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Executive Function, Perceived Stress, and Academic Performance Among Middle Schoolers With and Without Behavior Problems

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Abstract

Students with emotional and behavioral disorders (EBD) characteristically experience academic difficulties. There is growing evidence that the continuum from academic competence to underachievement is partially explained by executive function (EF; neurocognitive attention-regulation processes) and stress. Yet, there is scarce research investigating these relationships among students with or at risk for EBD, especially during the elevated stress and risk period of middle school, and particularly among racially/ethnically under-represented groups. Therefore, with 118 middle schoolers with or at risk for EBD and typical peers (70% Hispanic/Latinx; 25% Black), we examined group differences and relationships among perceived family, peer, and school stress, EF, and academic outcomes. When compared with their typical peers, students with or at risk for EBD scored lower on EF and academic tasks. For all students, higher EF predicted better academic functioning. Perceived stress was directly and negatively related with EF and indirectly associated with academic outcomes via EF.

Keywords

emotional and behavioral disorders, executive function, academic outcomes, perceived stress

Middle school is a period of vulnerability in which interconnected neurocognitive executive function (EF) skills and stress-related variables may have lasting implications for academic outcomes, particularly for students identified with emotional and behavioral problems (e.g., Cumming, Zelazo, et al., 2022). As mandated by federal law (Individuals with Disabilities Education Improvement Act [IDEA], 2004), students with emotional and behavioral disorders (EBD) must be provided quality school-based supports to meet their needs. Yet, despite existing services, students with EBD make limited progress not only socially and behaviorally, but also academically (Bradley et al., 2008; Kauffman & Landrum, 2018). Students with EBD place below the 25th percentile in reading, math, and written expression (Lane et al., 2008) and tend to not increase in academic achievement over time (Gage et al., 2017). By secondary school, their academic performance gap typically increases to a 3.5-grade-level deficit compared with typically developing peers (Adamson & Lewis, 2017). Although certain approaches (e.g., teacher-directed, peer-mediated; Campbell et al., 2018) have shown promising effects on students' academic competence, students with EBD continue to have negative short- and long-term outcomes (grade failure, school drop-out, incarceration; Bradley et al., 2008; Kauffman & Landrum, 2018). Clearly, current school-based services fail to provide sufficient supports to students with (i.e., special education classification) or at risk (elevated internalizing/externalizing behaviors) for EBD. The design and implementation of more effective services will benefit from a more comprehensive understanding of the complex relationships among variables that contribute to the academic performance of these students.

Although there are many factors that relate to students' performance, over two decades of EF research (e.g., Diamond, 2013; Zelazo, 2020) has underscored its foundational role in students' academic achievement (see Pascual et al., 2019, for meta-analysis) and behavioral competence

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(Zelazo, 2020). This research has also revealed that persistent or uncontrollable stress associated with adverse experiences can have a negative effect on EF skills and their development (Cumming et al., 2020; Valcan et al., 2018), highlighting, that although there is a genetic component to EF (Miyake & Friedman, 2012), its development does not occur independently of experience. These findings align with (a) dynamic developmental systems perspectives according to which development is an interplay between individual processes (i.e., EF) and contextual experiences (e.g., relationships, learning opportunities; Farmer et al., 2020; Sameroff, 2020), and (b) Blair's (2014) psychobiological model of self-regulation, which highlights the influence of stress on EF. Thus, the continuum of students' academic competence to impairment appears closely linked to stressors and individual EF development, which develops rapidly during middle school (i.e., ~11–13 years in the United States). Middle school is also a period when students are at heightened risk for high stress, as well as the onset and escalation of behavioral and academic problems (Goldstein et al., 2015; Steinberg & Morris, 2001). As such, in this study, we aim to gain insight into the academic functioning of middle schoolers with or at risk for EBD by examining individual processes (i.e., EF) and social-ecological factors (i.e., perceived stress).

EF Is Pivotal to Student Academic Achievement

EF is an overarching term for an interrelated set of neurocognitive attention-regulation processes that underlie goal-directed behavior (Miyake et al., 2000). Although there is variability in how scholars define EF, there is growing consensus that EF comprises at least three unique yet interconnected processes: working memory, cognitive flexibility, and inhibitory control. These skills, respectively, permit students to keep information in mind, switch gears for goal-directed behavior, and control impulses–skills crucial to learning and success in school. For instance, when completing a task, students must simultaneously use working memory to remember and follow assignment instructions, cognitive flexibility to generate different approaches to completing the assignment, and inhibitory control to stay focused on the assignment and control impulses while completing it. Overall, when working in tandem, EF processes support students to successfully engage in goal-directed control of thoughts, emotions, and actions (Karr et al., 2022). Indeed, research has suggested that EF permits students to be more fully engrossed and reflective in their learning, resulting in deeper and longer-lasting understanding of content (e.g., Marcovitch et al., 2008). As a result, students with EF strengths tend to learn more (i.e., retain more information) from instruction and practice (Benson et al., 2013).

As such, it is unsurprising that a robust body of EF research has underscored its foundational role not only in healthy adaptation and cognitive development (Diamond, 2013; Zelazo, 2020) but also specifically in learning and achievement (e.g., Zelazo et al., 2016). EF is a significant predictor of students' school readiness and performance (e.g., McClelland et al., 2007), such that students with higher EF skills tend to have better proficiency in reading, science, and math (Nayfeld et al., 2013; Pascual et al., 2019). In contrast, students who experience EF difficulties are at increased risk for academic underachievement (Booth et al., 2010; Toll et al., 2011). Thus, EF is foundational to students' academic competence. Yet, there is little research on EF with students with or at risk for EBD (cf. Cumming et al., 2019; Feifer & Rattan, 2007; Mattison et al., 2006), limiting insight into the role EF plays in their academic functioning.

Academic Competence: Considering EF and Perceived Stress

Although EF provides a foundation for academic competence, day-to-day academic functioning likely depends on interactions among EF skills and environmental stressors. According to Blair's (2014) psychobiological model of self-regulation, EF skills interact with more automatic, bottom-up responses to stimulation associated with emotion and the physiological response to stress. EF, which develops throughout childhood and into early adulthood (Best & Miller, 2010; Zelazo et al., 2013), reflects both genetic predisposition (Miyake & Friedman, 2012) and sensitivity to experiences that range from positive to negative. For instance, positive family and school environments and social interactions, such as parental and class warmth, access to learning materials, and positive teacher–student relationships are often associated with stronger EF skills (e.g., Cumming et al., 2020; Cumming, Poling, Patwardhan, et al., 2022). Conversely, adverse experiences, which elicit a stress response, can negatively shape EF development. Although mild stress can facilitate EF skills (e.g., Robbins & Arnsten, 2009), prolonged exposure to situations perceived as threatening or uncontrollable can have a damaging impact on prefrontal cortex development and related EF skills (Carrion & Wong, 2012; Lupien et al., 2009). Physiological responses to stress include activation of the hypothalamic-pituitary-adrenal axis and result in the release of adrenal hormones such as cortisol that at high levels can interfere with EF in the moment and cause more reactive responding (e.g., Liston et al., 2009; Robbins & Arnsten, 2009). Exposure to prolonged, uncontrollable stress (e.g., trauma, housing instability, maltreatment) also interferes with EF development over time because of the toxic effects of cortisol on EF-related brain structures (e.g., Kolb et al., 2017).

Even common stressors at home and school can have an adverse effect. For instance, Valcan et al. (2018) found negative parenting (e.g., intrusiveness, detachment) adversely predicted child EF development across 42 studies. Cumming et al. (2020), in a systematic review of 20 studies, determined that unsafe or punitive schools, classrooms characterized by low emotional support, conflicts between peers or teachers and students, and unproductive instructional time all negatively predicted students' growth of EF skills over time. Though these studies did not focus on students with EBD, results are salient, given emerging research underscoring the likelihood that students with EBD may exhibit EF difficulties and vulnerability for heightened perceived stress associated with social isolation and relationship difficulties (Cumming et al., 2019); notably, the connection between social difficulties and stress is well established (e.g., Campagne, 2019). In turn, environmental and/or interpersonal adversity can further elevate the risk for psychopathology and behavioral problems (e.g., Grant et al., 2003; McLaughlin, 2016; Zelazo, 2020), which can potentially place students with EBD at additional risk.

Stress can also have a negative direct effect on students' academic outcomes. For instance, researchers have found family-related stressors (e.g., worrying about family income) tend to be associated negatively with student academic achievement (e.g., Mistry & Elenbaas, 2021), especially for students from lower socio-economic backgrounds (Oxford & Lee, 2011) or multiply disadvantaged families (e.g., racially diverse, refugee; Nurius et al., 2015; Suárez-Orozco et al., 2018). Furthermore, school-related stressors (e.g., test or class work anxiety) adversely predict academic competence, especially in secondary school (Pascoe et al., 2020) when academic and social expectations increase (Anderson et al., 2000). While stress can predict academic competence and interfere with EF skills, EF skills can also be used to manage responses to stress, consistent with their role as a protective factor against risks associated with adversity (e.g., Masten et al., 2012). EF skills, due to their demonstrated malleability, are now a popular target of intervention designed to improve outcomes for children facing a wide range of risks, including psychopathology (e.g., Diamond & Lee, 2011; Dunning et al., 2019; Takacs and Kassai, 2019). Overall, academic competence/impairment appears closely linked to stress and individual EF development, which may be especially important for students with EBD during middle school, when students are at heightened risk of academic and behavioral problem onset and escalation (Goldstein et al., 2015; Steinberg & Morris, 2001).

Current State of EF Research With Students With or At Risk for EBD

Although there is a wealth of research underscoring the salience of EF in learning (e.g., Toll et al., 2011), attention (i.e., attention-deficit/hyperactivity disorder), and multiple mental health disorders (Zelazo, 2020), there is limited EF research with students receiving special education services for EBD. For instance, there is a growing consensus that EF difficulties serve as a transdiagnostic risk factor for mental health difficulties, resulting in a range of clinical symptoms associated with depression, anxiety, schizophrenia, and bipolar and substance use disorders (e.g., McLaughlin, 2016; McTeague et al., 2017). In essence, because EF skills provide a necessary foundation for flexible adaptation to changing circumstances and challenges, difficulties with these skills have widespread behavioral consequences (e.g., Moffitt et al., 2011).

The few existing studies of EF with students with or at risk for EBD provide promising evidence that aligns with mental health research. For instance, Feifer and Rattan (2007) found students with or at risk for EBD had difficulties with EF skills as measured by teacher report and Mattison et al. (2006) identified EF challenges on performance-based assessments. Yet, these skills exist on a continuum. More recently, Cumming, Poling, Qiu, et al. (2023) conducted a latent profile analysis with a sample of kindergarteners and first graders at risk for EBD ($n = 1{,}154$) and found support for a three-profile solution of mildly, moderately, and clinically at-risk EF profiles (i.e., demonstrating increasing levels of EF difficulty). These profiles predicted problematic behaviors, social competence, and language, and students in the moderately and clinically at-risk EF profiles exhibited considerable difficulties in all three areas.

Finally, based on an EF-Stress Loop conceptual framework (Cumming, Zelazo, et al., 2022), in which EF serves as a vulnerability or resilience factor for stress regulation and student outcomes, Cumming et al. (2019) conducted one of the few studies that examined differences in all three distinct EF processes (i.e., inhibitory control, working memory, cognitive flexibility) among students with or at-risk for EBD and a comparison group of peers without significant behavior problems ($n = 79$; Cumming et al., 2019). Compared with peers, middle schoolers with or at risk for EBD scored significantly lower on measures of inhibitory control, working memory, and cognitive flexibility. Students with or at-risk for EBD also reported higher levels of peer stress than peers. Although Cumming et al. (2019) did not find an association between EF and student perceived stress and did not examine academic achievement, they did find heightened levels of perceived stress were associated with greater internalizing and externalizing behaviors. This study provides promising evidence that stress plays an important role in student functioning.

Although promising, these studies have multiple limitations. First, apart from Cumming, Poling, Qiu, et al. (2023), the studies had sample sizes ranging from 35 to 79 participants (Cumming et al., 2019; Feifer & Rattan, 2007; Mattison et al., 2006), potentially lacking statistical power to detect important effects. Three out of the four studies also did not include a comparison group of students *without* behavior problems (Cumming, Poling, Qiu, et al. 2023; Feifer & Rattan, 2007; Mattison et al., 2006). To fully understand the underlying factors that predict academic competence in students with or at risk for EBD, it is important to determine whether findings differ from peers without significant behavior problems.

Only one study (Cumming et al., 2019) focused exclusively on middle schoolers with or at risk for EBD and examined both EF and perceived stress. Early adolescence has the potential to be a heightened period of vulnerability for EF, perceived stress, and academic outcomes due to rapid EF development (Zelazo et al., 2013), higher levels of stress (American Psychological Association, 2014), and increased risk for psychopathology (Dahl & Gunnar, 2009; Paus et al., 2008) and academic underachievement (Adamson & Lewis, 2017); thus, middle school is a key time for school-based prevention and intervention efforts. Yet, most research investigating the relationship between family and school-based stress and EF involves children under 6 years old without EBD. Therefore, knowledge is limited regarding middle schoolers with or at risk for EBD (e.g., Cumming et al., 2019).

Only one study (Mattison et al., 2006) enrolled a sample of students from racially, ethnically, or linguistically diverse (RELD) backgrounds (60% Black). The limited inclusion of RELD participants is problematic given (a) the disproportionate representation of students with EBD from RELD backgrounds (Office of Special Education Programs [OSEP], 2022), (b) research on EF differences among racial/ethnic groups in the U.S. (Rea-Sandin et al., 2021), (c) systemic inequities in schools that shape experienced stressors (e.g., educational access, racism, classification stigma, deficit perspectives; Artiles, 2022), and (d) the growing racial and ethnic diversity in the United States, particularly among the Latinx population (U.S. Census Bureau, 2021). Thus, additional research is warranted with RELD middle schoolers with or at risk for EBD and RELD comparison peers to gain insight into ways EF skills and stress interact in this population.

Purpose

This study was designed to gain a deeper insight into the academic functioning of middle schoolers with or at risk for EBD by taking into account EF and stress. EF, which exists on a continuum of ability (e.g., Cumming, Poling, Qiu, et al., 2023), may confer increasing levels of vulnerability for academic underachievement by reducing students' ability to navigate the elevated work and social demands associated with middle school (Cumming et al., 2019). Similarly, EF may confer heightened resilience for academic competence by improving students' capacity to meet expectations. As individuals' perceived levels of experienced stress within their family, among peers, and school vary, so too can their capacity to access EF and perform well academically.

As such, building on a small but growing literature (e.g., Cumming et al., 2019), we examined (a) differences in perceived stress, EF performance, and academic outcomes between racially and ethnically diverse students *with* behavioral difficulties (i.e., students with or at risk for EBD) and racially and ethnically diverse comparison peers *without* behavioral difficulties, and (b) direct and indirect effects among perceived stress, student EF, and academic outcomes. Our sample of middle schoolers (e.g., 70% Latinx; 25% Black; 35% White)[1] from a school district with a large Latinx population will help address limitations of current research with students with or at risk for EBD.

We hypothesized:

> **Hypothesis 1:** Students with or at risk for EBD (i.e., behavior problem group) would score lower than comparison peers on EF and academic competence (math, English language arts [ELA]). They would also report higher perceived (i.e., family, school, peer) stress.
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> **Hypothesis 2:** Perceived stress would predict academic outcomes, both directly and indirectly through EF. Students who reported higher perceived stress in the family and school and with peers would score lower on EF and academic tasks. In turn, EF would have a direct effect on academic outcomes; better performance on EF tasks would relate to higher math and ELA scores.

Method

Sample and Setting

A total of 118 sixth- and seventh-grade students and 27 of their teachers from six schools in a large urban school district located in the southeastern United States participated in the study (see Table 1). The mean age of students in the study was 12.2 years (SD = 0.87). Approximately 45% of students were classified with a primary disability (33% EBD, 9% specific learning disability, and 3% other disability [e.g., speech/language impairment, other health impaired]). Of students identified with a disability, 15% had a secondary special education classification (e.g., other health impaired, EBD). The majority (69.5%) of students identified as male, and the percentage of male students was much higher (86.0%) for students with disabilities. This is not unexpected given that male students tend to be identified for behavior problems more often than female students (Kauffman & Landrum, 2018). Students were two thirds Latinx (69.5%) and identified as White (32.2%), Black (24.6%), Asian (0.8%), or multiracial/other (2.5%). The majority indicated the primary language spoken at home was English, while 17.7% reported they primarily spoke

Table 1. Student and Teacher Demographics for Study on Academic Functioning as Affected by Executive Functioning and Stress.

Demographic Variable	Overall		Comparison group *n* =61		Behavior group *n* = 57		Sig.
Students (*n* = 118)							
Age: *M* (*SD*)	12.23	0.87	11.98	0.719	12.49	0.96*	$p < .001$
Gender							$p < .001$
Male	69.50%		54.1%		86.0%		
Female	30.50%		45.9%		14.0%		
Grade							
6	45.8%		50.8%		40.4%		$p = .254$
7	54.2%		49.2%		59.6%		
Race/Ethnicity[a]							
White	32.2%		49.2%		14.0%		$p < .001$
Black	24.6%		14.8%		35.1%		$p = .010$
Latinx/Hispanic	69.5%		78.7%		59.6%		$p = .025$
Asian	0.8%		0.00%		1.8%		$p =. 299$
Multiracial	0.8%		1.6%		0.00%		$p = .332$
Other	1.7%		1.6%		1.8%		$p = .961$
Primary language							$p = .552$
English	80.5%		77.0%		84.6%		
Spanish	17.7%		21.3%		13.5%		
Other	1.80%		1.6%		1.9%		
Free/reduced-price lunch	86.2%		80.3%		92.7%		$p = .053$
Neighborhood SES							$p = .185$
Very low	53.3%		57.9%		48.0%		
Low	14.0%		15.8%		12.0%		
Moderate	25.2%		22.8%		28.0%		
High	0.9%		1.8%		0.0%		
Very high	6.5%		1.8%		12.0%		
Neighborhood crime							$p = .748$
Well below average	4.7%		5.3%		4.0%		
Slightly below average	20.6%		21.1%		20.0%		
Slightly above average	29.0%		24.6%		34.0%		
Well above average	45.8%		49.1%		32.0%		
Teachers (*n* = 27)							
Race/ethnicity[a]							
White	22.2%						
Black	33.3%						
Multiracial	3.7%						
Hispanic/Latinx	41.0%						
Missing data	7.4%						
Classroom setting							
General education	51.9%						
Self- contained	22.2%						
Resource	11.1%						
Other	7.4%						
Missing data	7.4%						
Certification							
General education	44.4%						
Special education	26.0%						
Both	22.2%						
Missing data	7.4%						
Teacher role							
General educator	48.2%						
Special educator	44.4%						
Missing data	7.4%						

Note. Out of 27 teachers, 25 reported demographic information.
[a]Race/ethnicity categories were not mutually exclusive.
*Statistical significance of results of chi-square tests of independence and independent samples *t* tests for differences in socio-demographic variables between groups.

Spanish at home, and 1.8% spoke other languages. Finally, in the full sample, the majority of students (86.2%) received free or reduced- priced lunch. Based on neighborhood zip codes, approximately half (53.3%) lived in very low socioeconomic communities that had well above average crime levels (45.8%). See Table 1 for sample demographics.

In comparison with the overall population of students in the school district, our sample had more male students (69.5% compared with 51.0% in the district) and more students receiving free or reduced-priced lunch (86.2% vs. 55.2%) but was comparable in terms of race and ethnicity (e.g., 69.5% Latinx, 72.7% in the district) and primary language spoken at home (19.5% of students spoke a language other than English at home, 22.9% in the district).

Procedures

All recruitment and study procedures met university Institutional Review Board standards. We contacted six middle school principals to describe the study; all six agreed to participate. We then contacted sixth- and seventh-grade general education teachers whose classes included both students with (i.e., with or at risk for EBD) and without (i.e., comparison peers) significant behavioral difficulties. We also contacted special educators who taught students with EBD in self-contained classrooms. We obtained consents from 29 teachers. We found two teachers taught the same students and one teacher had no consenting students; therefore, we dropped them prior to data collection, resulting in 27 participating teachers.

To ensure the representation of a broad range of student behaviors, each participating general education teacher was instructed to identify one class in their caseload that had typically developing students as well as students with or potentially at risk for EBD. We asked general education teachers to select only one class to minimize teacher load and increase willingness to participate. For special education teachers who taught self-contained classrooms for students with EBD, we asked teachers to identify students who had a primary or secondary classification of EBD. We excluded students identified with autism spectrum disorders or intellectual disabilities. We recruited only sixth- and seventh-grade students, as this (a) is an active brain maturation period and (b) permitted us to follow students longitudinally before exiting middle school at the end of Grade 8. Due to COVID-19, our data collection was limited to Fall 2019, hence the cross-sectional nature of the current study.

General education teachers then completed the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) on each assenting student (i.e., parent consent, student assent) in their classroom to identify students at risk for EBD (emotional symptoms, conduct problems, hyperactivity, peer problems). Students whose score fell at or above the borderline SDQ for total difficulties categorization were considered at risk for EBD. With the exception of one self-contained class of nine students with EBD, we randomly selected seven students to participate from both general education and self-contained EBD classrooms with over seven assenting students. This resulted in an overall sample of 118 students, of whom 48% were students with or at risk for EBD and 52% were peers without behavior problems.

Research assistants met individually with participating students to complete measures on computer tablets to assess perceived stress (family, school, peer) and EF in the fall of the 2019–2020 school year. Data collection for each student lasted approximately 75 min across one to three sessions and took place in a designated, quiet room at school, during typical school hours. Prior to collecting data, each research assistant completed an extensive training that included procedural scripts, sequencing of measures, and assessment administration. Each research assistant had to demonstrate at least 94% adherence to a study procedures checklist.

Measures

Behavior Screener. We used the SDQ (3- to 16-year-old; Goodman, 1997, 2001) to identify students at risk for EBD. The SDQ is a well-validated behavioral screener and is sensitive to identifying individuals with internalizing and externalizing behaviors (e.g., Goodman, 2001). General education teachers rated each student on 25 items (0 = *not true* to 2 = *certainly true*) that comprise five scales with five items each: emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems, and prosocial behavior. A total difficulties score (range from 0 to 40) was calculated by summing scores from all the scales except the Prosocial scale. Total difficulties scores were then classified as close to average (0–11), slightly raised (12–15), high (16–18), or very high (19–40). Students who scored in the slightly raised, high, or very high range (i.e., 12 or above) on the total difficulties scale were identified as at risk for EBD. According to Stone et al.'s (2010) review of 48 studies examining the SDQ's psychometric properties, the SDQ has well established validity and reliability, with test–retest reliability at .84, internal consistency at .82, and concurrent validity with the Child Behavior Checklist at .76. In our sample, internal consistency was α =.86.

Perceived Stress. We measured students' perceived levels of stress (1 = *not at all* to 4 = *a lot*) over the last 6 months with the Response to Stress Questionnaire (Connor-Smith et al., 2000). The survey includes three separate subscales that measure distinct sources of perceived stress related to family (12 items; e.g., arguing with a parent, parents not understanding), school (10 items; e.g., doing poorly in school, not understanding classes), and peers (9 items; e.g., having problems with friends, being left out or rejected). We summed scores across family (range = 12–48), peer (range = 9–36), and school (range = 10–40) subscales, with higher scores indicating more reported stress. In previous research with middle school students (e.g., Sontag et al., 2008), including those with or at risk for EBD (Cumming et al., 2019), the subscales demonstrated good internal consistency (family =.84; school/peer = .82). For the current sample, internal consistency was α =.80 (family), α =.86 (school), and α =.85 (peer).

Executive Function. We assessed three aspects of EF using the empirically validated and nationally normed National Institutes of Health (NIH) Toolbox iPad app (Slotkin et al., 2012). These included the following: (a) working memory with a recall and sequencing task (number of items recalled and correct sequence), (b) inhibitory control with a flanker task (reaction time and accuracy), and (c) cognitive flexibility with the dimensional change card sort task (reaction time and accuracy). In previous analysis, convergent validity ranged from 0.48 to 0.93 and test–retest reliability from 0.78 to 0.99 (Weintraub et al., 2013). We did not measure test–retest reliability in the current study, given the cross-sectional data. Yet, the NIH Toolbox has been used reliably across age groups, including with middle schoolers with EBD (Cumming et al., 2019). We used age-corrected scores given that EF develops over time.

Academic Outcomes. We used both grades and i-Ready scores for ELA and math to provide a comprehensive assessment of students' academic abilities (Miller et al., 2013; Shepard, 2000). We obtained i-Ready scores via the state's individually administered, web-based, K-12 adaptive diagnostic assessment that measures students' relative strengths and weaknesses in reading and math and aligns with Common Core State Standards (Curriculum Associates, 2014). Previous reported test–retest reliability was within the excellent range (math = .93; reading = .90), as was internal consistency (math =.97; reading = .97).

Analyses

Students who had a special education classification of EBD or who met at-risk criteria on the SDQ, we combined to form a behavior difficulty group. Peers who were not at-risk, we identified as the comparison peer group. We utilized multiple analytic approaches, including independent samples *t*-tests and chi-square tests of independence (to evaluate demographic group differences), ANOVAs, bivariate correlations, and structural equation models (SEMs) to test our hypotheses. De-identified data and codes are available upon request.

ANOVAs and Correlations. Our preliminary analyses assessed differences in perceived stress, EF, and academic outcomes among students with or at risk for EBD (i.e., behavior problem group) and peers without behavior problems (i.e., comparison peer group). We used one-factor between-subjects ANOVAs with η^2 as the effect size (Cohen, 1988; Miles & Shevlin, 2001). Prior to analyses, we evaluated homogeneity of variance with Levene's test. As recommended by Hahs-Vaughn and Lomax (2020), we used multiple sources of evidence to evaluate normality, including the Wilk–Shapiro test and test statistics for skewness and kurtosis (included due to Wilk–Shapiro test's sensitivity to sample size; Field, 2013). Variables that violated the normality assumption based on the Wilk–Shapiro test and at least one of the test statistics for skewness and kurtosis were considered non-normal. To address non-normality, the following variables were log-transformed: family stress, peer stress, and inhibitory control. We then ran a series of ANOVAs to assess group differences. Because peer stress continued to violate the assumption of normality after log-transformation, we conducted a Kruskal–Wallis H-test (Field, 2013). We also analyzed bivariate associations with Pearson's correlations as well as Kendall's Tau correlations to address variables that violated normality (Field, 2013). We used SPSS 25.

Structural Equation Modeling. We conducted a series of analyses using SEM (Anderson & Gerbing, 1988), which affords an adequate representation of the hypothesized relations between factors (i.e., perceived stress, EF, and academic outcomes) and allows for statistical adjustment to standard errors that can be biased due to the nested structure of our data. Specifically, we followed a two-step modeling approach (Kline, 2016) where the full SEM was respecified as a measurement model and was fitted to the data via confirmatory factor analysis in Step 1. In Step 2, the original structural model was fitted based on the accepted measurement model from Step 1. As shown in Panel A of Figure 1, the measurement model included three latent factors (perceived stress, EF, and academic outcomes) and 10 observed indicators. No residual correlations or cross-loadings of indicators were specified in the initial measurement model. Furthermore, for the purpose of model identification, we used the reference variable method by fixing the loading of the first indicator at one for perceived stress, EF, and academic outcomes, respectively. Next, based on the accepted measurement model, a structural model (see Panel B of Figure 1) was fitted. The direct effect of perceived stress and its indirect effect via EF were specified on academic outcomes. As the structural component of this model is just identified, fits of the measurement model and the structural model were identical.

Analyses of this phase were conducted in Mplus 8.4. We used the mean- and variance-adjusted weighted least squares estimator, given that the levels of i-Ready math and ELA were categorical variables. In addition, as the students were clustered within classrooms, we specified TYPE = COMPLEX in Mplus to address potential non-independence of observations. Model fit was assessed based on the following criteria (Kenny, 2020; Kline, 2016), χ^2 test, root mean square error of approximation (RMSEA $\leq$ .08) plus the 90% confidence interval (CI) and the *p*-value for the test of the close-fit hypothesis (p_{RMSEA}), comparative fit index (CFI $\geq$ .90), and Tucker Lewis index (TLI $\geq$ .90). In the process of model building, we reviewed model modification indexes (MIs) and respecified the model accordingly.

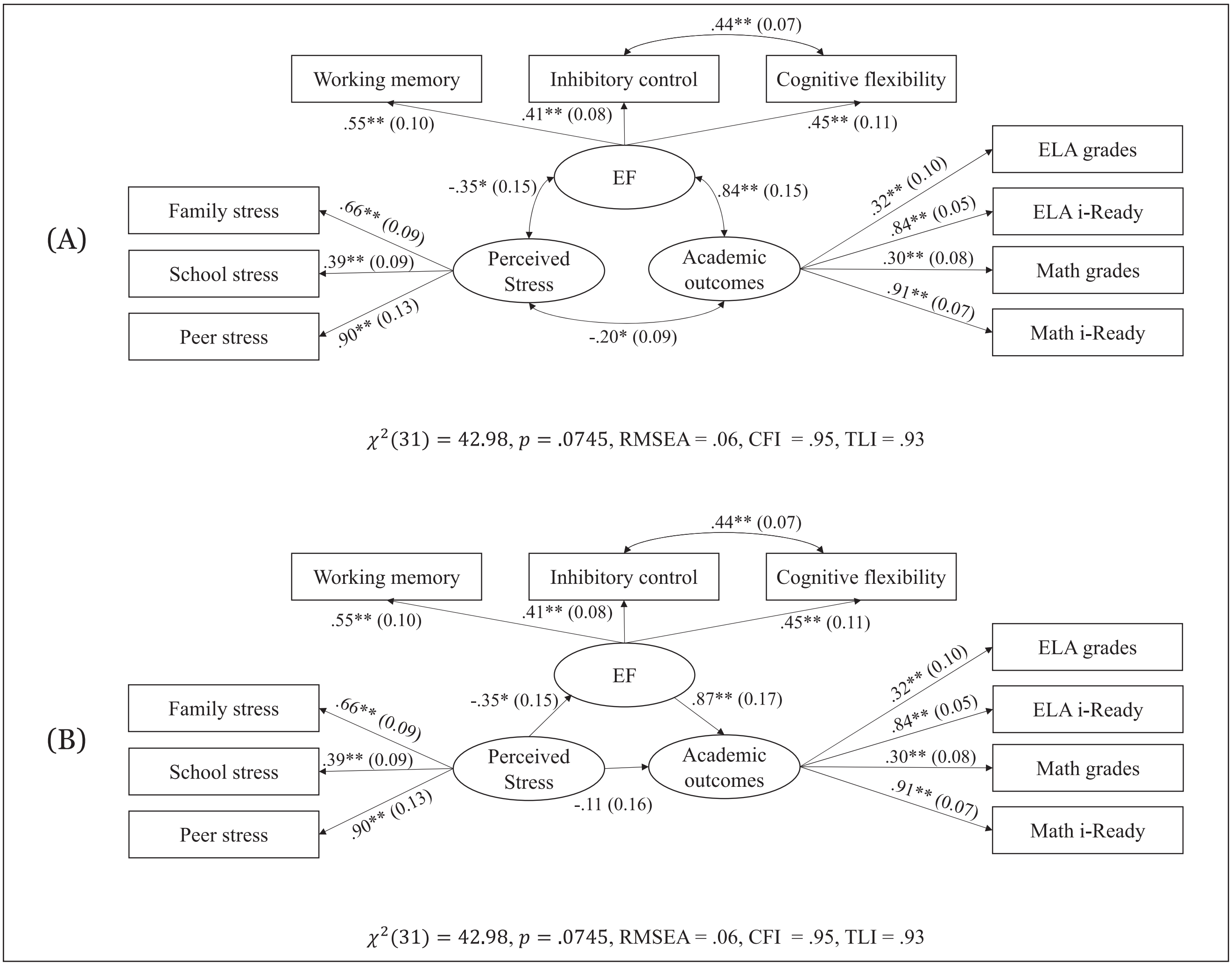

Figure 1. Visual Representation of the Final Measurement Model and Structural Model.
Note. Panel A is the final measurement model, panel B is the structural model. EF = executive function, ELA = English language arts. Parentheses contain standard errors.
$^*p < .05$. $^{**}p < .001$.

Prior to the analyses, we examined the data for multivariate normality and outliers using the MVN package (Korkmaz et al., 2014) in R and mechanism of missingness via MissMech package (Jamshidian et al., 2014). The factor indicators were found to be multivariate normal with no outliers. The result of Hawkins test of missingness was not statistically significant ($p = .08$) suggesting that incomplete data of i-Ready math and ELA were missing at random.

Results

Descriptive Statistics

Table 1 displays the demographics of our sample. Students with or at-risk for EBD were, on average, significantly older than our comparison group. Students with or at-risk for EBD were also less likely to identify as White or Latinx, and more likely to identify as Black. There were no significant differences in grade, primary language, free/reduced price lunch status, socioeconomic status, or neighborhood crime level based on group classification.

Aim 1: Group Differences

We provide means and standard deviations for all study variables for students with behavior problems and comparison peers in Table 2. Students with or at risk for EBD scored significantly lower on measures of working memory and cognitive flexibility than their comparison peers, with medium effect sizes ($\eta^2 = .11$ and $.05$, respectively). There were no group differences for inhibitory control. Similarly, students in the behavior group performed lower than comparison peers on all academic measures of math achievement and ELA

Table 2. Group Differences for Perceived Stress, Executive Functioning, and Academic Outcomes.

Variable	Comparison group *M (SD)*	Behavior group *M (SD)*	*F*	*df*	η^2
Raw variables					
Perceived stress					
Family	21.05 (5.77)	22.26 (7.52)	0.98	117	0.01
Peer	16.39 (5.99)	17.49 (6.62)	0.90	117	0.01
School	23.03 (7.18)	22.65 (7.13)	0.09	117	0.00
Executive functioning					
Working memory	96.31 (14.42)	86.93 (12.35)	14.31**	117	0.11
Inhibitory control	89.49 (14.30)	86.02 (14.14)	1.76	117	0.02
Cognitive flexibility	97.30 (17.68)	89.16 (16.89)	6.52*	117	0.05
Academics–math					
Grade	2.38 (1.01)	1.98 (1.00)	4.74*	117	0.04
i-Ready level	4.94 (1.76)	3.51 (1.75)	17.80**	106	0.15
Academics–English language arts					
Grade	2.45 (0.97)	2.20 (0.85)	2.09	117	0.02
i-Ready level	5.02 (2.11)	3.43 (1.91)	18.08**	116	0.14
Log-transformed variables					
Perceived stress					
Family	3.01 (0.26)	3.05 (0.32)	0.51	117	.00
Peer	2.74 (0.33)	2.80 (0.35)	0.89	117	.01
Inhibitory control	4.48 (0.15)	4.44 (0.17)	1.94	117	.02
Kruskal-Wallis test					
Perceived stress: peer	56.74	62.46	0.83	–	–

*$p < .05$. **$p < .001$.

i-Ready level, with effect sizes that were small (math grade; $\eta^2 = .04$) and large (i-Ready ELA level; $\eta^2 = .14$; i-Ready math level; $\eta^2 =. 15$). There were no group differences in student-reported perceived stress on any domain (family, school, peer).

Aim 2: Direct and Indirect Effects Among Perceived Stress, EF, and Academics

Correlations among all study variables are reported in Supplemental Table S1. We provide a summary of selected fit statistics in Supplemental Table S2. The initial three-factor measurement model did not fit adequately, $\chi^2(32) = 50.14$, $p = .022$, $RMSEA = .07$, $90\%\, CI = [.02, .10]$, $p_{RMSEA} = .188$, $CFI = .92$, $TLI = .89$. After reviewing the MIs, we noted the residual correlation between cognitive flexibility and inhibitory control was not only empirically significant (MI(1) = 6.878), but also conceptually interpretable. Although EF domains are distinct, they are also interrelated. Thus, we respecified the measurement model by adding a correlated residual of cognitive flexibility and inhibitory control. This modified measurement model presented adequate fit, $\chi^2(31) = 42.98$, $p = .075$, $RMSEA = .06$, $90\%\, CI = [.00, .01]$, $p_{RMSEA} = .360$, $CFI = .95$, $TLI = .93$. The result of model comparison test also was found statistically significant ($\Delta\chi^2(1) = 13.74$, $p = .0002$), indicating the model with the correlation residual showed better fit than the initial measurement model. Estimates of factor loadings, factor correlations, and residual correlations are illustrated in Panel A of Figure 1. All indicators positively loaded onto their respective latent factors, with the majority loading above .30. Although loadings of ELA and Math grades were relatively low, we retained both in the model as unique evidence of students' academic outcomes (Bowers, 2019).

Based on the final measurement model, structural paths were added between perceived stress, EF, and academic outcomes, which led to a saturated structural model (Panel B of Figure 1). Correspondingly, the model fit information was identical to the final measurement model. Estimates of the structural paths are listed in Supplemental Table S3. As shown, the direct standardized path coefficient between EF and academic outcomes was statistically significant ($\beta = .87$, $p < .001$), suggesting a .87 unit increase in academic outcomes due to a standard unit increase in EF. Similarly, the direct standardized path coefficient between perceived stress and EF was significant (β = −.35, p = .022). On average, a one standard unit increase in perceived stress was associated with .35 unit decrease in EF. Yet, no statistically significant effect of perceived stress was found on academic outcomes after controlling for the effect of EF. The total effect of perceived stress on academic outcomes was significant (β = −.20, p = .029). Decomposing this total effect led to a nonsignificant direct effect of perceived stress on academic outcomes (β = .11, p = .498) and a marginally significant indirect effect of perceived stress on academic outcomes via EF (β = −.31, p = .054), which signifies the potential intervening effect of EF.

Discussion

The purpose of this study was to gain insight into the academic functioning of middle schoolers with or at risk for EBD from a predominately Latinx school district by accounting simultaneously for individual processes (i.e., EF) and proximal social-ecological factors (i.e., perceived family, peer, and school-based stress). This study not only extends a small but growing body of EF research on students identified with or at risk for EBD (e.g., Cumming et al., 2019) but is also the first study, to our knowledge, to examine their perceived stress, EF, and academic outcomes. Results showed (a) group differences (students with or at risk for EBD vs. peers without behavior problems) in EF (working memory and cognitive flexibility) and academic ability (math and ELA) and (b) meaningful relationships among students' perceived stress, EF, and academic outcomes. We also found students with EBD were more likely to identify as Black, which aligns with persistent issues of disproportionality in EBD identification (OSEP, 2022). In the following sections, we discuss results, describe limitations, and highlight implications.

Group Differences in Perceived Stress, EF, and Academic Outcomes

As expected, students with or at risk for EBD scored lower on academics than comparison peers, adding to the robust research documenting an academic gap between students with EBD and typical peers (e.g., Gage et al., 2017). In partial support of our hypotheses, we found students with or at risk for EBD scored lower on working memory and cognitive flexibility tasks compared with peers without behavior problems. These findings align with emerging school-based research (e.g., Cumming et al., 2019), as well as the literature linking EF difficulties with mental health and behavioral challenges (Cumming, Poling, Qiu, et al., 2023; Zelazo, 2020). Yet, contrary to Cumming et al.'s (2019) findings, there were no group differences in inhibitory control. Understanding the differentiation among EF processes as children and adolescents develop is still ongoing, yet research provides evidence of ongoing EF refinement in early and late adolescent years (Zelazo et al., 2013). Thus, for students with or at risk for EBD, working memory and cognitive flexibility may be especially important to their capacity to engage in academically demanding tasks; yet additional research is warranted.

In contrast to our hypothesis, students in both groups also endorsed similar levels of family, peer, and school stress. Our findings were similar to Cumming et al. (2019), who found students with and without elevated behavioral difficulties had similar levels of perceived family and school stress. Unlike their study, however, we also did not find group differences in perceived peer stress. Because students with EBD tend to have difficulties establishing positive relationships and likely exhibit challenging behaviors that can negatively affect relationship quality (Kauffman & Landrum, 2018), lack of differences was initially unexpected. Yet, results may be due to multiple reasons.

First, although we found good internal consistency for our sample, it is possible that our measure of stress is relatively insensitive for middle schoolers, especially for students with behavior difficulties in a predominantly Latinx district. According to Grant et al. (2003) in their review of the connection between stressors and child and adolescent psychopathology, there are ongoing difficulties with accurately measuring cognitive appraisal of stress (e.g., perceptions of stress) during childhood and adolescence, as appraisal processes vary substantially across development and become more complex during middle school. Gauging nuances among students' perceived stressors during middle school may be more challenging with students with or at risk for EBD, who may be less self-reflective (Kauffman & Landrum, 2018). Also, our measures of perceived stress did not include other sources of more significant stressors (e.g., trauma; Carrion & Wong, 2012) or stressors that may be unique and important for a predominantly Latinx and Black sample (discrimination; Berger & Sarnyai, 2015).

Another possible explanation may be that the two groups indeed did not differ in perceived stress levels due to shared environmental experiences and/or heterogeneous interpersonal competencies. Our sample may have had similar shared experiences, across both groups, of stress associated with economic disadvantage (majority of the overall sample) and living in neighborhoods of concentrated poverty and frequent crime (about half of the sample). Although adolescence is typically a high-stress period, living in poverty and high crime neighborhoods may place the entire sample of students at risk for multiple and similar stressors that might directly influence EF and academic performance (e.g., insecure neighborhoods; Nurius et al., 2015). Furthermore, it could be that students with or at risk for EBD may have experienced similar stress to peers without behavioral difficulties due to distinct interpersonal competencies. For instance, a student with EBD may display aggressive behaviors, but still be considered popular by peers due to their perceived toughness. Another student with EBD may also be perceived as aggressive yet less socially adapt, and therefore is socially marginalized (Farmer et al., 2008). Thus, we encourage scholars to consider these nuances when examining stress. The fact that there were no perceived stress differences is compelling given our analysis found stress had a negative effect on EF (discussed later) and students with or at risk for EBD still scored lower on EF tasks—highlighting that students with or risk for EBD are likely predisposed to EF challenges and especially sensitive to experienced stress. We encourage researchers to investigate this as an area of future research.

Relationships Among Perceived Stress, EF, and Academic Outcomes

Consistent with our hypothesis, students who performed better on EF tasks had higher academic outcomes. These findings provide further evidence for the importance of EF in students' academic success (Pascual et al., 2019), as scholars posit that EF permits students to be fully engaged, to be reflective, and to retain more information from instruction (Benson et al., 2013; Marcovitch et al., 2008). Yet, for students with or at risk for EBD in our study, who scored lower on EF tasks, EF difficulties may serve as a vulnerability for academic challenges.

In partial support of our hypothesis, perceived stress was negatively related to students' EF performance and indirectly to their academic outcomes via EF. These findings align with research highlighting the adverse relationship between negative experiences (e.g., family, peer conflict) and student EF development (Cumming et al., 2020; Valcan et al., 2018). Researchers have found stress exposure is crucial during adolescence as it has long term and lasting effects on developing cognition (Carrion & Wong, 2012; Lupien et al., 2009). Yet, few published school-based studies have examined EF skills as a potential mediator of the relationship between stress and academic outcomes, though our findings are similar to those reported by Zhang et al. (2019), whose study found EF mediated the relationship between middle schoolers' stressful life events and school adjustment ($\beta = -.20$). Overall, the more stressors middle schoolers experience, the worse their EF, which, in turn has an indirect effect on their ability to perform well academically. Yet, we urge readers to have caution when drawing conclusions related to this indirect relationship due to its marginal significance ($p = .054$). Complex SEM models tend to require large sample sizes (e.g., $n > 200$) to detect effects (Keith, 2006) and our sample of 118 middle schoolers may have been underpowered. Despite this, however, the magnitude of the indirect effect ($\beta = -.31$) was fairly robust and comparable to Zhang et al. (2019) whose study included a much larger sample ($n = 1{,}175$), providing additional credence to our finding. Taken altogether, our findings suggest: (a) a student's EF skills during middle school relate to their academic progress—it may either increasingly protect them or make them vulnerable to underachievement, and (b) perceived stress may create or exacerbate this continuum of vulnerability or resilience. Thus, our study provides evidence that EF and perceived stress may play important roles in the academic functioning of middle school students, including RELD students with or at risk for EBD in a large Latinx district.

Limitations and Future Research

Many of our study findings are compelling, but limitations should be considered. First, there are potential sample limitations. Our sample size was relatively small and underpowered for SEM, resulting in potentially undetected effects (Keith, 2006). We included only sixth and seventh grade students with or at risk for EBD and comparison peers without behavior problems; students with autism spectrum disorders or intellectual disabilities were excluded, limiting generalization to this population of students. Also, within the behavior problem group, participants included students identified with EBD in self-contained or general education settings, as well as students identified with elevated behavior problems in general education classrooms (measured with the SDQ), resulting in potential group heterogeneity. We combined students both with and at risk for EBD into one group (because we were underpowered to examine them separately), and thus we may be missing important group differences that we will examine in future work; for instance, we would expect that students with EBD would manifest greater differences on EF and stress, as well as potential differences in the relationships among variables. Thus, we recommend researchers replicate our findings with larger samples of students with or at risk for EBD and peers without behavior problems which would (a) enhance power to detect effects and (b) determine whether differential effects exist based on at-risk or EBD classification.

There are possible limitations to assessment procedures and materials used in this study. There was variability in assessment administration timing due to school schedules and student motivation/frustration levels. Some students completed all assessments in one sitting, while others (particularly students with EBD) completed assessments across up to three sittings, reflecting possible differences in the quality of data. In addition, we captured students' self-reported perceptions of family, peer, school-based stress. Given the challenges associated with measuring perceived stress with children and youth, future research should consider including measures that gauge the number, frequency, duration, and immediate and sustained impact of events that objectively threaten a student's well-being (Grant et al., 2003). In addition, due to the complexities of interpersonal competencies (e.g., being tough linked with popularity; Farmer et al., 2008), stress associated with peer interactions are likely highly variable among students, including students with or at risk for EBD. Thus, we encourage scholars to consider these nuances when examining peer stress. Researchers should also consider examining additional sources of stress not included in our study. For instance, trauma, exposure to violence, and poverty are known stressors that adversely affect student EF and outcomes (Hackman & Farah, 2009; Irigaray et al., 2013). Specifically, we encourage researchers to investigate stress and resilience factors that may be unique to RELD students and their emotional and behavioral outcomes, such as structural and relational racism (Artiles, 2022).

There are limitations to our analysis. Given the nested nature of our data, multiple level SEM would have been beneficial, yet the number of classrooms (n = 27) was smaller than what is recommended (e.g., Hox et al., 2017). To address this limitation, we included TYPE = COMPLEX in Mplus to correct standard errors for clustered data. In addition, although the intended study design was longitudinal, spring data collection was disrupted by COVID-19, resulting in the need to do cross-sectional analysis. This limits our ability to make strong conclusions about directionality or causality. Therefore, given EF develops over time and perceived stress may change as students age, we will examine associations longitudinally in our future studies with students with and at risk for EBD and comparison peers across active developmental periods.

Finally, we urge researchers to develop and test programming geared toward fostering student EF and academic outcomes and reducing stress, particularly focusing on stressors unique to RELD students. Over 20 years of research has not only established EF's foundational role in student academic competence but also demonstrated that it can be actively fostered (Zelazo et al., 2016). Clearly, the persistent negative outcomes of students with EBD (Kauffman & Landrum, 2018) underscore need for practices within schools that go beyond conventional approaches. Specifically, these may include systemic change within classrooms that reduces sources of school-based stressors and support students to flourish at all places on the EF continuum. In addition, students with or at risk for EBD whose EF vulnerability is significant, consistent and impairing, may benefit from targeted EF-focused interventions (e.g., Smith et al., 2017). Finally, we encourage scholars to embed culturally responsive practices within both classroom and targeted programming to enhance effectiveness, with a focus on lifting student voice and agency, creating educational experiences that connect to student culture and collaboration, and foster positive teacher and student relationships (Riley & Serpell, 2022).

Implications for Policy and Practice

Understanding the potential mechanisms through which the continuum of academic competence or underachievement develops and escalates has significant implications for school programming, particularly for middle school students with or at risk for EBD. Our findings have important implications for identifying at-risk students early, given that middle school is a critical identification and intervention period before students' behaviors and academic problems worsen and become more resistant to intervention (Bradley et al., 2008). Schools can minimize stressors known to adversely affect EF development (e.g., peer conflict, academic anxiety) by building environments characterized by strong emotional support (e.g., positive climate, teacher sensitivity, student perspective taking; Pianta et al., 2012), which have been associated with student EF gains (Cumming et al., 2020). School professionals may also look for opportunities to strengthen students' social emotional learning (SEL) skills (e.g., self-management, social awareness) toward improving students' socio-emotional competence, behaviors, and academic achievement (Durlak et al., 2011). SEL may in turn mitigate the impact of stress or improve students coping with potential stressors at school or home.

School professionals can consider implementing multiple approaches to enhance student EF skills, such as mindfulness (also linked to stress reduction), targeted EF training (i.e., computerized and noncomputerized), and physical activity. These have all shown positive results in enhancing the EF of students with or at risk for high-incidence disabilities (Cumming, Zelazo et al., 2022; Takacs & Kassai, 2019). In addition, strategy-focused programs (i.e., explicitly teaching EF/self-regulation skills) hold promise, especially with students at risk for EF difficulties. For instance, Tools for Getting Along (Smith et al., 2016) has been found to enhance the self-regulation and EF skills of elementary school students who exhibit problem behaviors. Although there is a paucity of programming for middle school students, and particularly middle school students with EBD, I Control—an intensive self-regulation and EF-focused intervention targeted for students with EBD—has shown positive results. In addition, self-regulation strategies (e.g., self-monitoring and self-talk) can be effective at improving the academic outcomes of students with EBD (see Popham et al., 2018, for review).

Finally, to ensure that fostering EF and reducing stressors within the school are prioritized for students, especially those with or at risk for EBD, leaders in higher education and administrators at the district and school levels should ensure access to EF focused course work and professional development for both pre- and in-service school professionals. These courses should not only build understanding of the foundational role EF plays in student academic competence, but also provide practical knowledge on how to modify classrooms to build these skills with students with significant behavior problems. In addition, leaders can work closely with staff to ensure time is allocated in the school calendar to skill development, as well as access to relevant resources.

Conclusion

Students with EBD have persistent academic underachievement, which has long-term implications for school graduation and later employment (Kauffman & Landrum, 2018). Timely identification and effective programming that targets underlying variables that contribute to academic competence may be key to improving these outcomes, and our findings suggest individual EF and stressors within the home and school relate to students' abilities to succeed in school. Thus, it is critical that schools not only focus on teaching academic skills but also focus on building student EF and reducing stressors known to impede its development.

Authors' Note

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Supplemental Material

Supplementary material for this article is available on the Remedial and Special Education website at http://rase.sagepub.com.

Note

1. Race/ethnicity categories were not mutually exclusive.

References

Adamson, R. M., & Lewis, T. J. (2017). A comparison of three opportunity-to-respond strategies on the academic engaged time among high school students who present challenging behavior. *Behavioral Disorders*, *42*(2), 41–51. https://doi.org/10.1177/0198742916688644

American Psychological Association. (2014). *Stress in America: Are teens adopting adults' stress habits?*. https://www.apa.org/news/press/releases/stress/2013/stress-report.pdf

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin*, *103*(3), 411–423. https://doi.org/10.1037/0033-2909.103.3.411

Anderson, L. W., Jacobs, J., Schramm, S., & Splittgerber, F. (2000). School transitions: Beginning of the end or a new beginning? *International Journal of Educational Research*, *33*(4), 325–339. https://doi.org/10.1016/S0883-0355(00)00020-3

Artiles, A. J. (2022). Interdisciplinary inequality research in the E/BD field: Animating intersectionality, reflexivity, and equity. *Journal of Emotional and Behavioral Disorders*, *30*(2), 154–158. https://doi.org/10.1177/10634266221083922

Benson, J. E., Sabbagh, M. A., Carlson, S. M., & Zelazo, P. D. (2013). Individual differences in executive functioning predict preschoolers' improvement from theory-of-mind training. *Developmental Psychology*, *49*(9), 1615–1627. https://doi.org/10.1037/a0031056

Berger, M., & Sarnyai, Z. (2015). "More than skin deep": Stress neurobiology and mental health consequences of racial discrimination. *Stress*, *18*(1), 1–10. https://doi.org/10.3109/10253890.2014.989204

Best, J. R., & Miller, P. H. (2010). A developmental perspective on executive function. *Child Development*, *81*(6), 1641–1660. https://doi.org/10.1111/j.1467-8624.2010.01499.x

Blair, C. (2014). Stress and the development of executive functions: Experiential canalization of brain and behavior. In P. D. Zelazo & M. D. Sera (Eds.), *Minnesota symposia on child psychology: Developing cognitive control processes: Mechanisms, implications, and interventions* (Vol. 37, pp. 145–180). Wiley. https://doi.org/10.1002/9781118732373.ch5

Booth, J. N., Boyle, J. M., & Kelly, S. W. (2010). Do tasks make a difference? Accounting for heterogeneity of performance of children with reading difficulties on tasks of executive function: Findings from a meta-analysis. *The British Journal of Developmental Psychology*, *28*(Pt. 1), 133–176. https://doi.org/10.1348/026151009x485432

Bowers, A. J. (2019). Towards measures of different and useful aspects of schooling: Why schools need both teacher assigned grades and standardized assessments. In S. Brookhart & T. McMillian (Eds.), *Classroom assessment as educational measurement* (pp. 209–223). Routledge. https://doi.org/10.4324/9780429507533-12

Bradley, R., Doolittle, J., & Bartolotta, R. (2008). Building on the data and adding to the discussion: The experiences and outcomes of students with emotional disturbance. *Journal of Behavioral Education*, *17*, 4–23. https://doi.org/10.1007/s10864-007-9058-6

Campagne, D. M. (2019). Stress and perceived social isolation (loneliness). *Archives of Gerontology and Geriatrics*, *82*, 192–199. https://doi.org/10.1016/j.archger.2019.02.007

Campbell, A. R., Bowman-Perrott, L., Burke, M. D., & Sallese, M. R. (2018). Reading, writing, math, and content-area interventions for improving behavioral and academic outcomes of students with emotional and behavioral disorders. *Learning Disabilities: A Contemporary Journal*, *16*(2), 119–138.

Carrion, V. G., & Wong, S. S. (2012). Can traumatic stress alter the brain? Understanding the implications of early trauma on brain development and learning. *Journal of Adolescent Health*, *51*(2), S23–S28. https://doi.org/10.1016/j.jadohealth.2012.04.010

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

Connor-Smith, J. K., Compas, B. E., Wadsworth, M. E., Thomsen, A. H., & Saltzman, H. (2000). Responses to stress in adolescence: Measurement of coping and involuntary stress responses. *Journal of Consulting and Clinical Psychology*, *68*(6), 976–992. https://doi.org/10.1037/0022-006X.68.6.976

Cumming, M. M., Bettini, E., Pham, A. V., & Park, J. (2020). School-, classroom-, and dyadic-level experiences: A literature review of their relationship with students' executive functioning development. *Review of Educational Research*, *90*(1), 47–94. https://doi.org/10.3102/0034654319891400

Cumming, M. M., Poling, D., Patwardhan, I., & Ozenbaugh, I. (2022). Executive function in kindergarten and development of behavioral problems: Moderating role of positive parenting practices. *Early Childhood Research Quarterly*, *60*(3), 161–172. https://doi.org/10.1016/j.ecresq.2022.01.008

Cumming, M. M., Poling, D., Qiu, Y., Prykanowski, D., Lumpkins, A., Daunic, A., Corbett, N., & Smith, S. W. (2023). Executive function profiles of kindergarteners and first graders at risk for emotional and behavioral disorders. *Exceptional Children*, *89*(3), 294–313. https://doi.org/10.1177/00144029221135573

Cumming, M. M., Smith, S. W., & O'Brien, K. (2019). Perceived stress, executive function, perceived stress regulation, and behavioral outcomes of adolescents with and without significant behavior problems. *Psychology in the Schools*, *56*(9), 1359–1380. https://doi.org/10.1002/pits.22293

Cumming, M. M., Zelazo, P. D., Smith, S. W., & Flores, H. (2022). Self-regulation and executive function as foundational to student success. In B. Talbott, K. McMaster, D. Lee, & T. Farmer (Eds.), *Handbook of special education research: Theory, methods, & leveraging developmental processes* (pp. 285–298). Routledge.

Curriculum Associates. (2014). *The science behind i-Ready's adaptive diagnostic*. Renaissance.

Dahl, R. E., & Gunnar, M. R. (2009). Heightened stress responsiveness and emotional reactivity during pubertal maturation: Implications for psychopathology. *Development and Psychopathology*, *21*(1), 1–6. https://doi.org/10.1017/S0954579409000017

Diamond, A. (2013). Executive functions. *Annual Review of Psychology*, *64*(1), 135–168. https://doi.org/10.1146/annurev-psych-113011-143750

Diamond, A., & Lee, K. (2011). Interventions shown to aid executive function development in children 4 to 12 years old. *Science*, *333*, 959–964. https://doi.org/10.1126/science.1204529

Dunning, D. L., Griffiths, K., Kuyken, W., Crane, C., Foulkes, L., Parker, J., & Dalgleish, T. (2019). The effects of mindfulness-based interventions on cognition and mental health in children and adolescents: A meta-analysis of randomised controlled trials. *Journal of Child Psychology and Psychiatry*, *60*(3), 244–258. https://doi.org10.1111/jcpp.12980

Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2011). The impact of enhancing students' social and emotional learning: A meta-analysis of school-based universal interventions. *Child Development*, *82*(1), 405–432. https://doi.org/10.1111/j.1467-8624.2010.01564.x

Farmer, T. W., Estell, D. B., Hall, C. M., Pearl, R., Van Acker, R., & Rodkin, P. C. (2008). Interpersonal competence configurations, behavior problems, and social adjustment in preadolescence. *Journal of Emotional and Behavioral Disorders*, *16*(4), 195–212. https://doi.org/10.1177/1063426608320355

Farmer, T. W., Gatzke-Kopp, L., & Latendresse, S. J. (2020). The development, prevention, and treatment of emotional and behavioral disorders: An interdisciplinary developmental systems perspective. In T. W. Farmer, M. Conroy, E. M. Z. Farmer, & K. Sutherland (Eds.), *Handbook of research on emotional and behavioral disorders* (pp. 3–22). Routledge.

Feifer, S. G., & Rattan, G. (2007). Executive functioning skills in male students with social-emotional disorders. *International Journal of Neuroscience*, *117*(11), 1565–1577. https://doi.org/10.1080/00207450701239350

Field, A. (2013). *Discovering statistics using IBM SPSS statistics*. Sage.

Gage, N. A., Adamson, R., MacSuga-Gage, A. S., & Lewis, T. J. (2017). The relation between the academic achievement of students with emotional and behavioral disorders and teacher characteristics. *Behavioral Disorders*, *43*(1), 213–222. https://doi.org/10.1177/0198742917713211

Goldstein, S. E., Boxer, P., & Rudolph, E. (2015). Middle school transition stress: Links with academic performance, motivation, and school experiences. *Contemporary School Psychology*, *19*(1), 21–29. http://doi.org/10.1007/s40688-014-0044-4

Goodman, R. (1997). The Strengths and Difficulties Questionnaire: A research note. *Journal of Child Psychology and Psychiatry*, *38*(5), 581–586. https://doi.org/10.1111/j.1469-7610.1997.tb01545.x

Goodman, R. (2001). Psychometric properties of the strengths and difficulties questionnaire. *Journal of the American Academy of Child & Adolescent Psychiatry*, *40*(11), 1337–1345. https://doi.org/10.1097/00004583-200111000-00015

Grant, K. E., Compas, B. E., Stuhlmacher, A. F., Thurm, A. E., McMahon, S. D., & Halpert, J. A. (2003). Stressors and child and adolescent psychopathology: Moving from markers to mechanisms of risk. *Psychological Bulletin*, *129*(3), 447–466. https://doi.org/10.1037/0033-2909.129.3.447

Hackman, D. A., & Farah, M. J. (2009). Socioeconomic status and the developing brain. *Trends in Cognitive Sciences*, *13*(2), 65–73. https://doi.org/10.1016/j.tics.2008.11.003

Hahs-Vaughn, D. L., & Lomax, R. G. (2020). *An introduction to statistical concepts*. Routledge.

Hox, J. J., Moerbeek, M., & Van de Schoot, R. (2017). *Multilevel analysis: Techniques and applications*. Routledge.

Individuals with Disabilities Education Act of 20 U.S.C §1400. (2004).

Irigaray, T. Q., PachecoI, J. B., Grassi-Oliveira, R., Fonseca, R. P., de Carvalho Leite, J. C., & Kristensen, C. H. (2013). Child maltreatment and later cognitive functioning: A systematic review. *Psicologia: Reflexão E Crítica*, *26*(2), 376–387. https://doi.org/10.1590/S0102-79722013000200018

Jamshidian, M., Jalal, S., & Jansen, C. (2014). MissMech: An R Package for testing homoscedasticity, multivariate normality, and missing completely at random (MCAR). *Journal of*

Statistical Software, *56*(6), 1–31. http://doi.org/10.18637/jss.v056.i06

Karr, J. E., Rodriguez, J. E., Goh, P. K., Martel, M. M., & Rast, P. (2022). The unity and diversity of executive functions: A network approach to life span development. *Developmental Psychology*, *58*(4), 751–767. https://doi.org/10.1037/dev0001313

Kauffman, J. M., & Landrum, T. J. (2018). *Characteristics of emotional and behavioral disorders of children and youth* (11th ed.). Pearson.

Keith, T. Z. (2006). *Multiple regression and beyond*. Allyn & Bacon.

Kenny, D. A. (2020, June 5). *Measuring model fit*. https://davidakenny.net/cm/fit.htm

Kline, R. B. (2016). *Principles and practices of structural equation modeling* (4th ed.). Guilford.

Kolb, B., Harker, L., de Melo, S., & Gibb, R. (2017). Stress and pre-frontal cortical plasticity in the developing brain. *Cognitive Development*, *42*, 15–26. https://doi.org/10.1016/j.cogdev.2017.01.001

Korkmaz, S., Goksuluk, D., & Zararsiz, G. (2014). MVN: An R package for assessing multivariate normality. *The R Journal*, *6*(2), 151–162.

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

Liston, C., McEwen, B. S., & Casey, B. J. (2009). Psychosocial stress reversibly disrupts prefrontal processing and attentional control. *Proceedings of the National Academy of Sciences of the United States of America*, *106*(3), 912–917. https://doi.org/10.1073/pnas.0807041106

Lupien, S. J., McEwen, B. S., Gunnar, M. R., & Heim, C. (2009). Effects of stress throughout the lifespan on the brain, behaviour and cognition. *Nature Reviews Neuroscience*, *10*(6), 434–445. https://doi.org/10.1038/nrn2639

Marcovitch, S., Jacques, S., Boseovski, J. J., & Zelazo, P. D. (2008). Self-reflection and the cognitive control of behavior: Implications for learning. *Mind, Brain, and Education*, *2*(3), 136–141. https://doi.org/10.1111/j.1751-228X.2008.00044.x

Masten, A. S., Herbers, J. E., Desjardins, C. D., Cutuli, J. J., McCormick, C. M., Sapienza, J. K., Long, J. D., & Zelazo, P. D. (2012). Executive function skills and school success in young children experiencing homelessness. *Educational Researcher*, *41*(9), 373–384. https://doi.org/10.3102/0013189X12459883

Mattison, R. E., Hooper, S. R., & Carlson, G. A. (2006). Neuropsychological characteristics of special education students with serious emotional/behavioral disorders. *Behavioral Disorders*, *31*(2), 176–188. https://doi.org/10.1177/019874290603100205

McClelland, M. M., Cameron, C. E., Connor, C. M., Farris, C. L., Jewkes, A. M., & Morrison, F. J. (2007). Links between behavioral regulation and preschoolers' literacy, vocabulary, and math skills. *Developmental Psychology*, *43*(4), 947–959. https://doi.org/10.1037/0012-1649.43.4.947

McLaughlin, K. A. (2016). Future directions in childhood adversity and youth psychopathology. *Journal of Clinical Child & Adolescent Psychology*, *45*, 361–382. https://doi.org/10.1080/15374416.2015.1110823

McTeague, L. M., Huemer, J., Carreon, D. M., Ying, J., Eickhoff, S. B., & Etkin, A. (2017). Identification of common neural circuit disruptions in cognitive control across psychiatric disorders. *American Journal of Psychiatry*, *174*(7), 676–685. https://doi.org/10.1176/appi.ajp.2017.16040400

Miles, J., & Shevlin, M. (2001). *Applying regression and correlation: A guide for students and researchers*. Sage.

Miller, M. D., Linn, R. L., & Gronlund, N. E. (2013). *Measurement and assessment in teaching* (11th ed.). Prentice-Hall.

Mistry, R. S., & Elenbaas, L. (2021). It's all in the family: Parents' economic worries and youth's perceptions of financial stress and educational outcomes. *Journal of Youth and Adolescence*, *50*(4), 724–738. https://doi.org/10.1007/s10964-021-01393-4

Miyake, A., & Friedman, N. P. (2012). The nature and organization of individual differences in executive functions: Four general conclusions. *Current Directions in Psychological Science*, *21*(1), 8–14. https://doi.org/10.1177/0963721411429458

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive Psychology*, *41*(1), 49–100. https://doi.org/10.1006/cogp.1999.0734

Moffitt, T. E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R. J., Harrington, H., Houts, R., Poulton, R., Roberts, B. W., Ross, S., Sears, M. R., Thomson, W. M., & Caspi, A. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. *PNAS Proceedings of the National Academy of Sciences of the United States of America*, *108*(7), 2693–2698. https://doi.org/10.1073/pnas.1010076108

Nayfeld, I., Fuccillo, J., & Greenfield, D. B. (2013). Executive functions in early learning: Extending the relationship between executive functions and school readiness to science. *Learning and Individual Differences*, *26*(1), 81–88. https://doi.org/10.1016/j.lindif.2013.04.011

Nurius, P. S., Prince, D. M., & Rocha, A. (2015). Cumulative disadvantage and youth well-being: A multi-domain examination with life course implications. *Child and Adolescent Social Work Journal*, *32*(6), 567–576. https://doi.org/10.1007/s10560-015-0396-2

Office of Special Education Programs. (2022). *44th annual report to congress on the implementation of the Individuals with Disabilities Education Act*. https://sites.ed.gov/idea/2022-individuals-with-disabilities-education-act-annual-report-to-congress/

Oxford, M. L., & Lee, J. O. (2011). The effect of family processes on school achievement as moderated by socioeconomic context. *Journal of School Psychology*, *49*(5), 597–612. https://doi.org/10.1016/j.jsp.2011.06.001

Pascoe, M. C., Hetrick, S. E., & Parker, A. G. (2020). The impact of stress on students in secondary school and higher education. *International Journal of Adolescence and Youth*, *25*(1), 104–112. https://doi.org/10.1080/02673843.2019.1596823

Pascual, A. C., Moyano, N., & Robres, A. Q. (2019). The relationship between executive functions and academic performance in primary education: Review and meta-analysis. *Frontiers in Psychology*, *10*, Article1582. https://doi.org/10.3389/fpsyg.2019.01582

Paus, T., Keshavan, M., & Giedd, J. N. (2008). Why do many psychiatric disorders emerge during adolescence? *Nature Reviews Neuroscience*, *9*, 947–957. https://doi.org/10.1038/nrn2513

Pianta, R. C., Hamre, B. K., & Mintz, S. (2012). *Classroom Assessment Scoring System Secondary (CLASS-S). Manual*. Teachstone.

Popham, M., Counts, J., Ryan, J. B., & Katsiyannis, A. (2018). A systematic review of self-regulation strategies to improve academic outcomes of students with EBD. *Journal of Research in Special Educational Needs*, *18*(4), 239–253. https://doi.org/10.1111/1471-3802.12408

Rea-Sandin, G., Korous, K. M., & Causadias, J. M. (2021). A systematic review and meta-analysis of racial/ethnic differences and similarities in executive function performance in the United States. *Neuropsychology*, *35*(2), 141–156. https://doi.org/10.1037/neu0000715

Riley, T. N., & Serpell, Z. N. (2022). Developmental considerations in a problematic ecology: Achieving equity and socially just learning environments for African American adolescents with emotional and behavioral challenges. *Journal of Emotional and Behavioral Disorders*, *30*(2), 111–127. https://doi.org/10.1177/10634266221077904

Robbins, T. W., & Arnsten, A. F. (2009). The neuropsychopharmacology of fronto-executive function: Monoaminergic modulation. *Annual Review of Neuroscience*, *32*, 267–287. https://doi.org/10.1146/annurev.neuro.051508.135535

Sameroff, A. J. (2020). It's more complicated. *Annual Review of Developmental Psychology*, *2*, 1–26. https://doi.org/10.1146/annurev-devpsych-061520-120738

Shepard, L. (2000). *The role of classroom assessment in teaching and learning* (CSE Technical Report 517). National Center for Research on Evaluation, Standards, and Student Testing.

Slotkin, J., Nowinski, C., Hays, R., Beaumont, J., Griffith, J., Magasi, S., & Gershon, R. (2012). *NIH Toolbox® scoring and interpretation guide*. Northwestern University and National Institutes of Health.

Smith, S. W., Daunic, A. P., Algina, J., Pitts, D. L., Merrill, K. L., Cumming, M. M., & Allen, C. (2017). Self-regulation for students with emotional and behavioral disorders: Preliminary effects of the I control curriculum. *Journal of Emotional and Behavioral Disorders*, *25*(3), 143–156. https://doi.org/10.1177/1063426616661702

Smith, S. W., Daunic, A. P., Aydin, B., Van Loan, C. L., Barber, B. R., & Taylor, G. G. (2016). Effect of tools for getting along on student risk for emotional and behavioral problems in upper elementary classrooms: A replication study. *School Psychology Review*, *45*(1), 73–92. https://doi.org/10.17105/SPR45-1.73-92

Sontag, L. M., Graber, J. A., Brooks-Gunn, J., & Warren, M. P. (2008). Coping with social stress: Implications for psychopathology in young adolescent girls. *Journal of Abnormal Child Psychology*, *36*(8), 1159–1174. https://doi.org/10.1007/s10802-008-9239-3

Steinberg, L., & Morris, A. S. (2001). Adolescent development. *Annual Review of Psychology*, *52*, 83–110. https://doi.org/10.1146/annurev.psych.52.1.83

Stone, L. L., Otten, R., Engels, R. C., Vermulst, A. A., & Janssens, J. M. (2010). Psychometric properties of the parent and teacher versions of the Strengths and Difficulties Questionnaire for 4-to 12-year-olds: A review. *Clinical Child and Family Psychology Review*, *13*(3), 254–274. https://doi.org/10.1007/s10567-010-0071-2

Suárez-Orozco, C., Motti-Stefanidi, F., Marks, A., & Katsiaficas, D. (2018). An integrative risk and resilience model for understanding the adaptation of immigrant-origin children and youth. *American Psychologist*, *73*(6), 781–796. https://doi.org/10.1037/amp0000265

Takacs, Z. K., & Kassai, R. (2019). The efficacy of different interventions to foster children's executive function skills: A series of meta-analyses. *Psychological Bulletin*, *145*(7), 653–697. https://doi.org/10.1037/bul0000195

Toll, S. W. M., Van der Ven, S. H. G., Kroesbergen, E. H., & Van Luit, J. E. H. (2011). Executive functions as predictors of math learning disabilities. *Journal of Learning Disabilities*, *44*(6), 521–532. https://doi.org/10.1177/0022219410387302

U.S. Census Bureau. (2021). *2020 census statistics highlight local population changes and nation's racial and ethnic diversity*. https://www.census.gov/newsroom/press-releases/2021/population-changes-nations-diversity.html

Valcan, D. S., Davis, H., & Pino-Pasternak, D. (2018). Parental behaviours predicting early childhood executive functions: A meta-analysis. *Educational Psychology Review*, *30*(3), 607–649. https://doi.org/10.1007/s10648-017-9411-9

Weintraub, S., Dikmen, S. S., Heaton, R. K., Tulsky, D. S., Zelazo, P. D., Bauer, P. J., Carlozzi, N. E., Slotkin, J., Blitz, D., Wallner-Allen, K., Fox, N. A., Beaumont, J. L., Mungas, D., Nowinski, C. J., Richler, J., Deocampo, J. A., Anderson, J. E., Manly, J. J., Borosh, B., . . . Gershon, R. C. (2013). Cognition assessment using the NIH Toolbox. *Neurology*, *80*(11 Suppl. 3), S54–S64. https://doi.org/10.1212/WNL.0b013e3182872ded

Zelazo, P. D. (2020). Executive function and psychopathology: A neurodevelopmental perspective. *Annual Review of Clinical Psychology*, *16*, 431–454. https://doi.org/10.1146/annurev-clinpsy-072319-024242

Zelazo, P. D., Anderson, J. E., Richler, J., Wallner-Allen, K., Beaumont, J. L., & Weintraub, S. (2013). II. NIH Toolbox Cognition Battery (CB): Measuring executive function and attention. *Monographs of the Society for Research in Child Development*, *78*(4), 16–33. https://doi.org/10.1111/mono.12032

Zelazo, P. D., Blair, C. B., & Willoughby, M. T. (2016). *Executive function: Implications for education* (NCER 2017-2000). National Center for Education Research. https://eric.ed.gov/?id=ED570880%0Ahttps://eric.ed.gov/?q=gender+differences+distraction&pg=2&id=ED570880

Zhang, Y., Zhang, X., Zhang, L., & Guo, C. (2019). Executive function and resilience as mediators of adolescents' perceived stressful life events and school adjustment. *Frontiers in Psychology*, *10*, Article 446. https://doi.org/10.3389/fpsyg.2019.00446