials in the intended manner, and (d) engaging appropriately in the task. On the other hand, non-engagement was defined as vocal or motor behavior inconsistent with the learning task, such as leaving the seat without approval. To measure reading comprehension a curriculum-based measure (CBM) was administered. The CBM for study one entailed reading a passage and developing questions with the five w's (e.g., who, what). Alternatively, the CBM for study two entailed reading a passage and identifying referents for the bolded words in the

passage. For academic engagement, Tau-U indicated a very large (1.00, 1.12, 1.12) change for three participants and a large (1.00) change for one participant from reading only to reading plus behavior. For reading comprehension, Tau-U indicated a moderate (0.38, 0.38) change for two participants, large (0.80) change for one participant, and a very large (0.88) change for one participant from reading only to reading plus behavior.

Summary of Reading plus Behavior and Behavior Outcomes Studies. Overall, the studies summarized in this section implemented various reading and behavior interventions. However, the most common reading intervention was peer-assisted learning (3 studies), while the most common behavior intervention was a point system (4 studies). Further, of the six studies, three studies (Bruhn & Watt, 2012; Roberts et al., 2021; Solis et al., 2016) included a detailed operationalized definition of the behavior intervention, while the remainder two studies lacked clarity and details about the intervention (IES, 2022). For example, one of the studies (Kamps et al., 1995) did not provide a definition for verbal praise or the sticker chart. All six studies were missing a description and/or examples of the materials (e.g., visual schedule) for the behavior intervention and the procedures for the behavior intervention (e.g., how preferred items were selected).

Regarding the outcome measures, direct observations were used across the studies. Of the six studies, two utilized the Multiple Option Observation System for Experimental Studies (MOOSES) as the data sheet during observations. One of the studies included two behavior outcome measures with the second measure being the Code for Instructional Practice (CISSAR). The target behaviors across the studies

included academic engagement and disruptive behaviors. Further, the two studies including a reading comprehension outcome measure in addition to the behavior outcome measure, utilized different measures for reading comprehension.

Across the studies for which a visual analysis was performed and Tau-U was calculated, findings indicated moderate to very large changes from baseline to intervention for the behavior outcome measures (Bruhn & Watt, 2012; Roberts et al., 2021; Sinclair et al., 2019; Solis et al., 2016), with most of the studies showing large to very large changes. For reading comprehension, findings suggested moderate to very large changes from baseline to intervention (Kamps et al., 1995; Solis et al., 2016). Altogether, the studies provide evidence for the positive impacts that a reading and behavior intervention has on the engagement levels, disruptive behavior, social behavior, and the reading comprehension of students with disabilities.

Considerations

A total of 21 studies met the inclusion criteria and were reviewed to support the empirical base of the study. Out of the 21 studies, eight included students with autism as part of the sample. The remainder of the studies included students with or at-risk for reading difficulties and a behavioral disorder (6 studies), with reading difficulties only (2 studies), and with a combination of disabilities including intellectual disability, learning disabilities, language impairment, and/or speech impairment (five studies). Of the studies, eleven focused on elementary school aged students, eight on middle school aged students, one on high school aged students, and one on a combination of elementary and middle school aged students.

Further, of the 21 studies eight embedded a behavior intervention, six measured behavior outcomes, and seven embedded a behavior intervention and measured behavior outcomes. Thus, only seven studies addressed the impacts of embedding behavior supports and provided insight about potential techniques to increase the levels of engagement for students with disabilities. Collectively, Hedges *g* and Tau-U calculations suggest the following: (a) a reading and behavior intervention has small to very large impacts on the reading comprehension of students with disabilities, (b) a reading intervention has no impact to very large impacts on behavior (e.g., engagement, disruptive behavior) and moderate to large impacts on the reading comprehension of students with disabilities, and (c) a reading and behavior intervention has large to very large impacts on behavior (e.g., engagement, disruptive behavior) and moderate to very large impacts on the reading comprehension of students with disabilities. Due to limited research in this area of study, more research assessing the impact of embedding behavior supports on the engagement levels of students with disabilities is needed.

Chapter 3: Methods

This chapter presents and reviews the methods for the secondary analysis of levels of engagement for an alternating treatment single-case design study completed in Spring 2021 during Covid-19. The primary analysis was part of a separate study assessing academic outcomes. The following are presented: (a) design summary, (b) research question, (c) participants and setting, (d) interventionist, (e) descriptive and dependent measures, (f) procedures, (g) interventions, (h) treatment fidelity, and (i) data analysis.

Design Summary

The study utilized an alternating treatment single-case design. This research design allowed for the simultaneous implementation of two treatments, reading only and reading plus behavior intervention. Additionally, this research design allowed for a secondary analysis to determine whether a functional relationship existed between manipulation of treatments and student engagement levels. Intervention sessions were randomized in blocks of two to ensure that the schedule did not include more than two consecutive sessions with the same treatment (WWC, 2020; WWC, 2022). Both conditions had a minimum of five data points per phase to meet the What Works Clearinghouse Design Standards without reservations (WWC, 2020; WWC 2022).

Research Question

1. What are the effects of integrating behavior supports into a reading intervention on student engagement relative to a reading intervention without behavior supports?

Participants and Setting

Parent consent and student assent forms approved by the Institutional Review Board of the sponsoring University were obtained for all participants. The participant selection criteria followed a two-step gating procedure. For the first gate, school administrators identified students that met the following criteria: (a) school-based special education eligibility under the autism category, (b) evidence of reading challenges including not passing the grade level state reading test or not meeting a reading related IEP goal, and (c) not identified as an English Learner. For the second gate, the Gilliam Autism Rating Scale, third edition (GARS) was administered. The GARS scores are categorized under three levels of symptom severity. Level one indicates milder symptoms (e.g., requiring minimal support) while level three indicates more severe symptoms (e.g., requiring very substantial support). Students with an index score between 71-100, level 2 (requiring substantial support), were selected for participation. See table 6 for student scores on the descriptive measures including the GARS-3.

The participants included three students (N = 3) with autism. The first student, Henry, was a 13-year-old Caucasian male in eighth grade. He did not receive free and reduced lunch or any pull-out reading service, other than the intervention for this study, for the 2022 school year. Henry's autism index score on the GARS-3 was 71. This score indicated that the probability of autism was very likely and substantial support was needed (level 2). The second student, Sara, was a 13-year-old Asian female in the seventh grade. She did not receive free and reduced lunch or any other pull-out reading service for the 2022 school year. Sara's autism index score on the GARS-3 was 77, also

indicating that the probability of autism was very likely and substantial support was needed. The third student, Diana, was a 13-year-old Caucasian female in the eighth grade. She did not receive free and reduced lunch or any other pull-out reading service for the 2022 school year. Diana's autism index score on the GARS-3 was 78. Similar to Henry's and Sara's autism index score, Diana's autism index score indicated that autism was very likely and substantial support was needed. English was reported as the home Language for all students. See Table 7 for student demographics.

The study was conducted in a specialized school run by a non-profit organization located in the southwestern United States. The school focuses on providing services to children and adolescents with autism, cognitive delays, social communication, language, and behavioral challenges. The school provides general education and specialized programs including small class sizes, individualized instruction, and related services (e.g., counseling, occupational theraphy). School demographics were not available online and could not be attained by the graduate researcher.

Interventionist

The interventionist was a Hispanic male serving as a teaching assistant at the non-profit organization who was hired for additional hours of work. He was trained and supervised by the graduate researcher. He had a High School degree, some college training, and 16 years of experience working with students and adults with autism, down-syndrome, emotional and behavioral disorders, and cerebral palsy. Additionally, he had five years working with the non-profit organization and prior experience in reading

instruction which he gained serving as a tutor for a literacy program during his early career.

Table 6
Descriptive Measures

Participant	GARS-3[a]	AIMSweb ORF[b]	WJ IV-LWID[c]	WJ IV-PC[c]
Henry	71 (Level 2)	42	83	46
Sara	77 (Level 2)	30	81	NR
Diana	78 (Level 2)	53	62	61

Note. GARS = Gilliam Autism Rating Scale; NR = Not Reported/Missing Data; ORF = Oral Reading Fluency; WJ IV-LWID = Woodcock Johnson Letter Word Identification; WJ IV-PC = Woodcock Johnson Passage Comprehension.
[a] Autism Index Score and Severity Level.
[b] Words read correctly.
[c] Reported as standard scores.

Table 7
Participant Demographics

Participant	Grade/Age	Gender	Race/Ethnicity	Free and Reduced Lunch
Henry	8/13 years	Male	Caucasian	No
Sara	7/13 years	Female	Asian	No
Diana	8/13 years	Female	Caucasian	No

Descriptive Measures

The descriptive measures included the Gilliam Autism Rating Scale (GARS), AIMSweb Oral Reading Fluency (AIMSweb ORF), and the Woodcock-Johnson Letter Word Identification (WJ-LWID) and Passage Comprehension (WJ-PC) subtests. In consideration of the heterogeneity that is part of autism, descriptive measures were administered to attain more information about the participants and to contextualize findings. The descriptive measures were all administered prior to the beginning of the single-case design study. In addition, a student and interventionist questionnaire were

distributed at the end of the study to gather information about the interventions (e.g., perspectives about effectiveness), materials, training, and coaching.

The Gilliam Autism Rating Scale, Third Edition (GARS)

Purpose. The GARS was administered to provide information about autism symptom severity (Level 1, 2, 3). Level one indicates a lower severity level whereas level three indicates a higher severity level. *Description.* The GARS is a standardized assessment of restricted/repetitive behaviors, social interaction, social communication, emotional response, cognitive style, and maladaptive speech. The average internal consistency reliability coefficient for the indexes and subscales round or exceed 0.90 in exception for cognitive style (.86) and maladaptive speech (.79) subscales (Gilliam, 2013).

AIMSweb, Oral Reading Fluency (AIMSweb, 2001)

Purpose. The AIMSweb ORF was administered to assess reading rate and to identify the readability level for the intervention materials. *Description*. The AIMSweb ORF is a one-minute timed reading of text leveled by grade level. Reliability coefficients range from 0.90 to 0.99 (Burns et al., 2010).

Woodcock-Johnson IV, Letter Word-Identification Subtest (WJ-LWID)

Purpose. The WJ-LWID was administered to assess word reading ability. *Description.* The LWID subtest requires the identification of written letters and verbalization of specific words. The difficulty of the letters and words increases over time. Reliability coefficients range from .91 to .94 (Schrank et al., 2014).

Woodcock-Johnson IV, Passage Comprehension Subtest (WJ-PC)

Purpose. The WJ-PC scores were used to assess reading comprehension.

Description. The PC subtest includes items that require matching a picture of a word with the picture of the object, identifying the picture that represents a specific phrase, and filling in blank(s) after reading short passages. The difficulty of the items increases over time. The reliability coefficient is .93 (Schrank et al., 2014).

Student Questionnaire

A student questionnaire was administered during the last intervention session. Prior to completing the questionnaire, the interventionist reviewed the instructions and completed a practice activity with the student. Part one of the questionnaire consisted of nine close-ended questions rated on a four-point scale. The questions focused on inquiring about the behavior intervention components, however they also targeted student feelings about working with the interventionist and learning to read. A four indicated "I really enjoy" accompanied by a happy face and a one indicated "Do not enjoy" accompanied by a sad face. Part two of the questionnaire consisted of open-ended questions delivered in an interview format. Some of the questions included the following: (1) What was your favorite part of the reading sessions? (2) For some of the sessions, we reviewed five expectations. For example, sit or stand with a calm body, did you like this part?, and (3) Did you like using the visual schedule for some of our sessions? See appendix A for an example of the student questionnaire.

Interventionist Questionnaire

The interventionist questionnaire included 22 close-ended questions rated on a four-point scale and one open-ended question. The questions targeted support (e.g., training, coaching sessions), feasibility, effectiveness, and acceptability. A score of four indicated strongly agree whereas a score of one indicated strongly disagree. The open-ended question asked the interventionist to share recommendations and/or feedback. See appendix B for an example of the interventionist questionnaire.

Dependent Measure

Student Engagement

The construct of engagement has been a topic of interest for many years and examined in various fields, some of which include behavioral sciences, psychology, and educational psychology (Fredricks et al., 2004; Skinner et al., 2009). Despite the field, there is consensus that engagement includes various dimensions, including behavioral (e.g., following rules, attention), emotional (e.g., student interests and emotions), and cognitive (e.g., motivation to learn, self-regulation). Engagement, for purposes of this study, primarily used a behavioral approach with a focus observable and measurable behavior and behavior that is often linked to attention related tasks and/or participation (Fredricks et al., 2004; Skinner et al., 2009). A behavioral approach seemed appropriate for this study seeing that this type of engagement enhances student learning and impacts academic success (Fredricks et al., 2004). Lastly, definitions of engagement used by previous research studies were considered in the development of the definition (Harris et al., 2005; Roberts et al., 2021; Roberts et al., 2019; Solis et al., 2016).

Engagement was defined as the student: (a) sitting on the chair, floor, or bed and/or standing with a calm body, (b) having eyes on the computer screen, tutor, and/or lesson materials, (c) using the lesson materials appropriately, and (d) asking lesson related questions or having a lesson related conversation. Alternatively, non-engagement was defined as the student engaging in the following: (a) head down on the desk and/or body on the floor, (b) looking away for more than three seconds from the computer screen, tutor, and/or lesson materials, (c) playing with materials irrelevant to the task, and (d) vocalizations irrelevant to the reading lessons. Examples of student engagement include sitting on the bed, looking at the screen, reading the lesson materials, and asking questions about the lesson. Non-examples include laying on the floor, looking at the ceiling, and initiating a conversation about a video game.

Student engagement was measured by coding the session video recordings. A 15-second momentary time sampling procedure was used to code student engagement. Momentary time sampling was selected because it is often used with continuous activity behaviors (e.g., engagement) and provides data similar to the data obtained with continuous recording systems (Cooper et al., 2020). Additionally, this recording system is well established as it has been used in research studies to measure engagement or behaviors similar to engagement (Cooper et al., 2020; Roberts et al., 2021). Each 45-minute intervention session was divided into 15-second intervals. At the end of each 15-second interval the coders identified if the student was engaged (1 point) or non-engaged (0 points) based on the operationalized definitions. After the whole 45-minute intervention session was coded, the percentage of intervals with student engagement was

calculated by dividing the total number of intervals with the presence of student engaged by the total number of intervals (with and without student engagement) and multiplied by 100.

Interobserver Agreement of Student Engagement. The graduate researcher coded 100% of the session video recordings. In consideration of WWC standards for single-case design studies, a random sample of 20% of the session video recordings were double-coded by an undergraduate researcher (WWC, 2022). Prior to coding engagement, the undergraduate researcher attended a five-hour training conducted by the graduate researcher. The training consisted of reviewing the operationalized definition of student engagement and non-engagement, examples and non-examples, and the 15-second momentary time sampling schedule. After reviewing the information, the graduate researcher provided a demonstration by coding a session video recording not selected for double coding. After the demonstration, the graduate and undergraduate researchers jointly coded another session video recording and discussed discrepancies as they arose. Once discrepancies were addressed, the graduate and undergraduate researchers independently coded additional video recordings until moderate agreement, kappa score of at least .60, was reached. Once moderate agreement was reached, the graduate and undergraduate researchers independently coded the remainder video recordings. Kappa remained at or above .60 for the session recordings that were double-coded.

Kappa was used to calculate IOA because it is well suited for categorical data (e.g., interval observation), corrects for chance agreement, and is considered a more robust measure for IOA (Kazdin, 2011). The following formula was used: $k = \frac{P_o - P_c}{1 - P_c}$

where P_o equals the number of agreements between observers on occurrences and nonoccurrence and P_c equals the number of agreements based on chance.

Procedures

Prior to the intervention sessions, the graduate researcher and research team worked with parents, teachers, and personnel from the district to preselect session times for each participant. Intervention sessions were delivered via a distance learning platform during school hours five times a week for 45 minutes during a three-week period. Students attended intervention sessions by logging-in to their password protected Zoom sessions from their homes or classroom. A distance learning platform was selected due to Covid-19. Depending on the setting in which the student was logging-in from, either the teacher or a parent aided students in logging-in to the Zoom session (e.g., checking audio). Teacher or parent participation was not required during the reading sessions unless additional support was needed due to behavior challenges. Additionally, the graduate researcher worked with personnel from the district to ensure that all participants had access to a desktop or laptop and internet connection (Baweja et al., 2021; Pokhrel & Chhetri, 2021).

Interventionist Training

To train the interventionist the graduate researcher provided eight hours of training across two days via an online platform. Prior to training, the interventionist was mailed training materials that included a copy of the PowerPoint slides, steps for lesson preparation, and instructional routines.

The graduate researcher used a behavioral skills training (BST) approach to train the interventionist. Training began with brief introductions and the distribution of contact information. The first training session focused on the reading intervention and the second session focused on the behavior intervention. The training topics included distance learning platforms, protocols (e.g., absences, network issues), the reading intervention, and the behavior intervention. An emphasis was placed on distance learning platforms including how to successfully use and navigate Adobe Acrobat Reader and Zoom. The graduate researcher modeled screen sharing, the instructional routines, using the intervention materials, scaffolding, and redirecting problem behavior. The interventionist then practiced screen sharing and following the instructional routines while the graduate researcher provided feedback. During the last day of training the interventionist received his schedule, student information, and Zoom links.

Interventionist Coaching

Coaching sessions occurred throughout the research study via the online platform, Zoom. The graduate researcher observed one reading only and one reading plus behavior session for a total of two intervention sessions per participant. During coaching sessions, the graduate researcher observed, completed fidelity checks, modeled, and provided feedback. When needed, a Zoom meeting or phone call was scheduled to discuss feedback and practice implementing the feedback.

Student Training Session

A student training session was scheduled 15 minutes prior to the first intervention session for all participants. During the student training session, the behavior expectations

and visual schedule were introduced. First, the interventionist explained that the behavior expectations and visual schedule would only be used for the reading plus behavior intervention (e.g., During some sessions, we will follow behavior expectations. Let's look at the expectations.), presented the five behavior expectations, and summarized the purpose (e.g., I want you to try your best to follow the five reading session expectations when I introduce them. Deal?).

Second, the interventionist introduced the visual schedule (e.g., During some sessions we will also use a schedule. The schedule will help us pay attention during our reading sessions. Let's look at the reading steps.), presented the five reading components, explained how the schedule would be used/how to get stars, completed a quick preference assessment focused on identifying preferred activities for break time, and summarized the purpose. The goal of the student training session was to introduce expectations and materials, complete the preference assessment, and initiate a relationship with the student.

Reading Intervention Components

Vocabulary

All intervention sessions were delivered via a distance learning platform, Zoom. The reading intervention included three components: (a) vocabulary, (b) fluency with text and (c) reading comprehension (Solis et al., 2022). Part one of the vocabulary instruction included the presentation of the vocabulary word, a simplified definition, and a picture related to the vocabulary word. The second part of the instruction included introducing two or three synonyms, the vocabulary word used within a sentence context, and two discussion questions/sentence stems. Throughout the lesson, the interventionist delivered

specific affirmative (e.g., Awesome saying the word for today) and/or corrective (e.g., Try again. The word is transform.) feedback. The vocabulary instruction lasted anywhere from three to five minutes each session.

Fluency with Text

Part one of fluency with text included prosody instruction. The lessons focused on phrasing of text by teaching idea units. To teach idea units the meaning of different punctuation marks including periods, commas, question marks, exclamation marks, and quotation marks were taught. Due to time constraints, students only completed the lessons for periods (5 total lessons) and commas (5 total lessons). The instruction began with a brief presentation of the lesson focus followed by a model and independent reading of the short passage. Specific affirmative (e.g., awesome pausing) and/or corrective (e.g., Freeze. Try gain. This time pause for two seconds after the period.) feedback on punctuation, phrasing, and/or expression was delivered. The prosody instruction was approximately three minutes each session.

Part two of fluency with text entailed two to three repeated readings of QuickReads passages followed by a Does It Make Sense (DIMS?) activity. The QuickReads passages included four readability levels to allow individualizing intervention materials based on the student's needs. The instruction began with a model reading of the passage followed by a guided reading and/or independent reading and a main idea question prompt (e.g., What is the most important idea?). Lastly, five sentences were presented to students during the DIMS activity. Some of the sentences for this activity made sense while others did not. Of the five sentences, two required referring to

the text, while three required referring to the sentence. Specific affirmative (e.g., Yes, that makes sense because concerts are loud) and/or corrective (e.g., Read the sentence again. It says that concerts are a quiet place. Does this make sense?) feedback was delivered throughout the instruction. The repeated readings and DIMS activity was approximately 15 minutes each session.

Reading Comprehension

The reading comprehension instruction consisted of reading stretch text and discussing a main idea question prompt. The passages for the lessons were adapted from Newsela (https://newsela.com), which focus on social studies and science related content. All the passages were formatted in two or three chunks of text. A model or guided reading was provided for each chunk of text. After the last chunk of text was read, a main idea question prompt was delivered. Specific affirmative (e.g., Yes, this section is saying that humans have trillions of cells) and/or corrective (e.g., Let's look at the paragraph again. Here, it is talking about human cells) feedback was provided throughout the lesson. The reading comprehension instructional routine was approximately 10 minutes each session.

Reading plus Behavior Intervention

The reading plus behavior intervention included the same reading intervention outlined in the reading intervention components section with the addition of two behavioral strategies consisting of behavior expectations and a visual schedule (Ennis et al., 2018; Hirsch et al., 2021; Lane et al.,2023; Roberts et al., 2021). Prior to starting the reading instruction, a visual with five behavior expectations was presented. The

expectations included the following: (a) sit or stand with calm body, (b) eyes on the computer screen or lesson materials, (c) follow the lesson instructions and use the materials appropriately, (d) ask lesson related questions, and (d) have reading related conversations. The behavior expectations instructional routine was approximately five minutes each session.

Next, the visual schedule outlining the reading components was presented. The visual schedule included one column listing the five reading components (e.g., vocabulary, prosody), a second column including a picture of the lesson materials for each reading component, a third column titled "stars," and a fourth column titled "waiting stars" which included four stars. After reviewing the visual schedule, the interventionist notified students that they were able to attain stars for participating during each of the reading components and instructed students to select an activity from the pre-selected list of preferred activities for break time. If the student participated during the reading component, he/she received a star followed by a 2-minute break. Alternatively, if the student did not participate during the reading activity, a second opportunity to participate was provided. For the second opportunity, the same procedure was followed if the student participated, however if the student did not participate the next reading component immediately began. Examples of what behavior classified as participation for each reading component were provided by the graduate researcher. For example, during the vocabulary lesson, participation included repeating the vocabulary word, reading the vocabulary word definition, and answering the discussion question(s). The visual

schedule instructional routine was approximately 10 minutes each session. This included the two-minute breaks students could attain after each reding component.

A step-by-step task analysis including a sample script was provided to the interventionist for the behavior expectations and visual schedule. Appendix C shows the step-by-step task analysis for the visual schedule. All behavior related materials were developed and presented in standard-sized PowerPoint slides. See appendix D and E for the behavior materials and table 8 for treatment components and schedule.

Table 8
Treatment Components and Schedule

Activity	Reading Only	Reading plus Behavior
Behavior Expectations	0 minutes	5 minutes
Visual Schedule	0 minutes	10 minutes
Reading Intervention	45 minutes	30 minutes
Total Time	45 minutes	45 minutes

Treatment Fidelity

All intervention sessions were video recorded. To meet WWC standards for single-case design studies, a random sample of 40% of the intervention sessions per condition were checked for treatment fidelity (WWC, 2022). The treatment fidelity checklist consisted of the essential instructional steps for the reading only and reading plus behavior intervention. Each instructional step was checked for adherence by documenting its presence with a score of one and absence with a score of zero. Additionally, quality of instruction was rated on a four-point scale (global indicator). A score of one indicated low quality whereas a score of four indicated high quality. Quality

of instruction assessed (a) pacing and wait time, (b) language, (c) tone of voice, (d) affirmative and/or corrective feedback, and (e) redirection of problem behavior. Appendix F shows the treatment fidelity checklist and appendix G shows the rubric for the quality indicators.

Prior to coding for treatment fidelity, an undergraduate researcher attended a five-hour training led by the graduate researcher. The training consisted of reviewing the instructional steps listed in the treatment fidelity checklists (one version for reading only and another version for reading plus behavior), the four-point scale, and the rubric for quality of instruction. The graduate researcher provided a demonstration by coding a video recording for treatment fidelity. After the demonstration, the graduate and undergraduate researcher jointly coded another video recording and discussed discrepancies. Once discrepancies were addressed, the graduate and undergraduate researchers independently coded additional video recordings until moderate agreement (kappa score of at least .60) was reached. Once moderate agreement was reached, the undergraduate researcher independently coded the random sample of video recordings that were selected for treatment fidelity. The mean treatment fidelity percentage for the reading only intervention sessions was 98% for Henry, 98% for Sara, and 95% for Diana. For the reading plus behavior intervention sessions it was 96% for Henry, 100% for Sara, and 96% for Diana. The mean quality of instruction percentage for the reading only and reading plus behavior sessions was 100% across participants.

Data Analysis

A visual analysis was conducted for the outcome measure (i.e., engagement) as it is the recommended methodology to interpret single-case design results (Kazdin, 2011; WWC, 2022). The visual inspection included an analysis of level, trend, variability, immediacy of effect, and overlap. Percentage of non-overlapping data (PND) and Tau-U were used to calculate overlap. The following criteria was used to interpret PND: (a) more than 90% signifies very effective treatment, (b) 70% to 90% signifies effective treatment, (c) 50% to 70% signifies questionable treatment, and (d) less than 50% signifies ineffective treatment (Scruggs & Mastropieri, 1998). Tau-U values from 0 to .20 represented small changes, 0.20 to 0.60 represented moderate changes, 0.60 to 0.80 represented large changes, and 0.80 and above represented very large changes (Parker et al., 2011).Tau-U was selected as it has been used in other single-case design studies to attain more details about overlap, is well-suitable for small data sets, and has an agreed upon categorization of small, moderate, and large effects (Harrison et al., 2019; Parker et al., 2011; Roberts et al., 2021; Vannest & Ninci, 2015).

Chapter 4: Results

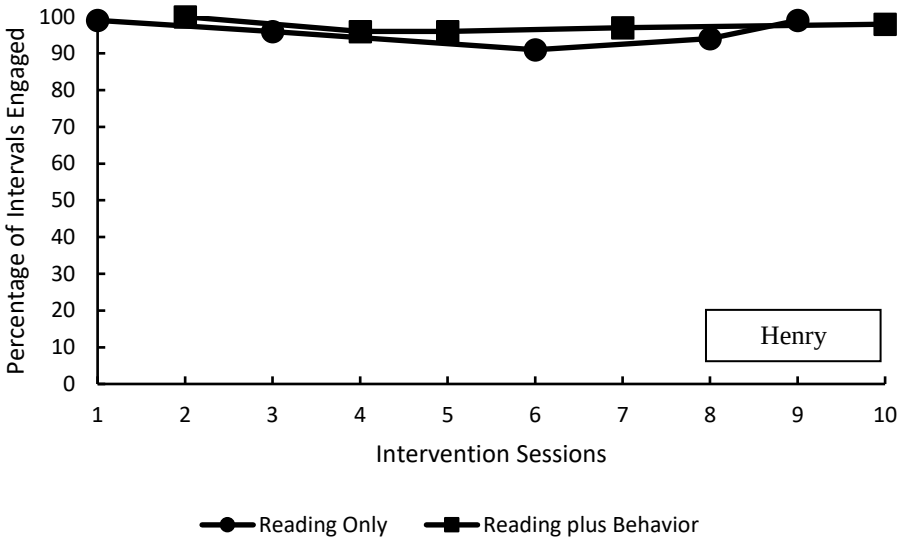
This chapter presents the results for the secondary analysis of levels of engagement. Findings for engagement are presented first followed by social validity. See table 9 for a summary of the visual analysis and Tau-U results.

Engagement

Henry

Henry's engagement data are presented in Figure 1. Overall, Henry's engagement levels were slightly higher during reading plus behavior (M = 96%) in comparison to reading only (M = 97%). The percentage of intervals with engagement ranged from 91% to 99% during reading only and from 96% to 100% during reading plus behavior. A comparison of the range of intervals with engagement between treatments revealed that the variability of engagement levels decreased in reading plus behavior relative to reading only. Although not extremely visible, an examination of the last three data points in reading only and the first three data points in reading plus behavior revealed an immediate increase in the percentage of intervals with engagement. A neutral trend was observed during both treatments. The percentage of non-overlapping data (PND) was 20%, indicating a substantial amount of overlapping data between the two treatments or ineffective treatment (Scruggs & Mastropieri, 1998). Lastly, Tau-U results suggested a moderate change in engagement levels from reading only to reading plus behavior (Tau-U = 0.32). See table 9 for a summary of the visual analysis and Tau-U results.

Figure 1
Henry: Percentage of Intervals Engaged

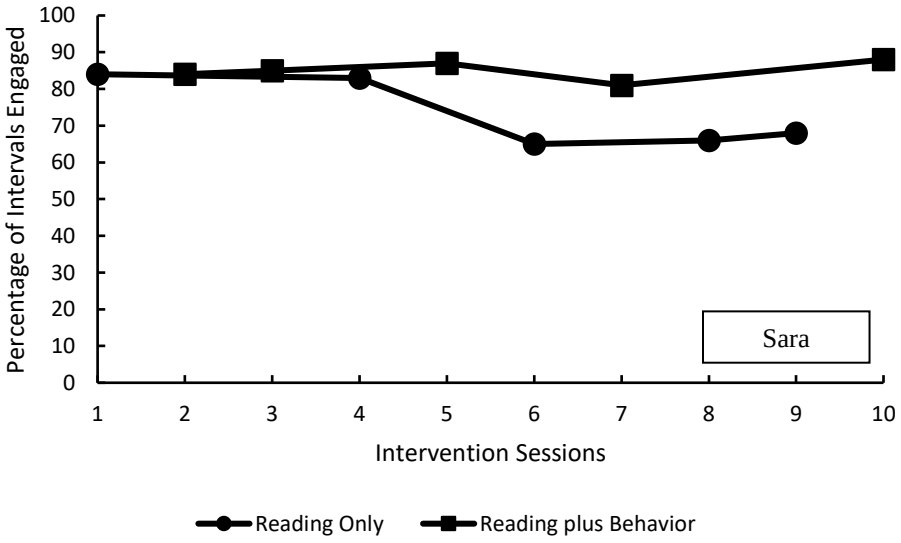


Sara

Sara's engagement data are presented in Figure 2. Overall, Sara's engagement levels were higher during reading plus behavior (*M* = 85%) in comparison to reading only (*M* = 73%). The percentage of intervals with engagement ranged from 66% to 84% during reading only and from 81% to 88% during reading plus behavior. A comparison of the range of intervals with engagement between treatments revealed that the variability of engagement levels decreased in reading plus behavior relative to reading only. An examination of the last three data points in reading only and the first three data points in reading plus behavior revealed an immediate increase in the percentage of intervals with engagement. A descending trend during reading only and a neutral trend during reading plus behavior were observed. The percentage of non-overlapping data (PND) was 60%, indicating less than half of overlapping data between the two treatments or questionable

treatment (Scruggs & Mastropieri, 1998). Lastly, Tau-U results suggested a very large change in engagement levels from reading only to reading plus behavior (Tau-U = 0.96). See table 9 for a summary of the visual analysis and Tau-U results.

Figure 2
Sara: Percentage of Intervals Engaged



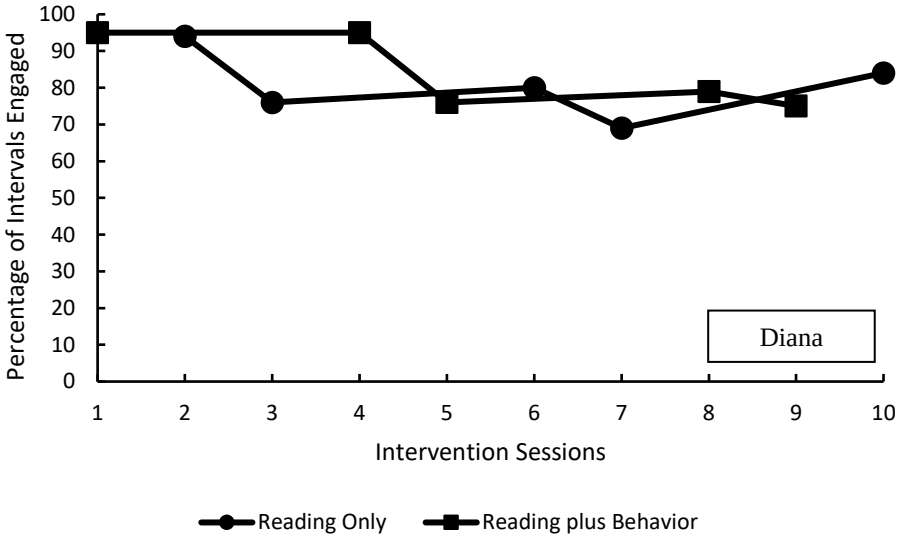
Diana

Diana's engagement data are presented in Figure 3. Overall, Diana's engagement levels were slightly higher during reading plus behavior (*M* = 84%) in comparison to reading only (*M* = 81%). The percentage of intervals with engagement ranged from 69% to 94% during reading only and from 75% to 95% during reading plus behavior. A comparison of the range of intervals with engagement between treatments revealed that the variability of engagement levels decreased in reading plus behavior relative to reading only. A neutral trend was observed during both treatments. The percentage of non-overlapping data (PND) was 40%, indicating less than half of overlapping data between

the two treatments or ineffective treatment (Scruggs & Mastropieri, 1998). Lastly, Tau-U results suggested a moderate change in engagement levels from reading only to reading plus behavior (Tau-U = 0.24). See table 9 for a summary of the visual analysis and Tau-U results.

Figure 3

Diana: Percentage of Intervals Engaged



Summary. For two out of three students, the mean percentage of intervals with engagement slightly increased from 96% in reading only to 97% in reading plus behavior and from 80% in reading only to 84% in reading plus behavior. For one student, the mean percentage of intervals with engagement increased from 73% in reading only to 85% in reading plus behavior. Across participants, variability was lower in the reading plus behavior condition relative to reading only condition. An immediate increase in the percentage of intervals with engagement was detected clearly for two participants. PND ranged from 20% to 60%. Lastly, Tau-U results indicated a moderate change (0.32, 0.24)

for two participants and a very large change (0.96) for one participant in levels of engagement when comparing reading only and reading plus behavior conditions.

Table 9
Engagement: Visual Analysis and Effect Sizes

Participant	Level	Trend	Variability	Immediacy	PND	Tau-U
Henry	Slightly higher in R+B than R.	R: Neutral R+B: Neutral	Lower in R+B than R.	Yes	1/5 (20%)	0.32 (Moderate)
Sara	Higher in R+B than R.	R: Descending R+B: Neutral	Lower in R+B than R.	Yes	3/5 (60%)	0.96 (Very large)
Diana	Slightly higher in R+B than R.	R: Neutral R+B: Neutral	Lower in R+B than R.	Yes	2/5 (40%)	0.24 (Moderate)

Social validity

For part one of the student questionnaire, the average score for each of the nine close-ended questions ranged from 2 to 3.67 (out of 4). Student responses indicated that they enjoyed attaining stars, getting breaks, and improving their behavior during the reading sessions. Students disclosed that they enjoyed getting starts and breaks because it helped them maintain attention during the reading sessions. Alternatively, students least enjoyed reviewing the behavior expectations followed by learning to read. The average score for all nine questions was a three indicating that students somewhat enjoyed the reading and behavior intervention components. See table 10 for the student questionnaire average scores.

For part two of the student questionnaire (open ended questions), students shared that their favorite parts of the intervention sessions included completing the session, the main idea component of the reading intervention, or taking breaks. All three students shared that they enjoyed using the visual schedule because it included getting stars and breaks. Additionally, all students reported that they enjoyed participating and that they had fun during the reading sessions. Regarding the reading intervention components, students shared that they favored the DIMS component followed by the main idea component. Students explained that DIMS and main idea were their favorite parts of the reading intervention because it was funny, or it felt good to finish. All other responses indicated that students were not sure how they felt about the intervention or did not understand the question (e.g., a parent of one of the students shared that "why" questions were challenging).

For the interventionist questionnaire, the average score for the 22 close-ended questions was a 3.95 (out of 4). The interventionist rated all the questions with a score of four (strongly agree) except for one question. He rated the additional question with a score of three (agree). The question rated with a score of three included the following: The behavior materials were user and distance learning friendly. The interventionist shared that he noticed students were more attentive during the reading plus behavior intervention sessions, breaks were a great motivator, and that he enjoyed working with the students and families. The only recommendation from the interventionist included extending the breaks (more than 2-minute breaks).

Table 10
Student Questionnaire: Average Scores

	Question	Average Score (Out of 4)	Four-point Rating Scale
1.	I enjoy working with the tutor during the reading sessions.	3.00	I enjoy a little
2.	I enjoy learning to read.	2.67	I enjoy a little
3.	I enjoy improving my behavior.	3.33	I enjoy a little
4.	I enjoy attending the reading sessions.	3.00	I enjoy a little
5.	I enjoy reviewing the reading expectations.	2.00	Don't enjoy but don't hate it
6.	I enjoy getting stars during the reading sessions.	3.33	I enjoy a little
7.	I enjoy taking breaks during the reading sessions.	3.67	I really enjoy
8.	I enjoy getting stars and breaks because they help me pay attention.	3.67	I really enjoy
9.	I would enjoy it if we would keep using the reading expectations and visual schedule (stars and breaks).	2.67	I enjoy a little
	Average Score	3.00	I enjoy a little

Chapter 5: Discussion

Currently, four theories address the relationship between problem behavior and academics (Cook et al., 2012; Morgan et al., 2008; Nelson et al., 2003). One of the main differences between the theories includes the proposed directionality of the relationship between the constructs (e.g., academic difficulties lead to problem behavior). Regardless of the directionality, all four theories emphasize the impact of problem behavior on academic achievement. To address this problem, several studies have investigated approaches to embed behavior supports in reading comprehension interventions and/or assess behavior outcomes (Bruhn & Watt, 2012; Roberts et al., 2021; Sinclair et al., 2019; Solis et al., 2016). Within this area there continues to be a lack of research assessing the impacts of reading comprehension and behavior interventions on the behavior of students with autism. To address this gap in research, this study compared the effects of embedding behavior supports in a reading intervention on student engagement levels relative to a reading intervention without behavior supports by conducting a secondary analysis of a study employing an alternating single-case design (N = 3).

Based on previous research, it was hypothesized that embedding behavior supports into a reading intervention would improve student engagement levels (Bruhn & Watt, 2012; Roberts et al., 2021; Sinclair et al., 2019; Solis et al., 2016). The findings from this study were mixed with the hypothesis only being confirmed for one of the three students. For the additional two students, engagement levels slightly increased during the reading plus behavior condition. Overall, the visual analysis suggested lower variability in the reading plus behavior condition across participants and Tau-U effect sizes ranging

from 0.24 to 0.96 (moderate to very large changes). The results diverged from previous findings that showed that the addition of behavior supports increased levels of engagement (Bruhn & Watt, 2012; Roberts et al., 2021; Sinclair et al., 2019; Solis et al., 2016).

One possible reason for this may include differences among the studies, such as the design of the study and participant characteristics (e.g., age). Of the 15 single-case design studies that were reviewed to support the empirical base of this study, 10 were multiple-baseline, four were withdrawal, and only one was an alternating treatment design. The majority of the studies focused on elementary aged students (8 total) and/or included students with or at risk of reading difficulties, ADHD and/or behavioral disorder (9 total). The participants in this study included middle-school aged students with autism. Further, findings from the descriptive measures indicated unique reading challenges across the students. Standard scores on the WJ-IV LWID and WJ-IV PC ranged from 62 to 83 and from 46 to 61 respectively. Words read correctly on the AIMSweb ORF ranged from 30 to 53. Overall, scores suggest a comorbidity of word reading and reading comprehension challenges. These findings emphasize the heterogeneity that is part of autism and offer a plausible explanation for the results of this study.

While there were no discernable differences between the two treatments, it is important to note that the mean percentage of intervals with engagement remained high across students and conditions. The mean percentage of engagement ranged from 96% to 97%, from 73% to 85% and 81% to 84% for Henry, Sara, and Diana respectively. This has not been the case in previous research studies (Roberts et al., 2021; Solis et al., 2016).

In fact, engagement ranged from 22% to 75% for most of the participants during baseline or the intervention without behavior supports (Roberts et al., 2021; Solis et al., 2016). Possible reasons for this may include setting and implementer characteristics and the type of behavioral supports embedded. In comparison to this study, Roberts et al. (2021) provided the intervention in small groups consisting of five students rather than a one-to-one setting. Another difference includes implementer characteristics. In Roberts et al. (2021) and Solis et al. (2016) the implementer included graduate students with a background in education who had no contact with the participants prior to the study, whereas this study included a paraprofessional with 16 years of experience working in education who had worked with some of the students prior to the study. Lastly, the behavior supports in this study included behavior expectations and a visual schedule, whereas Roberts et al. (2021) included a point system, behavior specific praise, and group rules, and Solis et al. (2016) included a token economy and readings based on the student's interests. Setting characteristics, implementer experience and rapport with students along with the type of behavior supports used provide plausible explanations for the high levels of engagement across participants and conditions. Treatment fidelity results indicated that both treatments were implemented with fidelity. Lastly, the student and interventionist social validity results suggested a preference for the reading plus behavior intervention.

Limitations and Future Research

The following should be considered when generalizing the findings of this study: (a) selection criteria of the participants, (b) design of the study, and (c) the data collection

procedures used for coding engagement. The first limitation was that the participant selection criteria did not include evidence of attention difficulties or problem behavior. Future research should consider screening for attention difficulties or problem behavior by administering a screener, conducting direct observations, requiring a behavior related goal in the students individualized education plan, and/or including teachers in the participant selection process. Examples of screeners include the Behavior Assessment System for Children (BASC), Social Skills Improvement System Performance Screening Guide, and Social, Academic, and Emotional Behavior Risk Screener (SAEBRS; Roberts et al., 2021).

The second limitation was the design of the study. The study used an alternating treatment design in which students alternated between reading only and reading plus behavior. When reviewing the session video recordings for coding purposes, it was observed that some of the students began to complain during the reading only intervention about not getting stars or breaks. Inadvertently, this may have impacted student engagement, specifically when it comes to the stability of engagement levels. Additionally, the interventionist implemented two separate but similar interventions in which the only difference between the interventions was the addition of the behavior expectations and a visual schedule. There is a possibility that the interventionist implemented some or similar behavior strategies during the reading only intervention sessions, particularly because the interventionist had a strong background in the behavioral sciences. This may have caused a threat to internal validity. Nonetheless, the

alternating treatment design facilitated an analysis of the effects of integrating behavior supports into a reading intervention on student engagement levels.

The third limitation was the small number of sessions. Students completed five reading only and reading plus behavior intervention sessions for a total of 10 sessions. Unfortunately, the study was run towards the end of the school year and increasing the number of intervention sessions was not an option. Future research should consider increasing the number of intervention sessions. The final limitation was that non-continuous observation (i.e., momentary time sampling) rather than continuous observation (e.g., duration) was used to measure engagement. Momentary time sampling was used based on the following (a) previous studies have used time sampling to code engagement or similar behaviors, (b) it is recommended for behaviors such as engagement, and (c) provides data similar to that obtained with continuous observation (Cooper et al., 2020; Roberts et al., 2021; Solis et al., 2016). Considering that continuous observation is the most precise and recommended system to measure behavior, future research should use continuous observation when appropriate and possible (Cooper et al., 2020). Additional variables to consider when selecting a recording system include the following: (a) the behavior of interest, (b) how often the behavior is occurring, and (c) the feasibility of the recording system (Cooper et al., 2020).

Lastly, although this study considered the individualization of preferences by conducting a quick preferences assessment prior to the beginning of intervention sessions, research findings predominantly guided the employed procedures, selection of behavior expectations, and operationalized definitions (Cooper et al., 2020; Ennis et al.,

2018; Harris et al., 2005; Hirsch et al., 2021; Lane et al., 2023; Roberts et al., 2021; Solis et al., 2016). Future research should consider conducting a more extensive preference assessment and/or observations prior to the beginning of the study to aid in the development of materials (e.g., color of the visual schedule), selection of behavior expectations, and operationalized definitions.

Implications for Practice

This study contributes to a small but growing area of research designed to investigate the impact of embedding behavior supports within academic instruction on the levels of engagement of students with autism in grades 7-8. The results showed that a systematically implemented one-to-one reading only and reading plus behavior intervention can be implemented by paraprofessionals with fidelity. With training and coaching, paraprofessionals can effectively embed behavior strategies into academic instruction, such as (a) behavior expectations, (b) visual schedules, (c) priming, and (d) behavior specific praise. Given the high levels of engagement across conditions, the primary implication for practice is that systematic procedures, such as the ones employed in this study, can be used to design and deliver instruction that consistently supports high levels of engagement for students with autism. This is of particular importance considering levels of engagement were a major concern when instruction relied on distance learning due to Covid-19 (Baweja et al., 2021; Lane et al., 2023; Pokhrel & Chhetri, 2021).

Although schools and services are back to in-person instruction, after almost three years since the beginning of Covid-19, it is inevitable that distance learning will continue

to serve as viable and practical option for both students and educators as a mechanism to increase access to resources and services (Baweja et al., 2021; Pokhrel & Chhetri, 2021). However, the challenges of using a distance learning platform should be noted, such as screens and/or video cameras freezing and Zoom meetings crashing due to internet connection. Practitioners should consider implementing strategies to help decrease the challenges that arise with distance learning, such as checking internet speed (Baweja et al., 2021; Pokhrel & Chhetri, 2021) and using either in-person, remote learning, or a combination of the two based on student and family needs. On a similar note, the mixed findings from this study reinforce the importance of individualizing interventions for students with autism. This may include reducing the teacher to student ratio or conducting observations to identify student preferences. In doing so the heterogeneity that is part of autism is addressed, consecutively helping ensure that students receive the best possible interventions.

Research in reading and behavior interventions for students with autism is still needed. This study utilized novel methods by (a) conducting a secondary analysis of an alternating treatment single-case design study that was entirely implemented through a distance learning platform during Covid-19, and (b) comparing the relative effects of a pre-developed reading intervention (Solis et al., 2022) to a reading intervention that embedded behavior supports on student engagement levels by measuring engagement using session video recordings and a 15-second momentary time sampling procedure. Although the hypothesis was only confirmed for one of three students, this study sheds

light on the engagement of students with autism and shows promise on the delivery of interventions through a distance learning platform.

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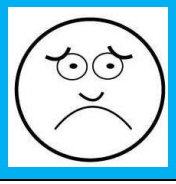
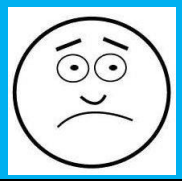
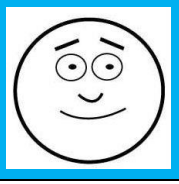
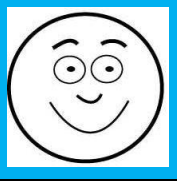
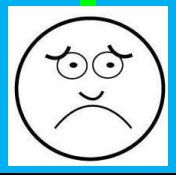
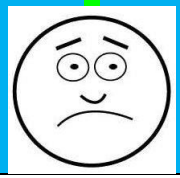
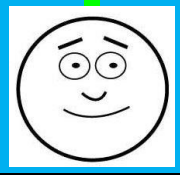
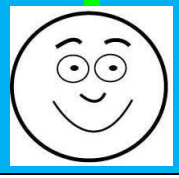
Appendix A: Student Questionnaire

Tutor Script:

- *I am going to ask you some questions about our sessions.*
- *After I ask you each question, I want you to (1) think about our time together and (2) tell me how **YOU** feel OR the face that represents the closest to how **YOU** feel.*
- *There are 4 options. Let's look at the pictures of the faces.* **(Hover mouse over each smiley face as you discuss what it means)**
    - *If you would say, **"No, I DO NOT enjoy!"** tell me face number 1*
    - *If you would say, **"Yes, I enjoy!"** tell me face number 4*
    - *If you would say, **"Closer to No"** tell me face number 2*
    - *If you would say, **"Closer to Yes"** tell me face number 3*
- *Let's start with some example questions.*

	1 	**2** 	**3** 	**4** 
Questions to ask:	**DO NOT** enjoy	Don't enjoy **BUT I don't hate it**	I **enjoy a little**	I **really enjoy**
Example 1: I enjoy pizza.				
Example 2: I enjoy homework time.				
Example 3: I enjoy dancing.				

	1 	2 	3 	4 
Questions to ask:	**DO NOT** enjoy	Don't enjoy **BUT I don't hate it**	I **enjoy a little**	I **really enjoy**
#1: I enjoy working with the tutor during the reading sessions.				
#2: I enjoy learning to read.				
#3: I enjoy improving my behavior.				
#4: I enjoy attending the reading sessions.				
#5: I enjoy reviewing the reading expectations.				
#6: I enjoy getting stars during the reading sessions.				
#7: I enjoy taking breaks during the reading sessions.				
#8: I enjoy getting stars and breaks because they help me pay attention.				
#9: I would enjoy it if we would keep using the reading expectations and visual schedule (stars and breaks).				

Part 2

Tutor Script	Notes
☐ *Now, I am going to ask you more questions. I want you to tell me as much as you can.* ☐ *What was your favorite part of the reading sessions?* ☐ *Why was that your favorite? OR Can you think of at least 1 thing you DID enjoy?* ☐ *For some of our sessions, we reviewed the 5 expectations. For example, sit OR stand with a calm body. Did you like this part?* ☐ *If yes, why did you like this part? OR if no, tell me more.* ☐ *Did you like using the visual schedule for some of our sessions? This is when we reviewed the reading activities AND you were able to get stars and breaks for participating.* ☐ *If yes, why did you like this part? OR if no, tell me more.* ☐ *Which one did you like better (1) session expectations OR (2) the visual schedule?* ☐ *Do you think they helped you pay attention for our reading sessions?* ☐ *Did you have fun during our sessions?* ☐ *I think we had a great time reading and working on our behavior.* ☐ *Okay, almost done.*	

☐ *During our sessions we completed vocabulary. We learned new words and talked about how the pictures related to the words. Did you like this part?* ☐ *If yes, why did you like this part? OR if no, tell me more.* ☐ *How about prosody? This is the part when we focused on punctuation. For example, pausing after periods.*	

Part 2 Continued

Tutor Script	Notes
☐ *If yes, why did you like this part? OR if no, tell me more.* ☐ *How about DIMS? This is the part we answered if the questions made sense or not. Some questions were silly and did not make ANY sense.* ☐ *If yes, why did you like this part? OR if no, tell me more.* ☐ *How about main idea? This is the part when I mostly read and you told me the main idea of the passage.* ☐ *If yes, why did you like this part? OR if no, tell me more.* ☐ *Last question, do you like reading and participating?* ☐ *I like to read and participate!* ☐ *Awesome, we are all done! Thank you for telling me about our reading sessions.* **Tutor: Please make sure that you SAVE the questionnaire before closing** 😊	

Appendix B: Interventionist Questionnaire

Question	1: Strongly Disagree	2: Disagree	3: Agree	4: Strongly Agree	Comments
#1: I enjoyed participating in the reading and behavior study.					
#2: The reading and behavior study was of interest to me.					
#3: The training for phase two was effective.					
#4: The coaching sessions were helpful.					
#5: The team meetings were effective.					
#6: I improved my skills related to implementing the reading intervention throughout the study.					
#7: I improved my skills related to responding to problem behavior throughout the study.					
#8: The training session which was scheduled 15-minutes prior to the first session was feasible and effective.					

#9: The reading and behavior intervention had an impact on student's overall reading skills.					
#10: The reading and behavior intervention helped increase student attention levels.					
#11: The students seemed excited to earn stars and breaks.					
#12: The reading instruction is feasible for other staff members and schools to implement.					
#13: The behavior instruction (reading expectations) is feasible for other staff members and schools to implement.					
#14: The behavior instruction (visual schedule) is feasible for other staff members and schools to implement.					
#15: The tutor reading materials were user and distance learning friendly.					
#16: The tutor behavior materials were user and distance learning friendly.					
#17: The tutor reading materials were clear and allowed for effective instruction.					

#18: The tutor behavior materials were clear and allowed for effective instruction.					
#19: I felt comfortable using the distance learning platforms (e.g. Zoom, Adobe, Google documents).					
#20: I was able to build a strong connection with the students.					
#21: I will continue to use the reading strategies learned from this study with other students.					
#22: I will continue to use the behavior strategies learned from this study with other students.					
#23. Please list some ideas, recommendations, or feedback that you would like to share with us.					

Appendix C: Visual Schedule Instructional Routine

Visual Schedule: 3-5 minutes	
Steps	**Tutor Script**
❑ Remind the student that you will use the visual schedule	*Today, you will be able to get stars for participating during each of the reading activities.*
❑ Briefly present the 4 activities	*We have vocabulary, prosody, DIMS, and the reading passage.*
❑ Briefly remind the student how the stars work	*A star means you get a? What do you get? Yes, a 2-minute break!*
❑ Show the student the list of activities & ask him/her to select one	*Here is the list of activities. What do you want to do during break time today?* **Highlight the student's choice.** **If the student is struggling to make a choice, provide choices based on items from the list.** *Would you like to have a dance party or tell me about your favorite animal?*
❑ Ask the student if he/she is ready	*Are you ready to get all your stars?*
❑ On a piece of paper, write down the task within each reading component NOT completed	**Tutor writes down "repeating vocabulary word" & "answering discussion question #2" since the student did not participate when asked.**
❑ After each activity, move a star next to the activity completed	*Here is a star next to vocabulary.* **If the student did not participate, look at your notes & ask the student to complete the task OR tasks they did not initially complete so that they can get a star.**
❑ Deliver specific verbal praise & send the student on a 2-minute break **(ONLY if they get a star)**	*You did awesome completing vocabulary. 2-minute break, let's have a dance party.*

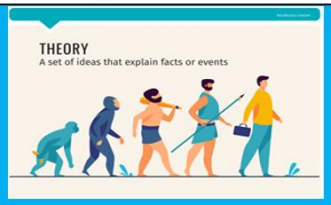
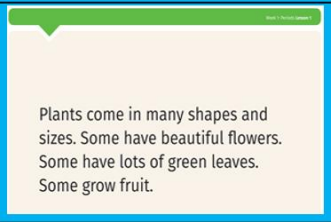
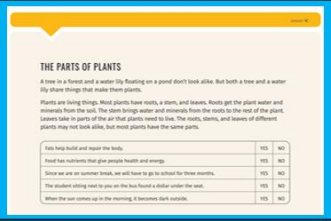
	If the student does not participate (after delivering the instruction during step #2), let them know that you are skipping break. *Since you did not participate, we are skipping break.* ☹
❑ Check-in with the student during break	*1 more minute and then prosody.*
❑ Check-in with the student when he/she returns from break	*Time is up. Are you ready to get your next star? Let's go!*
❑ At the end of session, review the total number of stars attained	*Let's check if you got all your stars.* **Tutor shows the student slide #2 of the PP.** *You got all 4. Way to go!* OR *Let's check if you got all your stars.* **Tutor shows the student slide #2 of the PP.** *You got 3. Tomorrow, let's try better and get all 4.*
❑ Provide specific verbal praise OR verbal feedback for the next session **(based on the completed activities)**	*Today you did awesome answering questions.* OR *Next session, I want you to work on answering questions.*

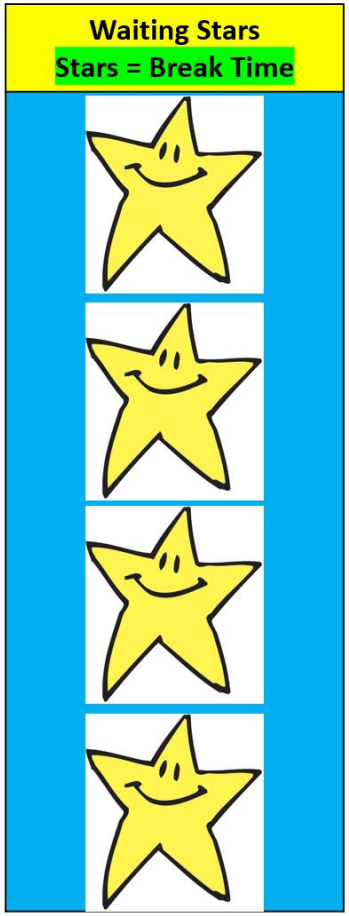
Appendix D: Reading Expectations

1. Sit OR stand with calm body	 
2. Eyes on the computer screen OR lesson materials.	
3. Follow the lesson instructions + use the materials appropriately.	 
4. Ask lesson related questions.	
5. Have reading related conversations.	

Appendix E: Visual Schedule

Reading Schedule

Vocabulary		
Prosody		
Fluency & Does it Make Sense?		
Main Idea		



Appendix F: Treatment Fidelity Checklist

Completed?	Reading Session Expectations
☐	RSE1. Notified the student that the reading session expectations would be used
☐	RSE2. Introduced expectation #1: Sit OR stand with a calm body
☐	RSE3. Introduced expectation #2: Eyes on the computer screen OR lesson materials
☐	RSE4. Introduced expectation #3: Follow the lesson instructions & use the materials appropriately
☐	RSE5. Introduced expectation #4: Ask lesson related questions
☐	RSE6. Introduced expectation #5: Have reading related conversations
	Visual Schedule: Introduction
☐	VS1. Notified the student that the visual schedule would be used
☐	VS2. Presented the 4 activities
☐	VS3. Briefly explained how the stars work
☐	VS4. Asked the student to select an activity for break time
	Vocabulary
☐	V1. Asked the student if he/she was ready to get a star
☐	V2. Presented word and visual to student (pg. 1)
☐	V3. Asked question connecting the word to the visual
☐	V4. Read the definition
☐	V5. Discussed synonyms (pg. 2)
☐	V6. Reviewed the example sentences with student
☐	V7. Asked the discussion questions OR provided the sentence stems
☐	V8. Provided specific affirmative and/or corrective feedback on the vocabulary word pronunciation, repetition of the definition & answering the discussion questions
☐	V9. Followed the delivery of behavior contingent reward (3 options) • Delivered a star & verbal praise contingent on completing vocabulary • Redirected the student to complete vocabulary before delivering a star & verbal praise • Skipped break time
☐	V10. Provided a 2-minute break
☐	V11. Delivered a 1-minute warning that break is about to end
☐	V12. Notified the student that the break is over
	Fluency with Text
	Part 1
☐	P1. Reminded the student that they could earn more stars

□	P2. Introduced prosody lesson focus
□	P3. Modeled fluent reading of the sentences for prosody practice (appropriate punctuation, phrasing, and expression)
□	P4. Prompted student to read aloud and to pay attention to targeted punctuation
□	P5. Provided specific affirmative and/or corrective feedback on punctuation, phrasing, and/or expression
□	P6. Followed the delivery of behavior contingent reward (3 options) • Delivered a star & verbal praise contingent on completing prosody • Redirected the student to complete prosody before delivering a star & verbal praise • Skipped break time
□	P7. Provided a 2-minute break
□	P8. Delivered a 1-minute warning that break is about to end
□	P9. Notified the student that the break is over
	Part 2
□	DIMS1. Reminded the student that they could earn more stars
□	DIMS2. Modeled fluent reading of *QuickReads* passage
□	DIMS3. Completed guided reading AND/OR independent practice
□	DIMS4. Asked student main idea question prompt(s)
□	DIMS5. Provided specific affirmative and/or corrective feedback on main idea answers
□	DIMS6. Read or prompted the student to read the "Does it Make Sense?" sentences one at a time
□	DIMS7. Asked student to say the evidence in the sentence OR the fluency passage to justify answer
□	DIMS8. Provided specific affirmative and/or corrective feedback on DIMS answers
□	DIMS9. Followed the delivery of behavior contingent reward (3 options) • Delivered a star & verbal praise contingent on completing DIMS • Redirected the student to complete DIMS before delivering a star & verbal praise • Skipped break time
□	DIMS 10. Provided a 2-minute break
□	DIMS 11. Delivered a 1-minute warning that break is about to end
□	DIMS 12. Notified the student that the break is over
	Reading Comprehension
□	M1. Reminded the student that they could earn more stars
□	M2. Modeled fluent reading OR completed guided/independent reading of the passage sections
□	M3. Asked student main idea question prompt(s)
□	M4. Provided specific affirmative and/or corrective feedback on main idea question answers
□	M5. Followed the delivery of behavior contingent reward (3 options)

	• Delivered a star & verbal praise contingent on completing main idea • Redirected the student to complete main idea before delivering a star & verbal praise • Skipped break time
☐	M6. Provided a 2-minute break
☐	M7. Delivered a 1-minute warning that break is about to end
☐	M8. Notified the student that the break is over
☐	M9. Reviewed the total number of starts attained
☐	M10. Delivered verbal praise OR verbal feedback for the next session
TF Score	
Total Completed= ____ / 53 possible = Percentage: _____	

Global Indicators				
	High Quality		Low Quality	
G1. INST Overall, I consider the teacher's quality of instruction to be:	○ 4	○ 3	○ 2	○ 1
G2. IMP Overall, the teacher's adherence to implementation of the intervention to be: *Score is based on IVC percentage*	○ 4 85%-100%	○ 3 70%-84%	○ 2 50%-69%	○ 1 0%-49%
Global Indicator Score				
Total out of 8: ____		Percentage: ____		

Note. For a definition of teacher's quality of instruction see "quality indicators and descriptors rubric."

Appendix G: Quality Indicator Rubric

Quality Indicators Rubric				
Component	**4- Excellent**	**3- High Average**	**2- Low Average**	**1- Weak**
Pacing and wait time	Consistently uses appropriate lesson pacing/wait time (e.g., Tutor asks questions and waits at least 3 seconds for student response). **(Includes 1 instance of inappropriate pacing and wait time within entire session)**	Somewhat consistently uses appropriate lesson pacing/wait time (e.g., Tutor asks questions and waits at least 3 seconds for student response). **(Includes 2 instances of inappropriate pacing and wait time within entire session)**	Inconsistently uses appropriate lesson pacing/wait time (e.g., Tutor asks questions and waits at least 3 seconds for student response). **(Includes 3 instances of inappropriate pacing and wait time within entire session)**	Does not use appropriate lesson pacing/wait time (e.g., Tutor asks questions and waits at least 3 seconds for student response). **(Includes 4 or more instances of inappropriate pacing and wait time within entire session)**
Language	Consistently uses language that is clear and specific. **(4 out of 4 intervention components OR 6 out of 6 intervention components)**	Somewhat consistently uses language that is clear and specific. **(3 out of 4 intervention components OR 5 out of 6 intervention components)**	Inconsistently uses language that is clear and specific. **(1 or 2 out of 4 intervention components OR 2 or 3 or 4 out of 6 intervention components)**	Does not use language that is clear and specific. **(Within no intervention components OR 1 intervention component)**
Tone of voice/ambiance	Consistently uses appropriate tone of voice throughout the session. This means that the tone of voice shifts and it's not monotone or robotic. **Close to 15% of the session = robotic and/or monotone.**	Somewhat consistently uses a somewhat appropriate tone of voice throughout the session. **Close to 25% of the session = robotic and/or monotone.**	Inconsistently uses an appropriate tone of voice throughout the session. **Close to half of the session = robotic and/or monotone.**	Does not use an appropriate tone of voice throughout the session. **More than half of the session = robotic and/or monotone.**

Corrective and affirmative feedback	Consistently provides immediate corrective (e.g., Let's try again, and this time pause after the period.) and affirmative feedback (e.g., Awesome job pronouncing the vocabulary word for the day.) **(3 or more instances within entire session)**	Somewhat consistently provides immediate corrective (e.g., Let's try again, and this time pause after the period.) and affirmative feedback (e.g., Awesome job pronouncing the vocabulary word for the day.) **(2 instances within entire session)**	Inconsistently provides immediate corrective (e.g., Let's try again, and this time pause after the period.) and affirmative feedback (e.g., Awesome job pronouncing the vocabulary word for the day.) **(1 instance within entire session)**	Does not provide immediate corrective (e.g., Let's try again, and this time pause after the period.) and affirmative feedback (e.g., Awesome job pronouncing the vocabulary word for the day.) **(No instances within entire session)**
Redirection of problem behavior	When problem behavior is present, consistently redirects to behavior expectations and/or visual schedule and/or to engage in a replacement behavior. **(Consistently = does NOT redirect for 1 instance of problem behavior OR Problem behavior not present, no redirections needed)**	When problem behavior is present, somewhat consistently redirects to behavior expectations and/or visual schedule and/or to engage in a replacement behavior. **(Somewhat consistently = does NOT redirect for 2-3 instances of problem behavior)**	When problem behavior is present, inconsistently redirects to behavior expectations and/or visual schedule and/or to engage in a replacement behavior. **(Includes 2-4 instances of redirection within entire session)**	When problem behavior is present, no redirection to behavior expectations and/or visual schedule and/or to engage in a replacement behavior. **(Includes 0-1 instances of redirection within entire session)**
OVERALL SCORE: Calculate the average score by adding the scores for each section and divide by five and round up if needed. Example: 4+3+3+2+1 = 13 → 13/5 = 2.6 → Overall Score = 3				
Adapted from Edmonds, M.S., & Briggs, K. L. (2003). Instructional Content Emphasis instrument. In S. R. Vaughn & K. L. Briggs (Eds.), *Reading in the classroom: Systems for observing teaching and learning. Baltimore: Brookes.*				