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RELATIONSHIPS BETWEEN COGNITIVE ABILITIES AND PATTERNS OF CHILDREN'S CLASSROOM BEHAVIOR AT AGE NINE

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ABSTRACT

RELATIONSHIPS BETWEEN COGNITIVE ABILITIES AND PATTERNS OF CHILDREN'S CLASSROOM BEHAVIOR AT AGE NINE

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Teacher reports are often used to indicate how well children perform in school and help clinicians identify behavioral problems, such as inattentiveness (Charach et al., 2009). However, various factors may have an effect on teacher ratings of children's behavior, which can have downstream effects on children's academic achievement (Teisl et al., 2001). Given teachers play a large role in identifying at-risk youth, it is important to understand how their reports of children's behavior are associated with childhood outcomes such as cognitive development, which is closely tied to academic achievement (Metcalfe et al., 2013). The present study aimed to identify patterns of children's behavior based on teacher report data, as well as test whether these patterns were associated with five domains of cognitive functioning. We hypothesized that there would be one low-risk pattern of behavior that would include children exhibiting low levels of behavioral issues, and moderate- to high-risk patterns that would include children with varying degrees of behavioral issues. We expected that children with greater performance across the cognitive domains would be more likely to exhibit the low-risk pattern of behavior compared to the moderate- and high-risk patterns of behavioral issues. Analyses were performed with data from wave 5 of the Future of Families and Child Wellbeing study (N=2063). Latent class analysis revealed seven classes, with one low-risk class and

six classes of varying risk level. Better performance on reading comprehension and mathematics assessments was associated with a greater likelihood of belonging to the low-risk class, even when controlling for significant demographic constructs. The present study suggests that teachers' reports of children's problematic classroom behavior may be useful for identifying children at risk for poor academic outcomes, leading to early intervention.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Introduction

School-aged children spend a significant portion of time with their teachers and as a result, teacher reports of a child's behavior in the classroom become one of the primary resources used to identify at-risk students, both socially and cognitively (Elliott et al., 1988). Teacher reports are often used to indicate how well children are performing in school and can help identify students who are gifted or may need extra help (Casale et al., 2023; Jarosewich et al., 2002). Teacher reports can also help to identify a variety of behavioral problems such as inattentiveness that clinicians may use to diagnose a child with disorders such as attention-deficit hyperactivity disorder (ADHD) (Charach et al., 2009). Accurate teacher reports of a child's behavior are pivotal to best understanding and providing the best education to children on a classroom and an individual basis.

Rating scales are a popular method for assessing children, as they are efficient, inexpensive, and allow teachers to provide an overview of the intensity and frequency of problematic behaviors (Conners, 1998). Importantly, some rating scales are designed to mirror diagnostic criteria, which allow specific behaviors to be identified that can inform diagnosis, intervention, and treatment options (Cordes & McLaughlin, 2004). While rating scales are not meant to be the only measure used to diagnose a child or identify areas for improvement, the results from rating scales have strong implications for how children are perceived and the help they may or may not receive as a result. Early identification of children at risk for learning difficulties is key to helping children achieve academic success, and teacher rating scales can play a major role. For example, research suggests that teacher ratings are predictive of academic achievement in children and

provide valuable feedback on which children would benefit from interventions for learning issues (Teisl et al., 2001).

The Conners Teacher Rating Scale (CTRS) is commonly used to assess a teacher's view of a child's classroom behavior (Conners, 1989). It has well established reliability and validity and has been used in hundreds of studies due to its well-established psychometric properties (Conners et al., 1998). The CTRS-R was created with subscales that model the Diagnostic Statistical Manual of Mental Disorders (DSM) diagnostic criteria for ADHD, as well as items relevant to diagnosing oppositional defiant disorder (ODD) and conduct disorder (Charach et al., 2009; Conners, 2001; Cordes & McLaughlin, 2004). The CTRS-R is also helpful in identifying children who struggle with academic learning, including the specific areas of learning in which those cognitive problems may lie.

While rating scales such as the CTRS are commonly used, there are issues with rating scales that preclude some of their effectiveness. Sum scores of behavior ratings conflate the number of types of behavior problems and severity of behavior problems. For example, children could end up with the same score if they exhibit moderate levels of multiple behavior problems or severe levels of a few behavior problems. Furthermore, different teachers may rate a series of similar behaviors as high when in reality, only one of the behaviors is truly present (Stevens & Quittner, 1998). Additionally, other factors or perceptions unrelated to the actual behaviors may influence the severity with which they are rated (Conners, 1998).

Although teacher ratings of children's behavior have been used to identify children at risk for learning difficulties and behavior problems, teacher ratings may also

be biased. A systematic review of research on ethnic and cultural bias in teacher ratings concluded that when children's behaviors seem to deviate from a perceived cultural stereotype, there is a higher likelihood that teachers' ratings of that child's behavior will be biased (Chang & Sue, 2003; Mason et al., 2014). In examining bias in the context of ethnicity and socioeconomic status, Stevens (1980) found that teachers rated students whom they perceived to be of lower socioeconomic status as exhibiting more negative behaviors. Additionally, teachers were shown to rate Black students as demonstrating more negative behaviors than Hispanic students and White students (Stevens, 1980). When looking at behaviors related to ADHD symptomology, Hosterman and colleagues (2008) found that teacher ratings of Black and Hispanic students' behaviors were accurate, but that the behaviors of White students were possibly underrated. Thus, bias may exist in the form of decreasing the severity of symptoms in White students as opposed to increasing the severity of behavior ratings of racial and ethnic minority students. Therefore, while rating scales have been shown to be a valid assessment of children's behavior and risk of learning difficulties (Fletcher & Satz, 1984), it is important to understand how a teacher's own beliefs can affect their perception, treatment, and overall assessment of their students (Beswick et al., 2005).

In a study comparing teacher ratings of ADHD and ODD symptomology, results found that the presence of ODD-related behaviors increased the likelihood that the teacher would inaccurately rate the presence of ADHD behaviors as being high as well (Stevens & Quittner, 1998). That is, when teachers observed students exhibiting ADHD symptomology, they were more likely to rate that child as also exhibiting behaviors relating to ODD symptomology. Additionally, while more research should be done on

teacher biases of student intelligence, work by Alvidrez and Weinstein (1999) did suggest that teacher ratings of intelligence and cognitive abilities could be impacted by perceptions of socioeconomic status and certain behavioral traits.

Gender bias is also a common issue in the classroom. Teachers have been shown to behave differently towards male and female students (Frawley, 2005), and may rate the behaviors of male and female students inaccurately based on gender stereotypes (Splett et al., 2018). For example, teachers tend to rate the behavior of male students as being more disruptive and troublesome in the classroom compared to female students, such as having trouble sitting still or getting started on work (Åhslund & Boström, 2018). Splett and colleagues (2018) concluded that demographic characteristics such as gender may heavily influence how behaviors of children are rated, versus the actual frequency and severity of the behaviors being exhibited. Teacher behavior towards females can negatively impact their academic outcomes, as teachers can implicitly view girls as having less academic potential (Frawley, 2005). On the other hand, teacher's more often attribute more negative characteristics and behaviors to boys, leading to reduced expectations of cognitive outcomes and potentially even future academic performance (Åhslund & Boström, 2018).

Teachers may also treat children differently depending on their perceptions of children's behavior, which can have downstream effects on children's academic achievement. Teachers have been shown to give more commands to students they rated as having more behavioral issues overall, non-specific to internalizing or externalizing problems (Dobbs & Arnold, 2009). Fry (1983) found that children who were seen by their teachers as having more behavioral issues in the classroom not only received more

negative affect and reprimands from their teachers but also were less involved in class and with their teachers overall. Further, children exhibiting more behavioral issues were perceived as being less intelligent and were asked less complex and fewer cognitively challenging questions when compared to children with few to no behavioral issues (Fry, 1983). Children rated as having "problematic" behavior likely are those who require the most support, therefore it is important to understand how such perceptions could affect how children are challenged in the classroom and ultimately how that may impact their overall academic achievement.

Given there is heterogeneity in teacher reports of children's behavior, some of which may be due to biases, and that sum scores conflate frequency and severity of behavior problems, patterns of children's behavior based on item-level teacher report data rather than rating scales may be most useful at identifying children at greatest risk for poor academic outcomes, which is correlated with cognitive skills (Beswick et al., 2005; Metcalfe et al., 2013). A latent profile analysis by McDermott and colleagues (2022) supports the idea of studying patterns of behaviors in the classroom as a way to inform and individualize interventions for children at an early age. Obtaining a complete picture of a child's behavioral profile will give a better understanding of risk for future problems, such as cognitive and academic outcomes.

The relationship between behavioral issues and various cognitive outcomes and achievement has been confirmed in the literature. Children with internalizing and externalizing behavioral problems have been shown to have greater difficulty with reading comprehension (Willcutt & Pennington 2000). Children exhibiting attentional difficulties are also more likely to struggle with mathematics than children without such

behavioral problems (Wu et al., 2014). Even at an early age, there is evidence that the ability to regulate behavior is associated with better vocabulary knowledge (von Suchodoletz & Gunzenhauser 2013). As such, it is important to determine if specific patterns of problematic behaviors have similar relationships with cognitive performance in various domains.

The primary aim of the present study was to identify patterns of children's behavior based on teacher report data from a large, community sample of children who were at increased risk for experiencing childhood adversity due to high rates of poverty (Reichman et al., 2001). Given that problematic classroom behavior is related to cognitive deficits and academic achievement (Metcalfe et al., 2013; Ready & Wright, 2011), a secondary aim was to test whether patterns of children's behavior based on teacher reports were associated with five domains of cognitive functioning: reading comprehension, mathematics ability, vocabulary, attention, and concentration. We hypothesized that there would be one low-risk pattern of behavior that would include children exhibiting low levels of behavioral issues, and moderate- to high-risk patterns that would include children with varying degrees of behavioral issues, including inattention, hyperactivity, oppositionality, and learning issues. We expected that children with greater reading comprehension, mathematics ability, vocabulary, attention, and concentration would be more likely to exhibit the low-risk pattern of behavior compared to the moderate- and high-risk patterns of behavioral issues.

Methods

Participants

Data for this study were taken from the Future of Families and Child Wellbeing Study (FFCWS). FFCWS is a longitudinal study that was designed to assess the nature of familial relationships in higher-risk families over time. Mothers were recruited at the time of the target child's birth and were oversampled for unmarried parents in large U.S. cities, due to specific risk factors that are related to non-marital childbearing (Reichman et al., 2001). A total of 4,898 families were initially included in the study at baseline. Children and their caregivers completed interviews at the time of the target child's birth and through follow-up interviews and in-home assessments at ages one, three, five, nine, and fifteen. During the year nine study, from which data for the present study were taken, the focal child and their caregiver completed an in-home survey. The child's current teacher, or Language Arts teacher if it was indicated the child had more than one teacher, was asked to complete a paper survey about the child as well (Families, 2018).

The present study includes a subsample of 2,063 participants from the larger study who had complete data on teachers' ratings of classroom behavior and four cognitive assessments that measured reading comprehension, problem-solving, attention and concentration, and vocabulary at the age nine interview. Participants who did not complete the year nine interview or did not have fully complete data on the Conner's Teacher Rating Scale and the four cognitive assessments were excluded (n = 2,835). Demographic data for the sample is included in Table 1.

Table 1

Demographic Characteristics of the Study Sample

Demographic Variables	N	Frequency (%) or Mean (SD)
Gender of Child	2063	
Male		1,060 (51.38%)
Female		1,003 (48.62%)
Age of Child at Year 9 (months)	2063	111.32 (4.47)
Mother's Race/Ethnicity (Baseline)	2061	
White, Non-Hispanic		487 (23.63%)
Black, Non-Hispanic		983 (47.70%)
Hispanic		515 (24.99%)
Other		76 (3.69%)
Mother's Income-to-need Ratio at Baseline	2063	2.34 (2.53)
Mother's Education at Baseline	2061	
Less than High School		633 (30.71%)
High School or Equivalent		661 (32.07%)
Some College/Technical School		539 (26.15%)
College or Graduate School		228 (11.06%)
Mother's Education at Year 9	2001	
Less than High School		405 (20.24%)
High School or Equivalent		445 (22.24%)
Some College/Technical School		834 (41.68%)
College or Graduate School		317 (15.84%)
Mother's Household Income at Baseline	2063	$33,333.18 (32,444.43)
Mother's Household Income at Year 9	1998	$46,964.78 (51,791.77)

Note. Income-to-needs ratio was calculated as the ratio of total household income to U.S. poverty thresholds. Household income was reported as an exact dollar amount. If the exact amount was unknown, a range was provided. For mothers who provided a range, their income was imputed by taking into account their relationship status, age, race/ethnicity, nativity, whether they were employed last year, earnings, total adults in the household, and whether welfare was received (Families, 2018).

Measures

Teacher Ratings of Student Behavior

Children's behavior at age nine was assessed by their school teacher with the Conner's Teacher Rating Scale – Revised Short Form (CTRS; Conners, 2001). The CTRS is a questionnaire that includes 28 items with four subscales, pertaining to children's oppositional behavior (5 items), cognitive problems and inattention (5 items), hyperactive behavior (7 items), and ADHD symptoms (12 items). Example items include "Child is inattentive, easily distracted" (ADHD), "Child is not reading up to par" (cognitive problems and inattention), "Child argues with adults" (oppositional), and "Child is restless in the 'squirmy' sense" (hyperactivity). Responses were given on a 4-point Likert scale (0-3) ranging from 'not true' to 'very much true.' Items from each subscale were summed to calculate each subscale score, with higher values reflecting more problematic classroom behavior. Cronbach's alpha was deemed to be acceptable for the oppositional behavior ($\alpha = 0.94$), cognitive problems and inattention ($\alpha = 0.83$), hyperactive behavior ($\alpha = 0.92$), and ADHD ($\alpha = 0.95$) subscales and are consistent with published reliability values for the CTRS (0.882 to 0.952) (Gurley, 2011).

Consistent with previous studies that used the CTRS to evaluate children's behavior (Althoff et al., 2006), children's scores on the CTRS were recoded as dichotomous to indicate the severity and frequency of the behavior (Althoff et al., 2006). Items that were scored as 0 (not true) or 1 (just a little true) were coded as 1 and represent low severity/generally absent levels of problematic classroom behaviors, while items scored as 2 (pretty much true) or 3 (very much true) were coded as 2 and represent moderate to high severity/frequently present levels of problematic classroom behaviors.

Reading Comprehension

Children's reading comprehension abilities were assessed through completion of the Woodcock-Johnson III Passage Comprehension Subtest 9 as a part of the year nine in-home interview (Woodcock et al., 2001). The Passage Comprehension Subtest is a 47-item assessment that requires the child to match pictures to phrases and to supply a missing word in increasingly complex sentences and passages (Woodcock et al., 2001). The test assesses a child's overall understanding of written text, as well as symbolic learning, vocabulary, and understanding of syntax (Bradley-Johnson et al., 2004; Wendling et al., 2007). Each child received a raw score, which can be converted into various other score determinants of performance including a percentile score. The raw score indicates the number of questions correct on the assessment. A percentile score ranges from 0 to 100 and indicates how the child's score compares to their peers, with higher scores reflecting higher levels of reading comprehension relative to the child's peers. The percentile score was used in analyses.

Problem Solving/Mathematics

Children's problem-solving abilities were assessed through completion of the Woodcock-Johnson III Applied Problems Subtest 10 as a part of the year nine in-home interview (Woodcock et al., 2001). The Applied Problems subtest is a 63-item assessment that requires the child to analyze and solve math problems of increasing difficulty using various mathematical skills and concepts (Bradley-Johnson et al., 2004; Woodcock et al., 2001; Wendling et al., 2007). Each child received a raw score, which was converted into the percentile scores used in this study. Higher percentiles reflect higher levels of problem-solving and mathematics ability relative to the child's peers.

Attention and Concentration

Children's attention and concentration were assessed with the Wechsler Intelligence Scale for Children IV Digit Span Subtest as a part of the year nine in-home interview (Wechsler, 2003). The Digit Span Subtest requires the child to listen to and repeat back a series of digits either forwards or backwards. Every trial where the numbers are repeated back correctly and in full is scored as 1; any trials with incomplete or incorrect repetitions of the number sequence are scored as 0. There are 16 items for both the forwards and the backwards digit sections for a total of 32 items. The digits forward section of the test primarily measures attention, while the digits back section assesses concentration. This test also acts as a measure of auditory short-term memory and sequencing ability (Wechsler, 2003). Each child received a raw score that is the sum of the correct trials, which was converted into the percentile scores used in this study. Higher percentiles reflect higher levels of attention, concentration, and auditory short-term memory and sequencing ability relative to the child's peers.

Vocabulary

Children's vocabulary knowledge was assessed through the Peabody Picture Vocabulary Test (PPVT-III) as a part of the year nine in-home interview (Dunn & Dunn, 1997). During the PPVT-III, the child was asked to listen to a word and select one picture out of four that best corresponds to the word that was said. The assessment contains 204 word prompts and measures vocabulary, auditory comprehension, and verbal ability (Dunn & Dunn, 1997; McKinlay, 2011). Each child received a raw score that equals the total number of correct responses. Raw scores were converted into percentile scores, which were used in this study.

Covariates

Variables known to be associated with teacher reports of behavior and cognitive assessment performance were considered as covariates in models. Gender of the child was reported at baseline by the parent as either male or female. The mother's race and ethnicity were self-reported at baseline as either White (non-Hispanic), Black (non-Hispanic), Hispanic, or Other. Race was recoded such that children identifying as a racial or ethnic minority (Black, Hispanic, Other) were coded as 0 and children identifying as a non-racial or ethnic minority (White and non-Hispanic) were coded as 1. The income-to-needs ratio at baseline was calculated by comparing total reported household income to official poverty thresholds in the U.S. Income-to-needs ratios above 1 indicate that the family's household income is higher than the poverty level while ratios below 1 suggest the family's household income is less than the poverty level and these families may experience more financial hardship. Mothers self-reported their level of education at baseline as less than high school, completion of high school or equivalent, some college or technical school, or completion of college or graduate school. Mother's education was recoded as having a high school degree or less (0) vs. having some college or more (1).

Analytic Plan

Correlation analyses were performed to test for linear associations between the five cognitive variables (reading comprehension, mathematics, vocabulary, attention, and concentration) and teacher reports of children's oppositional, cognitive problems/inattention, hyperactivity, and ADHD behaviors.

Next, a series of latent class analyses (LCA) were performed to determine patterns of classroom behavior as reported by teachers. First, models were fit with two

through ten class solutions and the final class solution was selected based on parsimony and interpretability, and indices of fit including the Bayesian Information Criterion (BIC), Akaike Information Criterion (AIC), Chi-Square Goodness of Fit Statistic, and Likelihood Ratio Statistic. All initial models were run with the number of repetitions equaling 20. After selecting the best-fitting model, a second LCA was performed with reading comprehension, mathematics, vocabulary, attention, and concentration as predictors to test for associations between cognitive functioning and likelihood of class membership. The second model with predictors was run with 20 repetitions and a maximum number of iterations of 5000 (Bray, 2021; Weller et al., 2020).

To understand whether the covariates gender, mother's race and ethnicity, income-to-needs ratio, and mother's education level were associated with likelihood of class membership, a third LCA was performed with covariates as predictors in the model. The third model with covariates was run with 20 repetitions and a maximum number of iterations of 5000. To test whether cognitive functioning was associated with likelihood of class membership after accounting for the effect of covariates, a final LCA was performed that included measures of cognitive functioning and covariates that were associated with likelihood of class membership in previous models. This fourth model was run with 20 repetitions and a maximum number of iterations of 5000.

All statistical analyses were performed in R (version 4.1.1) and R studio (version 2022.12.0+353). LCA was performed with the poLCA package (Linzer & Lewis, 2011). A *p*-value of 0.05 was chosen as the threshold for statistical significance.

Results

Descriptive Statistics and Correlation Analyses

Descriptive statistics for teacher ratings of children's behavior and cognitive assessments are reported in Tables 2 and 3, respectively. According to a Pearson correlation analysis, percentile scores for reading comprehension, mathematics ability, attention and concentration, and vocabulary were all positively correlated (Table 4). Furthermore, percentile scores for reading comprehension, mathematics ability, attention and concentration, and vocabulary were all negatively correlated with teacher ratings of children's behavior (Table 5). Specifically, children with higher levels of reading comprehension, mathematics ability, attention and concentration, and vocabulary relative to their peers had lower levels of problematic classroom behavior as reported by their teachers.

Table 2

Descriptive Statistics for Teachers' Ratings of Children's Behavior

Children Behavior Ratings	Frequency (%)	
	Absent/Low Severity	Moderate/High Severity
Child is inattentive, easily distracted	1295 (62.77%)	768 (37.23%)
Child is defiant	1808 (87.64%)	255 (12.36%)
Child restless in the 'squirmy' sense	1649 (79.93%)	414 (20.07%)
Child forgets things he or she already learned	1566 (75.91%)	497 (24.09%)
Child disturbs other children	1673 (81.10%)	390 (18.90%)
Child actively defies/refuses to comply with adults' requests	1854 (89.87%)	209 (10.13%)
Child is always 'on the go' or acts as if driven by a motor	1794 (86.96%)	269 (13.04%)

Child is poor in spelling	1460 (70.77%)	603 (29.23%)
Child cannot remain still	1752 (84.92%)	311 (15.08%)
Child is spiteful or vindictive	1916 (92.87%)	147 (7.13%)
Child leaves seat when remaining seated is expected	1777 (86.14%)	286 (13.86%)
Child fidgets with hands or feet or squirms in seat	1736 (84.15%)	327 (15.85%)
Child is not reading up to par	1416 (68.64%)	647 (31.36%)
Child has a short attention span	1526 (73.97%)	537 (26.03%)
Child argues with adults	1844 (89.38%)	219 (10.62%)
Child only pays attention to things he/she is interested in	1548 (75.04%)	515 (24.96%)
Child has difficulty waiting his/her turn	1767 (85.65%)	296 (14.35%)
Child lacks interest in schoolwork	1673 (81.10%)	390 (18.90%)
Child has distractibility or attention span problem	1488 (72.13%)	575 (27.87%)
Child has temper outburst, is explosive, or has unpredictable behavior	1871 (90.69%)	192 (9.31%)
Child runs about or climbs where it is inappropriate	1972 (95.59%)	91 (4.41%)
Child is poor in arithmetic	1516 (73.49%)	547 (26.51%)
Child interrupts or intrudes on others	1761 (85.36%)	302 (14.64%)
Child has difficulty playing or engaging in leisure activities quietly	1821 (88.27%)	242 (11.73%)
Child fails to finish things he or she starts	1612 (78.14%)	451 (21.86%)
Child does not follow through on instructions and fails to finish homework	1627 (78.87%)	436 (21.13%)
Child is excitable, impulsive	1749 (84.78%)	314 (15.22%)
Child is restless, always up and on the go	1804 (87.45%)	259 (12.55%)

Note. Questions are taken from the 28-item CTRS (Conners, 2001). Responses were given on a 4-point Likert scale (0-3) ranging from 'not true' to 'very much true.' Scores were then recoded as dichotomous to indicate the severity and frequency of the behavior. Items that were scored as 0 (not true) or 1 (just a little true) were coded as 1 and represent low severity/generally absent levels of problematic classroom behaviors, while items scored as 2 (pretty much true) or 3 (very much true) were coded as 2 and represent moderate to high severity/frequently present levels of problematic classroom behaviors.

Table 3

Descriptive Statistics for Cognitive Assessments

	Raw Score			Percentile Score		
	N	Mean	SD	N	Mean	SD
Reading Comprehension	2063	25.84	5.59	2063	37.7	24.89
Mathematics Ability	2063	32.42	5.98	2063	49.29	28.4
Attention and Concentration	2063	13.92	3.03	2063	44.07	27.68
Vocabulary	2063	112.54	20.38	2063	37.91	28.62

Note. Reading comprehension was measured through the Woodcock-Johnson III Passage Comprehension Subtest 9 (Woodcock et al., 2001). Mathematics ability was measured through the Woodcock-Johnson III Applied Problems Subtest 10 (Woodcock et al., 2001). Attention and Concentration were measured through the Wechsler Intelligence Scale for Children IV Digit Span Subtest (Wechsler, 2003). Vocabulary was measured through the Peabody Picture Vocabulary Test (Dunn & Dunn, 1997). The raw scores were each converted to percentile scores, which range from 0 to 100 and indicates how the child's score compares to their peers on each construct.

Table 4

Correlations Between Cognitive Constructs

	Reading Comprehension	Mathematics Ability	Attention and Concentration	Vocabulary
Reading Comprehension		0.618 *	0.434 *	0.619 *
Mathematics Ability			0.432 *	0.540 *
Attention and Concentration				0.317 *

Note. Reading comprehension was measured through the Woodcock-Johnson III Passage Comprehension Subtest 9 (Woodcock et al., 2001). Mathematics ability was measured through the Woodcock-Johnson III Applied Problems Subtest 10 (Woodcock et al., 2001). Attention and Concentration were measured through the Wechsler Intelligence Scale for Children IV Digit Span Subtest (Wechsler, 2003). Vocabulary was measured through the Peabody Picture Vocabulary Test (Dunn & Dunn, 1997). The raw scores were each converted to percentile scores, which range from 0 to 100 and indicates how the child's score compares to their peers on each construct. N = 2063. Correlations significant at $p<.001$ are denoted by *.

Table 5

Correlations Between Behavioral Subscale Scores and Cognitive Constructs

	Oppositional	Cognitive Problems and Inattention	Hyperactivity	ADHD
Reading Comprehension	-0.184 *	-0.511 *	-0.196 *	-0.304 *
Mathematics Ability	-0.186 *	-0.529 *	-0.197 *	-0.319 *

Attention and Concentration	-0.0952 *	-0.3299 *	-0.124 *	-0.190 *
Vocabulary	-0.174 *	-0.404 *	-0.133 *	-0.212 *

Note. Items from each subscale on the CTRS (Conners, 2001) were summed to calculate each subscale score, with higher values reflecting more problematic classroom behavior. Reading comprehension was measured through the Woodcock-Johnson III Passage Comprehension Subtest 9 (Woodcock et al., 2001). Mathematics ability was measured through the Woodcock-Johnson III Applied Problems Subtest 10 (Woodcock et al., 2001). Attention and Concentration were measured through the Wechsler Intelligence Scale for Children IV Digit Span Subtest (Wechsler, 2003). Vocabulary was measured through the Peabody Picture Vocabulary Test (Dunn & Dunn, 1997). The raw scores were each converted to percentile scores, which range from 0 to 100 and indicates how the child's score compares to their peers on each construct. N = 2063. Correlations significant at $p<.001$ are denoted by *.

Latent Class Analysis of Teacher Reports of Children's Behavior

An LCA was performed on the 28 teacher ratings of children's behavior that reflect oppositional behavior, cognitive problems and inattention, hyperactivity, and ADHD symptoms observed in the classroom. According to fit indices and interpretability of the solutions (Table 6), the seven class solution was selected as the best fit for the data. The final model identified seven highly distinct profiles with class sizes that remained over or close to 5% of the sample. Only one class represented less than 5% of the sample but was deemed acceptable due to the large sample size and nature of that class (Weller et al., 2020). Specifically, this class was deemed to be the highest risk, as they were shown to exhibit high rates of problematic behaviors across all subscales.

Table 6

Fit Statistics for Latent Class Models

Number of Classes	BIC	AIC	Chi Square Goodness of Fit (χ^2)	Likelihood Ratio (G^2)
2	39,980.72	39,657.93	7,921,204,131	19,685.57
3	36,801.25	36,314.23	7,838,774,013	16,283.88
4	35,538.93	34,887.69	6,237,878,394	14,799.33
5	34,962.98	34,147.51	4,645,137,518	14,001.16
6	34,418.67	33,438.98	1,043,347,814	13,234.63
7	34,002.68	32,858.77	486,903,138	12,596.42
8	33,879.21	32,571.07	309,560,673	12,250.71
9	33,797.66	32,325.3	259,816,125	11,946.94
10	33,765.07	32,128.48	231,974,111	11,692.12

Note. BIC represents the Bayesian Information Criterion. AIC represents the Akaike Information Criterion. Lower numbers are indicative of a better fit per each fit index.

Description of Classes

Classes were labeled in order from highest to lowest incidence in the sample (Figure 1).

Class 1: Low Risk

This class was comprised of just under half of the children in this sample (46.93%). These children were rated as having few to no behavioral problems as reported by their teachers. Probabilities of endorsing all 28 child behaviors based on teacher reports were below 0.2 for this class.

Class 2: Cognitive Problems and Learning Issues

The second-largest class (13.43%) was characterized by having issues exclusively with learning in school and no other behavioral issues. These children were reported as

having the most trouble with reading and spelling, as well as issues with math and forgetfulness of learned material.

Class 3: Learning and Attention Issues

The third class makes up 13.33% of the sample. This class, like class 2, shows issues with learning in the classroom, but additionally are reported to have attention issues. Class 3 is also marked by being easily distracted and failing to listen to instructions.

Class 4: Low to Moderate Risk

Class four makes up 9.08% of the sample. This class shows small amounts of behavioral issues across all categories with probabilities around 0.2, with a slightly higher incidence of behaviors indicating ADHD.

Class 5: Extreme Distractibility and Hyperactivity

The fifth class makes up 7.72% of the sample. Class five is characterized by extremely hyperactive and distracted behaviors. Children in this class show behaviors exhibiting a lack of attention, fidgeting or inability to stay still, as well as being easily distracted and having difficulty staying on task.

Class 6: Aggressive

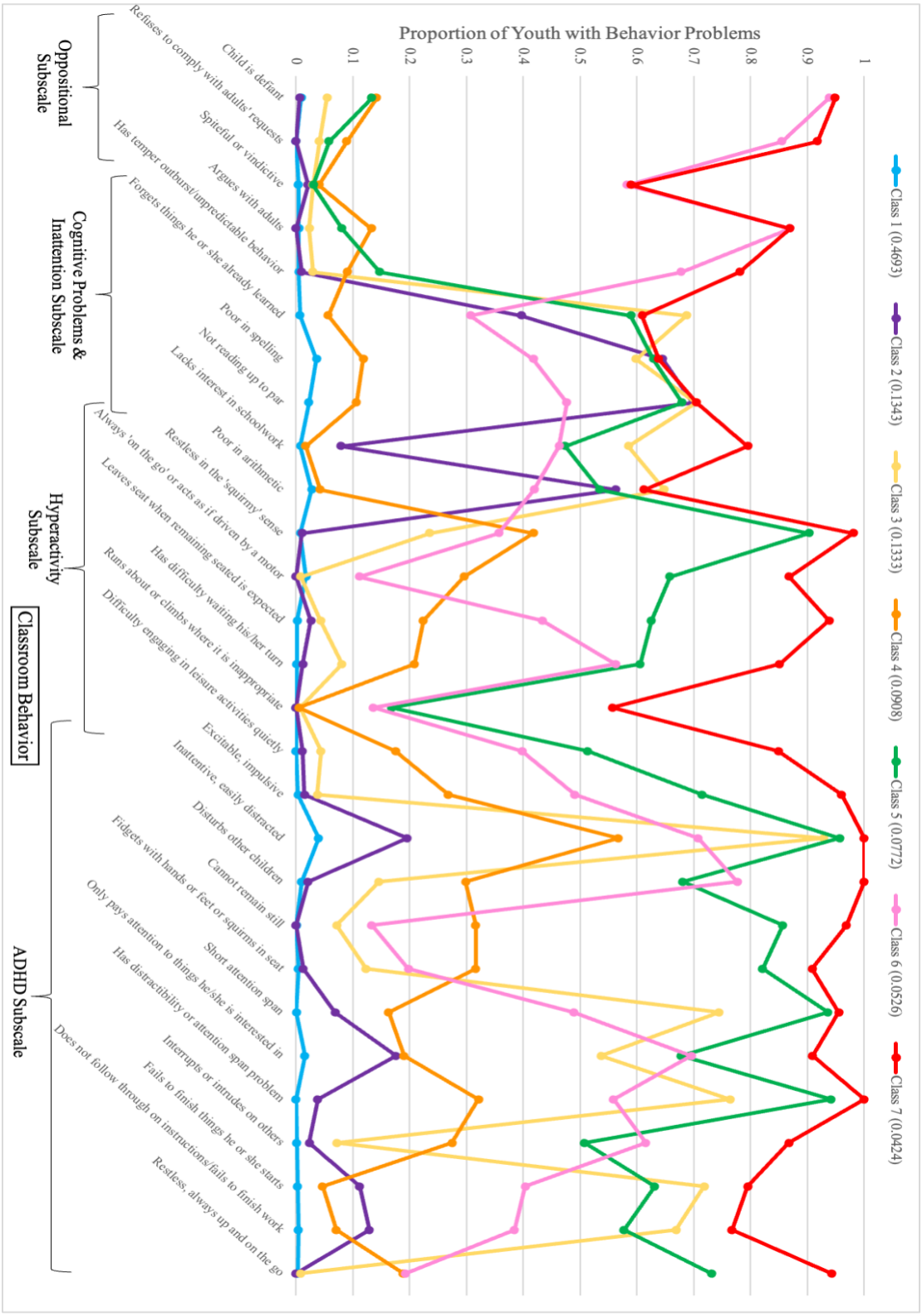
Class six makes up 5.26% of this sample. This class is one of only two that exhibit oppositional behaviors. Class six is defined by being extremely defiant and argumentative, as well as having issues with disrupting others and not listening to directions.

Class 7: High Risk

The seventh and final class makes up 4.24% of the sample. Class seven is characterized by having high rates of behavioral issues across all items. These children all have extreme behavioral problems that are not limited to one or two subscales of the CTRS. Although this class represents less than 5% of the sample, it includes over 85 youth.

Figure 1

Behavioral Profiles of the 7 Class Model



Cognitive Constructs as Predictors of Class Membership

In the LCA with reading comprehension, mathematics ability, attention and concentration, and vocabulary as predictors, the low-risk class (class 1) was used as the comparison class (Table 7). Better performance in reading comprehension and mathematics was associated with a greater likelihood of belonging to the low-risk class, compared to all other classes (*p*s <.001 to .016) except the low to moderate risk class (class 4). Attention, concentration, and vocabulary skills were less indicative of class membership, as these constructs only differentially predicted class membership in some cases. Specifically, better performance in attention and concentration was associated with a greater likelihood of belonging to the low-risk class compared to the learning and attention issues (class 3) and extreme distractibility and hyperactivity (class 5) classes but not the cognitive problems and learning issues (class 2), low to moderate risk (class 4), aggressive (class 6), and high risk (class 7) classes. Better performance in vocabulary was only associated with a greater likelihood of belonging to the low-risk class compared to the aggressive class (class 6).

Table 7

Relationship Between Cognitive Constructs and Behavioral Profiles

Class (% of sample)	Construct	Coefficient	*t* value	*p* value	Odds Ratio [95% CI]
Cognitive Problems and Learning Issues	Reading Comprehension	-0.03 **	-5.33	<.001	0.98 [0.97, 0.98]
(Class 2, 14.07%)	Mathematics Ability	-0.03 **	-7.74	<.001	0.97 [0.96, 0.98]
	Attention and Concentration	-0.01	-1.89	.06	0.99 [0.99, 1.00]

	Vocabulary	0.002	0.43	.67	1.00 [0.99, 1.01]
Learning and Attention Issues (Class 3, 13.38%)	Reading Comprehension	-0.03 **	-5.00	<.001	0.98 [0.97, 0.99]
	Mathematics Ability	-0.02 **	-5.71	<.001	0.98 [0.97, 0.99]
	Attention and Concentration	-0.01 *	-1.99	.047	0.99 [0.99, 0.999]
	Vocabulary	-0.01	-1.30	.19	0.99 [0.99, 1.00]
Low to Moderate Risk (Class 4, 9.44%)	Reading Comprehension	-0.01	-1.13	.28	0.99 [0.98, 1.00]
	Mathematics Ability	-0.01	-1.94	.05	0.99 [0.98, 1.00]
	Attention and Concentration	-0.002	-0.56	.57	1.00 [0.99, 1.01]
	Vocabulary	0.01	1.78	.08	1.01 [1.00, 1.02]
Extreme Distractibility and Hyperactivity (Class 5, 7.32%)	Reading Comprehension	-0.03 **	-4.56	<.001	0.97 [0.96, 0.99]
	Mathematics Ability	-0.03 **	-4.53	<.001	0.98 [0.96, 0.99]
	Attention and Concentration	-0.01 *	-2.01	.045	0.99 [0.98, 0.9998]
	Vocabulary	0.001	0.28	.78	1.00 [0.99, 1.01]
Aggressive (Class 6, 5.47%)	Reading Comprehension	-0.02 *	-2.42	.02	0.98 [0.97, 0.997]
	Mathematics Ability	-0.02 **	-3.85	<.001	0.98 [0.97, 0.99]
	Attention and Concentration	-0.0002	-0.04	.97	1.00 [0.99, 1.01]
	Vocabulary	-0.02 **	-2.86	.004	0.98 [0.97, 0.995]
High Risk	Reading Comprehension	-0.03 **	-2.92	.004	0.97 [0.95, 0.99]

(Class 7, 4.22%)	Mathematics Ability	-0.02 **	-2.90	.004	0.98 [0.96, 0.99]
	Attention and Concentration	0.0003	0.04	.97	1.00 [0.99, 1.01]
	Vocabulary	-0.002	-0.21	.83	1.00 [0.98, 1.01]

Note. Data is taken from analysis that compares classes 2 through 7 to class 1 (46.09%), the low-risk class. Coefficients significant at $p < .05$ are denoted by *. Coefficients significant at $p < .01$ are denoted by **.

Covariates Associated with Class Membership

An LCA was performed to understand how demographic characteristics of children are associated with teacher ratings of children's behavior (Table 8). The low-risk class (class 1) was used as the comparison group in the analysis. The child's gender and the mother's income-to-needs ratio were found to be significantly related to class membership. Children identifying as girls (*p*s <0.001 to 0.004) and mothers with a larger income-to-needs ratio at the time of the child's birth (i.e., greater household income relative to the poverty level) were more likely to belong to the low-risk class compared to most other classes (*p*s <.001 to .031). Mother's race and ethnicity was not associated with likelihood of class membership. The mother's years of education were only found to be indicative of class membership in two classes: learning and attention issues (class 3) and low to moderate risk (class 4).

Table 8

Relationship Between Demographic Covariates and Behavioral Classes

Class (% of sample)	Covariate	Coefficient	*t* value	*p* value	Odds Ratio [95% CI]
Cognitive Problems and Learning Issues (Class 2, 14.07%)	Gender of Child	-0.84 **	-5.33	<.001	0.43 [0.32, 0.59]
	Mother's Race/Ethnicity	-0.09	-0.47	.635	0.91 [0.62, 1.34]
	Mother's Income-to-Needs Ratio	-0.15 **	-3.74	<.001	0.87 [0.80, 0.93]
	Mother's Education	-0.13	-0.76	.447	0.88 [0.62, 1.24]
Learning and Attention Issues (Class 3, 13.38%)	Gender of Child	-0.08	-0.48	.633	0.93 [0.67, 1.27]
	Mother's Race/Ethnicity	-0.28	-1.30	.193	0.76 [0.50, 1.15]
	Mother's Income-to-Needs Ratio	-0.12 **	-2.70	.008	0.89 [0.81, 0.97]
	Mother's Education	-0.398 *	-1.97	.05	0.67 [0.45, 0.999]
Low to Moderate Risk (Class 4, 9.44%)	Gender of Child	-1.03 **	-5.31	<.001	0.36 [0.24, 0.52]
	Mother's Race/Ethnicity	0.16	0.72	.47	1.17 [0.77, 1.78]
	Mother's Income-to-Needs Ratio	-0.09 *	-2.16	.031	0.92 [0.85, 0.99]
	Mother's Education	0.45 *	2.14	.033	1.57 [1.038, 2.36]
Extreme Distractibility and Hyperactivity (Class 5, 7.32%)	Gender of Child	-1.68 **	-7.06	<.001	0.19 [0.12, 0.30]
	Mother's Race/Ethnicity	0.09	0.40	.69	1.10 [0.70, 1.73]
	Mother's Income-to-Needs Ratio	-0.14 **	-2.74	.006	0.87 [0.79, 0.96]

	Mother's Education	-0.20	-0.90	.368	0.82 [0.52, 1.27]
Aggressive (Class 6, 5.47%)	Gender of Child	-0.75 **	-2.85	.004	0.47 [0.28, 0.79]
	Mother's Race/Ethnicity	-0.66	-1.66	.098	0.52 [0.24, 1.13]
	Mother's Income-to-Needs Ratio	-0.39 **	-3.55	<.001	0.68 [0.55, 0.84]
	Mother's Education	-0.25	-0.81	.421	0.78 [0.42, 1.44]
High Risk (Class 7, 4.22%)	Gender of Child	-1.39 **	-4.98	<.001	0.25 [0.15, 0.43]
	Mother's Race/Ethnicity	-0.66	-1.50	.133	0.52 [0.22, 1.22]
	Mother's Income-to-Needs Ratio	-0.20 *	-2.29	.022	0.82 [0.70, 0.97]
	Mother's Education	-0.42	-1.23	.22	0.66 [0.34, 1.28]

Note. Data is taken from analysis that compares classes 2 through 7 to class 1 (46.56%), the low-risk class. Coefficients significant at $p < .05$ are denoted by *. Coefficients significant at $p < .01$ are denoted by **. Gender was recoded to that children identifying as male were coded as 0 and children identifying as female were coded as 1. Race was recoded such that children identifying as a racial or ethnic minority (Black, Hispanic, Other) were coded as 0 and children identifying as a non-racial or ethnic minority (White and non-Hispanic) were coded as 1. Mother's education was recoded as having a high school degree or less (0) vs. having some college or more (1).

Covariates as Predictors of Class Membership While Controlling for Covariates

A final LCA was run to determine if reading comprehension and mathematics ability were still predictive of class membership while controlling for the child's gender and the mother's income-to-needs ratio (Table 9). The child's gender and mother's income-to-needs ratio were included as covariates in this final model because they were the demographic characteristics that best distinguished between the low-risk class (class 1) and all other classes (classes 2-7). Reading comprehension and mathematics scores were still associated with class membership after controlling for children's gender and mothers' income-to-needs ratio. Specifically, higher reading comprehension and mathematics scores were associated with a greater likelihood of belonging to the low-risk class compared to the cognitive problems and learning issues (class 2), learning and attention issues (class 3), extreme distractibility and hyperactivity (class 5), aggressive (class 6), and high risk (class 7) classes. Higher mathematics scores, but not reading comprehension scores, were also associated with a greater likelihood of belonging to the low-risk class (class 1) compared to the low to moderate risk class (class 4).

Table 9

Relationship Between Cognitive Constructs and Behavioral Profiles While Controlling for Demographic Variables

Class (% of sample)	Variable	Coefficient	*t* value	*p* value	Odds Ratio [95% CI]
Cognitive Problems and Learning Issues	Reading Comprehension	-0.02 **	-5.38	<0.001	0.98 [0.97, 0.99]
(Class 2, 14.07%)	Mathematics Ability	-0.03 **	-8.27	<0.001	0.97 [0.96, 0.98]

	Gender of Child	-0.78 **	-4.55	<0.001	0.46 [0.33, 0.64]
	Mother's Income-to-Needs Ratio	-0.03	-0.85	0.397	0.97 [0.90, 1.04]
Learning and Attention Issues	Reading Comprehension	-0.03 **	-6.46	<0.001	0.97 [0.96, 0.98]
(Class 3, 13.38%)	Mathematics Ability	-0.03 **	-6.72	<0.001	0.97 [0.97, 0.98]
	Gender of Child	0.08	0.45	0.65	1.09 [0.76, 1.55]
	Mother's Income-to-Needs Ratio	-0.02	-0.57	0.572	0.98 [0.90, 1.06]
Low to Moderate Risk	Reading Comprehension	-0.0001	-0.03	0.977	0.9999 [0.991, 1.009]
(Class 4, 9.44%)	Mathematics Ability	-0.008 *	-1.98	0.047	0.99 [0.985, 0.9999]
	Gender of Child	-1.06 **	-5.35	<0.001	0.35 [0.24, 0.51]
	Mother's Income-to-Needs Ratio	-0.02	-0.69	0.489	0.98 [0.91, 1.05]
Extreme Distractibility and Hyperactivity	Reading Comprehension	-0.02 **	-4.13	<0.001	0.98 [0.97, 0.99]
(Class 5, 7.32%)	Mathematics Ability	-0.03 **	-5.95	<0.001	0.97 [0.96, 0.98]
	Gender of Child	-1.57 **	-6.42	<0.001	0.21 [0.13, 0.34]
	Mother's Income-to-Needs Ratio	-0.01	-0.26	0.795	0.99 [0.90, 1.09]
Aggressive	Reading Comprehension	-0.02 **	-2.81	0.005	0.98 [0.97, 0.99]
(Class 6, 5.47%)	Mathematics Ability	-0.02 **	-4.56	<0.001	0.98 [0.97, 0.99]
	Gender of Child	-0.86 **	-3.32	0.001	0.42 [0.26, 0.70]

	Mother's Income-to-Needs Ratio	-0.35 **	-3.19	0.001	0.71 [0.57, 0.88]
High Risk (Class 7, 4.22%)	Reading Comprehension	-0.03 **	-2.81	0.005	0.97 [0.96, 0.99]
	Mathematics Ability	-0.02 **	-3.06	0.002	0.98 [0.96, 0.99]
	Gender of Child	-1.33 **	-4.36	<0.001	0.26 [0.15, 0.48]
	Mother's Income-to-Needs Ratio	-0.16 *	-2.04	0.041	0.85 [0.73, 0.99]

Note. Data is taken from analysis that compares classes 2 through 7 to class 1 (46.09%), the low-risk class. Coefficients significant at $p < .05$ are denoted by *. Coefficients significant at $p < .01$ are denoted by **. Gender was recoded to that children identifying as male were coded as 0 and children identifying as female were coded as 1. Race was recoded such that children identifying as a racial or ethnic minority (Black, Hispanic, Other) were coded as 0 and children identifying as a non-racial or ethnic minority (White and non-Hispanic) were coded as 1. Mother's education was recoded as having a high school degree or less (0) vs. having some college or more (1).

Discussion

The present study identified patterns of children's classroom behavior based on teacher reports and tested whether behavior patterns were associated with children's reading comprehension, mathematics ability, attention and concentration, and vocabulary, above and beyond children's gender and income-to-needs ratio. Consistent with the study hypotheses, the LCA revealed a low-risk class that was marked by a low probability of problematic classroom behavior along with six other classes with relatively higher probabilities of behavioral risk. As expected, better performance on reading comprehension, mathematics ability, vocabulary, attention, and concentration were associated with a greater likelihood of belonging to the low-risk class compared to the other classes representing varying degrees of behavioral risk. Reading comprehension and mathematics ability continued to predict class membership, even after controlling for gender and income-to-needs ratio. These findings provide insight into how teacher ratings of children's behaviors can be grouped to identify children at risk for cognitive difficulties and problems with academics and learning.

Nearly half of all children in the present study belonged to the low-risk class that was associated with a low probability of oppositional behavior, cognitive problems and inattention, hyperactivity, and ADHD symptoms, as endorsed by teachers. This is not surprising, as the prevalence of ADHD in school-aged children in the U.S. is between 5 and 10%, with even fewer children being diagnosed with ODD (approximately 4.5%) (Boat & Wu, 2015; Scahill & Schwab-Stone, 2000). Indeed, only a small percentage of children belonged to the extreme distractibility and hyperactivity (7.72%), aggressive (5.26%), and high risk (4.24%) classes. Identification of these classes matches closely

with what one might expect to see in an average classroom – a small percentage of children with more extreme behavioral issues, a slightly larger proportion of children with general academic and learning issues, and the majority of children with few to no behavioral problems.

The CTRS is often used by clinicians to help diagnose disorders in children such as ADHD and ODD by summing items within the oppositional, cognitive problems and inattention, hyperactivity, and ADHD subscales (Althoff, 2006; Stevens & Quittner, 1998). However, one issue with sum scores is that a child with severe behavioral problems in one or two domains will have the same total score as a child with moderate behavioral problems across multiple domains. While it is important to identify children who are at risk for any type of behavioral issue, it is equally as important to identify the type of issues each child struggles with, as different behavioral issues likely require varying types of treatments and interventions. For example, in the present study, the LCA revealed four classes of children (classes 3, 5, 6, 7) with moderate to high probabilities of exhibiting behaviors from the ADHD subscale of the CTRS (e.g., inattentive, easily distracted) yet only one of these classes had a low probability of disturbing other students (class 3). This suggests these students may have less of an impact on the classroom climate. Similarly, classes 2 and 3 both have high probabilities of forgetfulness of learned material, poor spelling, reading issues, and poor arithmetic from the cognitive problems and inattentive subscale, yet class 2 has a low probability of lacking interest in coursework, suggesting these youth may have the motivation to do well. These subtle yet important differences between classes help provide an understanding of the entire picture of behavior, not just an overview of it, as well as where these issues might be stemming

from. These distinctions may also be immensely helpful in choosing the best intervention for a child and support the need for more individualized interventions.

Results from the secondary LCA in which cognitive assessment scores were included as predictors of class membership provided support for our second hypothesis. For nearly all classes, higher percentile scores on reading comprehension and mathematics assessments were predictive of low-risk class membership. In certain classes, attention, concentration, and vocabulary scores were also shown to be different. Overall, worse performance on cognitive testing across each of the domains was associated with higher likelihood of membership to one of the moderate to high-risk classes, compared to the low-risk class. The ability to use cognitive testing to identify children at risk for participating in disruptive or problematic behaviors is vital for early identification of such children. Children who exhibit problematic behaviors have been shown to perform worse academically, hence the importance of early identification of these children in schools (Malecki & Elliot, 2002). The results suggest that the presence of any kind of divergent behavior is a risk factor for cognitive difficulties Thus, results from the present stud suggest that cognitive assessments may be used to assist in identifying children who are most at risk for future cognitive and academic outcomes based on their current behaviors. Furthermore, changes in cognitive scores may be a useful benchmark for evaluating the effectiveness of classroom behavior interventions. Future studies should test how changes in problematic classroom behaviors relate to changes in cognitive assessments across childhood.

The LCA assessing teacher reports of behavior and demographics of the sample (mother's income-to-needs ratio, education, race and ethnicity, and child's gender)

returned interesting results. Gender was found to significantly affect class membership, with more girls belonging to the low-risk class when compared to all other classes, suggesting that boys are generally rated as having more behavioral issues (Åhslund & Boström, 2018; Auwarter & Aruguete, 2008). The income-to-needs ratio of the mothers was also highly indicative of class membership, with lower household income relative to the poverty level being associated with membership in the moderate to high-risk classes relative to the low-risk class. Indeed, teachers often perceive children of lower socio-economic status as showing more problematic behaviors as well as underestimating their cognitive and academic abilities (Auwarter & Aruguete, 2008; Ready & Wright, 2011).

Most notable, however, was that race and ethnicity were not found to be related to class membership. The literature has shown conflicting ideas regarding teacher reports of classroom behavior and ethnicity, with some studies finding differences in teachers' ratings of children's behavior according to race and ethnicity while others do not (Mason et al., 2014). For the purpose of this LCA, race and ethnicity were broken down to compare children of mothers who identified as White, Non-Hispanic versus children of mothers identifying as Black, Hispanic, and other races/ethnicities. A difference may still exist between specific minority populations, as one study found that children identifying as Black were rated as exhibiting more negative behaviors than children identifying as Hispanic (Stevens, 1980). However, when children of various racial and ethnic minorities were combined as part of this analysis, a difference did not present itself. Further, bias could potentially have presented itself in a second-hand manner. While overall, teacher ratings of behavior have been shown to be accurate in representing behaviors in Black

and Hispanic students, it is also possible that problematic behaviors are underreported in White children (Hosterman et al., 2008).

The final LCA, which assessed reading comprehension and mathematics scores as predictors of class membership, while controlling for the child's gender and the mother's income-to-needs ratio, further confirmed the results of the previous analyses. Even when controlling for these demographic characteristics that have been previously associated with teacher ratings of children's classroom behavior, better performance on reading comprehension and mathematics assessments were still strongly indicative of membership to the low-risk class. This analysis supports the notion that low scores on cognitive assessments can be used to identify children who exhibit problematic behaviors. In practice, this suggests that children who score higher on such assessments are less likely to have behavioral issues, regardless of possible differences that could be attributed to the child's gender or the mother's socio-economic status. Once again, the presence of any kind of behavioral issue is enough to put a child at risk for cognitive difficulties and performance on various assessments, which can also lead to issues with academic achievement in school (Baker et al., 2015; Ready & Wright, 2011).

While teacher ratings of a child's behavior are often accurate, there is no doubt they can still be prone to bias across various characteristics of the child. This sample contains children who could be extremely prone to bias, as children of lower income or lower socioeconomic status as prone to not only poor achievement but also more severe ratings of problematic behaviors by their teachers (Baker et al., 2015). While the present study suggests that teacher ratings of behavior and cognitive performance are related regardless of socioeconomic status, it is important to remember that the initial

identification of problematic behaviors could have been influenced by preconceived notions by the teachers. Additionally, White children may be under-identified as having behavior issues. Hosterman and colleagues (2008) suggested that while teachers may be rating the behaviors of children of racial and ethnic minorities accurately using rating scales, they could be underestimating or underreporting the presence of those same problematic behaviors in White children. This might be due to teachers holding stereotypes that children of ethnic minorities are prone to more problematic behaviors, as well as the idea that White children are less prone to these behaviors. This could help to explain why no relationship was found between classes of behavior and race and ethnicity.

The present study had many strengths, including a large, ethnically and socioeconomically diverse sample of children who are often underrepresented in research (Rad et al., 2018). This study also used a person-centered statistical approach to understand how teacher ratings of children's behavior are associated with cognitive functioning. However, there were several limitations as well. The present study relied on teacher reports of children's behavior that may be influenced by biases related to children's gender, race and ethnicity, and socioeconomic status (Åhslund & Boström, 2018; Hosterman et al., 2008; Ready & Wright, 2011; Stevens, 1980). Additionally, the study relied on the child's completion of the cognitive assessments during a home visit. The study relies on the accurate completion of these various assessments; however, we cannot determine if the children gave their best efforts on the assessments. Therefore, future studies should include reports of behaviors by other adults who regularly interact with the child such as parents, other caregivers, and even school psychologists, to ensure

a more well-rounded and less biased picture of behavior. Additionally, assessments should be given in a controlled environment to ensure accuracy of testing. Additional tests in various cognitive domains could also be given to further extend the results of this study.

The present study only tested whether cognitive assessments were associated with the likelihood of belonging to the low-risk class compared to all other moderate to high-risk classes. Future studies can expand on our results by examining the association between cognitive assessments and likelihood of class membership between each of the moderate to high-risk classes of behavior. Longitudinal studies may also help determine whether behavioral patterns in children identified in the present study are associated with performance on future cognitive assessments and academic success.

In conclusion, LCA was successful in determining novel classes of behaviors of at-risk children using teacher reports of problematic behaviors. Worse performance on various cognitive assessments was overall predictive of membership to the at-risk behavior classes. These results remained significant while controlling for the gender of the child and the income-to-needs ratio of the mother. Outcomes from this study suggest that any type of problematic behavior is associated with cognitive difficulties. By using teacher reports of such behaviors, these at-risk children can be identified in schools earlier so that interventions can be implemented to assist them in bettering their achievement in school.

References

Åhslund, I., & Boström, L. (2018). Teachers' Perceptions of Gender Differences: What about Boys and Girls in the Classroom?. *International Journal of Learning, Teaching and Educational Research*, *17*(4), 28-44.

Althoff, R. R., Copeland, W. E., Stanger, C., Derks, E. M., Todd, R. D., Neuman, R. J., ... & Hudziak, J. J. (2006). The latent class structure of ADHD is stable across informants. *Twin Research and Human Genetics*, *9*(4), 507-522.

Alvidrez, J., & Weinstein, R. S. (1999). Early teacher perceptions and later student academic achievement. *Journal of educational psychology*, *91*(4), 731.

Auwarter, A. E., & Aruguete, M. S. (2008). Effects of student gender and socioeconomic status on teacher perceptions. *The Journal of Educational Research*, *101*(4), 242-246.

Baker, C. N., Tichovolsky, M. H., Kupersmidt, J. B., Voegler-Lee, M. E., & Arnold, D. H. (2015). Teacher (mis) perceptions of preschoolers' academic skills: Predictors and associations with longitudinal outcomes. *Journal of educational psychology*, *107*(3), 805.

Beswick, J. F., Willms, J. D., & Sloat, E. A. (2005). A comparative study of teacher ratings of emergent literacy skills and student performance on a standardized measure. *Education-Indianapolis then Chula Vista-*, *126*(1), 116.

Boat, T. F., & Wu, J. T. (2015). Mental disorders and disabilities among low-income children.

Bradley-Johnson, S., Morgan, S. K., & Nutkins, C. (2004). Book review: The Woodcock-Johnson tests of achievement. *Journal of Psychoeducational Assessment*, *22*(3), 261-274.

Bray, B. (2021, November). Introduction to Latent Class and Latent Profile Analysis. Indiana University Workshop in Methods.

Casale, G., Herzog, M., & Volpe, R. J. (2023). Measurement Efficiency of a Teacher Rating Scale to Screen for Students at Risk for Social, Emotional, and Behavioral Problems. *Journal of Intelligence*, *11*(3), 57.

Chang, D. F., & Sue, S. (2003). The effects of race and problem type on teachers' assessments of student behavior. *Journal of consulting and clinical psychology*, *71*(2), 235.

Charach, A., Chen, S., Hogg-Johnson, S., & Schachar, R. J. (2009). Using the Conners' Teacher Rating Scale—Revised in school children referred for assessment. *The Canadian Journal of Psychiatry*, *54*(4), 232-241.

Conners, C. K. (1989). Conners Teacher Rating Scale. *The American Journal of Psychiatry*.

Conners, C. K. (1998). Rating scales in attention-deficit/hyperactivity disorder: use in assessment and treatment monitoring. *Journal of Clinical Psychiatry*, *59*(7), 24-30.

Conners, C. K. (2001). *Conners' rating scales revised*. Multi-Health Systems, Incorporated.

Conners, C. K., Sitarenios, G., Parker, J. D., & Epstein, J. N. (1998). Revision and restandardization of the Conners Teacher Rating Scale (CTRS-R): factor

structure, reliability, and criterion validity. *Journal of abnormal child psychology*, *26*, 279-291.

Cordes, M., & McLaughlin, T. F. (2004). Attention Deficit Hyperactivity Disorder and Rating Scales with a Brief Review of the" Connors Teacher Rating Scale"(1998). *International journal of special education*, *19*(2), 23-34.

Dobbs, J., & Arnold, D. H. (2009). Relationship Between Preschool Teachers' Reports of children's behavior and their behavior toward those children. *School Psychology Quarterly*, *24*(2), 95.

Dunn, L. M., & Dunn, L. M. (1997). Examiner's Manual for the Peabody Picture Vocabulary Test—Third Edition. Circle Pines, MN: American Guidance Service.

Elliott, S. N., Gresham, F. M., Freeman, T., & McCloskey, G. (1988). Teacher and observer ratings of children's social skills: Validation of the Social Skills Rating Scales. *Journal of psychoeducational Assessment*, *6*(2), 152-161.

Families, F. (2018). User's guide for the Fragile Families and Child Wellbeing Study Public Data, Year 9.

Fletcher, J. M., & Satz, P. (1984). Test-based versus teacher-based predictions of academic achievement: A three-year longitudinal follow-up. *Journal of Pediatric Psychology*, *9*(2), 193-203.

Frawley, T. (2005). Gender bias in the classroom: Current controversies and implications for teachers. *Childhood Education*, *81*(4), 221.

Fry, P. S. (1983). Process measures of problem and non-problem children's classroom behaviour: The influence of teacher behaviour variables. *British Journal of Educational Psychology*, *53*(1), 79-88.

Gurley, J. R. (2011). Conners' Teacher Rating Scales: Revised. *Encyclopedia of Child Behavior and Development; Goldstein, S., Naglieri, JA, Eds*, 405-406.

Hosterman, S. J., DuPaul, G. J., & Jitendra, A. K. (2008). Teacher ratings of ADHD symptoms in ethnic minority students: Bias or behavioral difference?. *School Psychology Quarterly*, *23*(3), 418.

Jarosewich, T., Pfeiffer, S. I., & Morris, J. (2002). Identifying gifted students using teacher rating scales: A review of existing instruments. Journal of Psychoeducational assessment, 20(4), 322-336.

Linzer, D. A., & Lewis, J. B. (2011). poLCA: An R package for polytomous variable latent class analysis. *Journal of statistical software*, *42*, 1-29.

Malecki, C. K., & Elliot, S. N. (2002). Children's social behaviors as predictors of academic achievement: A longitudinal analysis. *School psychology quarterly*, *17*(1), 1.

Mason, B. A., Gunersel, A. B., & Ney, E. A. (2014). Cultural and ethnic bias in teacher ratings of behavior: A criterion-focused review. *Psychology in the Schools*, *51*(10), 1017-1030.

McDermott, P. A., Rovine, M. J., Gerstner, C. C. E., Weiss, E. M., & Watkins, M. W. (2022). Latent profile analysis of classroom behavior problems in an American national sample of prekindergarten children. *Social Development*, *31*(4), 1059-1078.

McKinlay, A. (2011). Peabody picture vocabulary test–Third edition (PPVT-III). *Encyclopedia of child behavior and development*, 1072-1072.

Metcalfe, L. A., Harvey, E. A., & Laws, H. B. (2013). The longitudinal relation between academic/cognitive skills and externalizing behavior problems in preschool children. *Journal of educational psychology*, *105*(3), 881.

Rad, M. S., Martingano, A. J., & Ginges, J. (2018). Toward a psychology of Homo sapiens: Making psychological science more representative of the human population. *Proceedings of the National Academy of Sciences*, *115*(45), 11401-11405.

Ready, D. D., & Wright, D. L. (2011). Accuracy and inaccuracy in teachers' perceptions of young children's cognitive abilities: The role of child background and classroom context. *American Educational Research Journal*, *48*(2), 335-360.

Reichman, N. E., Teitler, J. O., Garfinkel, I., & McLanahan, S. S. (2001). Fragile families: Sample and design. *Children and Youth Services Review*, *23*(4-5), 303-326.

Scahill, L., & Schwab-Stone, M. (2000). Epidemiology of ADHD in school-age children. *Child and adolescent psychiatric clinics of North America*, *9*(3), 541-555.

Splett, J. W., Smith-Millman, M., Raborn, A., Brann, K. L., Flaspohler, P. D., & Maras, M. A. (2018). Student, teacher, and classroom predictors of between-teacher variance of students' teacher-rated behavior. *School Psychology Quarterly*, *33*(3), 460.

Stevens, G. (1980). Bias in attributions of positive and negative behavior in children by school psychologists, parents, and teachers. *Perceptual and Motor Skills*, *50*(3_suppl), 1283-1290.

Stevens, J., & Quittner, A. L. (1998). Factors influencing elementary school teachers' ratings of ADHD and ODD behaviors. *Journal of Clinical Child Psychology*, *27*(4), 406-414.

Teisl, J. T., Mazzocco, M. M., & Myers, G. F. (2001). The utility of kindergarten teacher ratings for predicting low academic achievement in first grade. *Journal of Learning Disabilities*, *34*(3), 286-293.

von Suchodoletz, A., & Gunzenhauser, C. (2013). Behavior regulation and early math and vocabulary knowledge in German preschool children. *Early Education & Development*, *24*(3), 310-331.

Wechsler, D. (2003). Wechsler Intelligence Scale for Children, 4th Edn San Antonio. *TX: PsychCorp*.

Weller, B. E., Bowen, N. K., & Faubert, S. J. (2020). Latent class analysis: a guide to best practice. *Journal of Black Psychology*, *46*(4), 287-311.

Wendling, B. J., Schrank, F. A., & Schmitt, A. J. (2007). Woodcock-Johnson® III.

Willcutt, E. G., & Pennington, B. F. (2000). Psychiatric comorbidity in children and adolescents with reading disability. *The Journal of Child Psychology and Psychiatry and Allied Disciplines*, *41*(8), 1039-1048.

Woodcock, R. W., McGrew, K. S., & Mather, N. (2001). Woodcock-Johnson III tests of achievement.

Wu, S. S., Willcutt, E. G., Escovar, E., & Menon, V. (2014). Mathematics achievement and anxiety and their relation to internalizing and externalizing behaviors. *Journal of learning disabilities*, *47*(6), 503-514.

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