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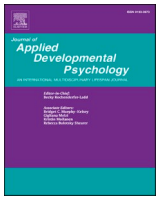

# Latent trajectories of learning- and teacher-context behavior problems across the primary school transition

Emily M. Weiss *, Clara-Christina Gerstner, Paul A. McDermott, Michael J. Rovine

*University of Pennsylvania Graduate School of Education, United States*

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ABSTRACT

This study explores children's development of behavior problems in specific classroom situations characterized by meaningful teacher interactions (teacher contexts) and structured learning activities (learning contexts) during the first four years of schooling. Multidimensional growth mixture modeling was employed to detect unobserved subpopulations (latent classes) with common trajectories of teacher- and learning- context behavior among a US national sample ($N$ = 3872) of children from low-income backgrounds. Analyses revealed three subpopulations with distinct behavior trajectories that were differentially associated with first-grade academic skills and social-emotional outcomes. Children with 'Optimal' and 'Difficult' school transitions had similar patterns of behavior problems in both Teacher and Learning contexts, whereas children with 'Moderate' school transitions had more divergent trajectories of behavior problems across context domains. Results are discussed in light of developmental theory and implications for practice.

Behavioral adjustment is central to children's success in early schooling. Upon school entry, children are confronted with a complex new environment characterized by unfamiliar activities, individuals, and situations. During a typical school day, young children may be expected to participate appropriately during circle time, engage in whole-group academic instruction, work in small groups with peers and teachers, and navigate free-play activities, while simultaneously developing a relationship with a nonfamilial adult amidst a classroom of peers (DiCarlo, Ota, & Deris, 2021). Structured learning activities can challenge students' cognitive abilities (e.g., memory, processing speed, attentional focusing) and can highlight a child's characteristic responses to stress, difficulty, and failure. Interactions with teachers require additional social skills like self-regulation and self-awareness in order to follow directives and seek help when needed.

The first years of schooling represent an important period of transition, during which children build foundational academic skills and nascent student identities to carry forward in their educational careers (Bossaert, Doumen, Buyse, & Verschueren, 2011). It also coincides with rapid developments in phenomena related to personality, social-emotional skills, and behavior (e.g., self-regulation, Olson, Sameroff, Lunkenheimer, & Kerr, 2009). Behavior variability often increases at important transition periods, and transitions marked by successful (i.e., 'normative') adaptation can result in very different outcomes than those characterized by extreme difficulty, interruptions, or failure (i.e., 'nonnormative'; O'Brien, 1991). Accordingly, this time can be a period of vulnerability for children at-risk for social and academic struggles (Entwisle, Alexander, & Olson, 2003).

Positive adaptation to the school setting depends on the extent to which children possess or are able to develop capacities that allow them to meet the demands of their immediate environment; thus, maladaptive behaviors can be seen as manifestations of poor child-environment fit (Ladd, 2004). Disruptive behaviors are fairly common at entry into school, while children learn the expectations of the environment and practice regulating themselves so as to meet those expectations (Rimm-Kaufman, Pianta, & Cox, 2000). However, persistent and/or severe behavior problems are atypical (Campbell, 1995; Huaqing Qi & Kaiser, 2003) and can indicate that maladaptive behavioral responses to environmental misfits have been internalized (Steinberg & Avenevoli, 2000). In this vein, children can develop patterns of context-specific behavior problems, or problematic 'behavioral signatures' (Mischel, Shoda, & Mendoza-Denton, 2002), that reflect recurrent situational difficulties. Behavior problems during the formative first years of school are therefore highly individual, unique to specific classroom contexts, and relevant for children's long-term development.

In accordance with this perspective, we take a longitudinal and person-centered approach to study children's behavior problems in

* Corresponding author at: University of Pennsylvania Graduate School of Education, 3700 Walnut Street, Philadelphia, PA 19104, United States.
*E-mail address:* weissemi@upenn.edu (E.M. Weiss).

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classroom contexts characterized by learning activities and teacher interactions. We employ multidimensional growth mixture modeling to explore the development of context-specific behavior problems among a sample of children from low-income families and examine associations between behavioral trajectories and important first-grade outcomes.

## Behavior problems in learning activities and teacher interactions

In the early school setting, children with behavior problems are at risk of greater social and academic difficulty. Ample research on internalizing- and externalizing-type problems—such as the tendency to act depressed and socially withdrawn or, respectively, be physically aggressive or hyperactive—has revealed negative associations with school-readiness competencies (Bierman, Torres, Domitrovich, Welsh, & Gest, 2009; Fantuzzo et al., 2007; Fantuzzo, Bulotsky-Shearer, Fusco, & McWayne, 2005; Montes, Lotyczewski, Halterman, & Hightower, 2012), early peer and adult relationships (Birch & Ladd, 1998; Ladd & Price, 1987), academic achievement in primary and secondary school (e.g., Kulkarni, Sullivan, & Kim, 2021; Masten et al., 2005), and long-term educational attainment (Vitaro, Brendgen, Larose, & Trembaly, 2005). Feedback effects (e.g., developmental cascades) may amplify these phenomena, such that trajectories of high and/or increasing behavior problems convey the greatest risk of academic difficulties and negative social outcomes over time (Bevilacqua, Hale, Barker, & Viner, 2018; Bub, McCartney, & Willett, 2007; Campbell, Spieker, Burchinal, Poe and NICHD Early Child Care Research Network, 2006). Cascading effects may also be more likely during school-related transition periods as students need to adjust to new environmental demands and form new relationships (e.g., Okano, Jeon, Crandall, Powell, & Riley, 2020).

The pathways through which problem behavior results in disadvantageous outcomes depend on the specific contexts in which such behaviors occur. Developmental-ecological theory indicates that development is driven by stimulating and increasingly complex interactions between individuals and social partners or objects (i.e., 'proximal processes'; Bronfenbrenner & Morris, 1998). Problematic behaviors, which are by definition momentary and context-bound, can therefore impede advantageous development by recurring in specific interactions and activities.

Children with frequent problem behavior in structured learning contexts may experience protracted academic difficulty. Maladaptive behavior can prevent children from taking advantage of learning opportunities in the moment, such that persistent behavior problems result in an accumulation of missed chances and lagged progress. For example, children with internalizing problems like anxiety or depressive symptoms may disengage from academic activities and miss out on opportunities to ask and answer questions or otherwise practice new skills (Coplan, DeBow, Schneider, & Graham, 2009; Olivier, Morin, Langlois, Tardif-Grenier, & Archambault, 2020). Similarly, externalizing problems like aggressive or inattentive behaviors can disrupt children's ability to focus on academic content and stay on-task during learning activities (Baker, Clark, Maier, & Viger, 2008; Olivier et al., 2020).

Problematic behavior in teacher-child interactions also can be detrimental. Teachers form a crucial source of support in early schooling, especially among children at risk for difficult school transitions (Pianta & Stuhlman, 2004), and positive teacher relationships can buffer against children's development of behavior problems (Ettekal & Shi, 2020; Maldonado-Carreño & Votruba-Drzal, 2011; O'Connor, Dearing, & Collins, 2011). Nonetheless, children with internalizing or externalizing behavior problems are less likely to receive nonpunitive attention and academic and/or emotional support from teachers (see Nurmi, 2012), and some researchers suggest that child behavior problems may be a primary driver of poor student-teacher relationships (Mejia & Hoglund, 2016; Skalická, Stenseng, & Wichstrøm, 2015; Zatto & Hoglund, 2019). Although teacher-student interactions constitute a dyadic relationship between individuals, the dynamics of young children's early teacher interactions also form a working model for future relationships with teachers in later grades (Jerome, Hamre, & Pianta, 2009; Lee & Bierman, 2018; Pianta, Steinberg, & Rollins, 1995). In this way, child behavior during teacher interactions is a marker of adjustment that can develop intra-personally across time (e.g., Collins, O'Connor, Supplee, & Shaw, 2017).

Empirical research on the development of children's behavior problems in structured learning and teacher interaction contexts is somewhat limited, as most studies employ ratings of broad-band externalizing and internalizing problems without accounting for the specific contexts wherein behavior problems occur. In response, researchers have developed context-specific measures to provide more nuanced and ecologically valid assessments of child behavior (e.g., Downer, Booren, Lima, Luckner, & Pianta, 2010; McDermott, Watkins, Rovine, & Rikoon, 2014). Research with such instruments finds that Learning and Teacher context problems are predictive of lower social competence and these effects may be moderated by the quality of student-teacher relationships (Bulotsky-Shearer et al., 2020). Evidence also suggests that children who exhibit problematic behavior in learning activities have a greater risk of concurrent and later academic non-proficiency (McDermott et al., 2014), especially when they also demonstrated socially-reticent behaviors (Bulotsky-Shearer, Fantuzzo, & McDermott, 2008). Similarly, learning context problems in preschool are significantly associated with lower reading ability at the end of first grade, when controlling for the effects of simultaneous behavior problems in teacher- and peer-interaction contexts (Bulotsky-Shearer & Fantuzzo, 2011).

## Person-centered analysis of context-specific behavior problems

Person-centered methods offer considerably more nuanced insights into the contextual specificity of childhood behavior problems by highlighting patterns of association among children, not variables (Wang, Sinclair, Zhou, & Sears, 2013). To this end, most prior work on context-specific behavior has applied cross-sectional profile analysis to children's behavior problem types (e.g., aggression) and contexts (e.g., teacher interactions). For example, evidence suggests that preschoolers with high levels of withdrawn/low energy behavior tend to struggle during structured learning activities and teacher interactions, whereas children with aggressive and inattentive/hyperactive behavior problems more often struggle during structured learning activities and peer interactions (Bulotsky-Shearer, Bell, & Domínguez, 2012). A similar study employing a cross-section of the current sample (McDermott, Rovine, Gerstner, Weiss and Watkins, 2022) found that problem behavior profiles with severe reticent/withdrawn and low energy behavior localized in teacher and learning contexts conveyed the greatest risk of concurrent academic difficulty, although problems in teacher, learning, and peer contexts were associated with the most difficult teacher relationships.

Much of this work has highlighted the implications of negatively-engaged behavior in learning and teacher contexts. Low-income kindergarteners with profiles of negative engagement across multiple classroom contexts showed smaller short-term gains in executive functions and print knowledge (Williford, Maier, Downer, Pianta, & Howes, 2013). Recently, Rojas and Abenavoli (2021) found that preschoolers with engagement profiles characterized by conflictual teacher interactions display lower expressive vocabulary skills and conclude that poor teacher-student relationships can lead to academic disengagement in kindergarten. There is also indication that profiles of teacher-context problems in kindergarten (i.e., poor quality teacher-student interactions) are associated with greater aggression and social difficulty in first grade (Lee & Bierman, 2016).

Almost no research has adopted a longitudinal, person-centered approach to the study of context-specific behavior problems from preschool to first grade. The studies described above were not designed to examine individuals' development of teacher- and learning-context problems over time or to detect variation in the trajectories that different children exhibit. Multiple latent trajectories of children's

behavior problems in peer-interaction contexts have been identified (Weiss, McDermott, Rovine, & Oh, 2021); results suggest that the transition to first grade is a particularly sensitive period in children's behavioral development and show that high and/or increasing patterns of peer context problems convey greater risks of social and academic difficulty. Nonetheless, individual differences in the development of teacher- or learning-context problems have not yet been explored, and it is not clear if children's development in these domains follows similar trajectories to those previously observed.

## Financial hardship and behavioral adjustment

This study focuses specifically on young children from families experiencing financial hardship. The psychological, socio-emotional, and health-related disadvantages of early childhood poverty have been discussed extensively (e.g., Evans, 2004; Wadsworth, Evans, Grant, Carter, & Duffy, 2016). These include greater risk of behavior problems and underdeveloped academic skills at school entry (Huaqing Qi & Kaiser, 2003; Ryan, Fauth, & Brooks-Gunn, 2014; Wadsworth et al., 2016), which likely results from a "constellation of disadvantages" associated with financial hardship (Duncan, Magnuson, & Votruba-Drzal, 2017, p. 415). In particular, children from low-income households are less likely to have access to high-quality, child-centered care and are less likely to attend preschool programs that are 'ready' to meet their needs (Bassok & Galdo, 2016; McCoy, Connors, Morris, Yoshikawa, & Friedman-Krauss, 2015; see Mashburn & Pianta, 2006); accordingly, research concludes that they have greater risk of experiencing difficult school transitions (e.g., Entwisle et al., 2003; Smith-Adcock, Leite, Kaya, & Amatea, 2019).

Crucially, however, a low-income background in no way guarantees school difficulties and substantial individual variation exists within this population (see Duncan et al., 2017). Adaptive behavioral adjustment is one individual characteristic that can promote positive academic and social development and, as such, an investigation of the different behavior problem trajectories exhibited by low-income children is warranted. Although some of the person-centered research described above has focused on children from low-income families (e.g., Bulotsky-Shearer et al., 2012; Rojas & Abenavoli, 2021), there is limited understanding of how this diverse population of children develop behavioral signatures in teacher- and learning-contexts.

## Current study

This project aims to fill these gaps in the literature by focusing on the development of context-specific classroom behavior among a national sample of children from low-income families. The current study explores the development of behavior problems in contexts characterized by teacher interactions and structured learning activities during the first four years of schooling. We apply multidimensional growth mixture modeling (MGMM; Wickrama, Lee, O'Neal, & Lorenz, 2021) to detect archetypal trajectories of teacher and learning context behavior problems that characterize unobserved subgroups (latent classes) of children and examine their associations with later developmental outcomes. Although other analytic options exist for examining how teacher- and learning-context problems jointly develop, they fail to reflect the heterogeneity of individual development obtained through person-centered methods while respecting the distinction between contexts; cross-lagged panel models or developmental cascades, for example, would illustrate how problems across contexts predict each other, but such methods reflect the 'average' child who likely has few behavior problems at all. By taking an exploratory, person-centered approach, this study is able to inform future research on the specific processes that underlie any emergent similarities in change trajectories across behavior context domains.

We address two research questions (RQs) and corresponding hypotheses.

1. *Are there multiple subpopulations (latent classes) with shared change trajectories that characterize children's teacher and learning context problems from preschool through first grade?*

Both theory and empirical research suggest that there are meaningful individual differences in the development of context-specific behavior problems and that some trajectory patterns are more common than others. As such, we hypothesized that there would be multiple subpopulations characterized by distinct change trajectories, with most children having few and/or decreasing behavior problems in teacher and learning contexts (i.e., no difficulties in school transitions) and a smaller subset of children exhibiting more severe and/or increasing problems in these contexts as they transition through prekindergarten into kindergarten and first grade. Behavior problems in teacher-contexts and learning-contexts are distinct facets of behavioral adjustment that are meaningfully correlated at the population level ($r = 0.61$, McDermott et al., 2014), although this statistic may reflect the relative rarity of very problematic classroom behavior among young children nationwide; as such we anticipated that some children would have similar trajectories of behavioral adjustment in both domains.

2. *Does subpopulation membership forecast important social and academic outcomes at the close of first grade?*

Based on the literature reviewed above, we hypothesized that children with trajectories characterized by greater and/or increasing behavior problems in teacher and learning contexts would have the greatest risk of disadvantageous social and academic outcomes. In particular, we expected that children with more problems in structured learning contexts would have relatively poorer academic skills and that children with more problems in teacher contexts would have relatively poorer student-teacher relationships.

## Methods

### *Sample*

Data for this project come from the Head Start Impact Study (HSIS; DHHS, 2010), a nationwide evaluation of Head Start and similar prekindergarten programs. Head Start is a federally-funded preschool program for 3- and 4-year-olds whose families fall below the federal poverty level; hence, the study participants form a national sample of low-income children. Data were collected across the first four years of schooling: two years of prekindergarten (PreK1, PreK2), kindergarten (KG), and first grade (1st). The sample size varied across the four waves due to both unplanned attrition and planned aspects of the study design; because fewer children were eligible for study participation during the first year of data collection, the sample size increased yearly (PreK1 $N = 1377$; PreK2 $N = 2764$; KG $N = 2873$; 1st $N = 3077$), and 84.7% of children were present at two or more data collection occasions. More details on the Head Start program and target population, the sampling design and data collection procedures, and teacher and school characteristics are presented by DHHS (2010) and McDermott, Watkins, Rovine, and Rikoon (2013).

Our analyses include a total of 3827 children, who were on average four years old ($SD = 0.5$) at entry to the study. The sample is 49.7% female, 29.5% Black, 37.9% Hispanic/Latinx, and 32.6% White or another race/ethnicity; 12.6% of children received special needs services, and 25.8% spoke English as a second language (ESL). Most children (82.7%) resided in urban areas, and 50% lived with both biological parents at study entry. Maternal characteristics were also recorded during data collection: 83.7% were adults at the time of their participant child's birth, 44.9% were currently married, 19.3% were US immigrants, and 61.9% had graduated from high school or obtained an equivalent degree.

## Measures

### *Classroom behavior problems*

Children's problems in teacher and learning contexts were measured with the Adjustment Scales for Early Transition in Schooling (ASETS; McDermott et al., 2013, 2014), a teacher-report instrument on which classroom teachers endorse indicators describing a child's typical behavior in a given classroom setting. The ASETS is comprised of 134 dichotomous behavioral indicators embedded in 22 commonly occurring classroom situations, including learning tasks, organized games, group activities, and interactions with teachers and peers. Behavioral indicators reflect both adaptive and problematic behaviors to minimize the potential for response bias, and thus only 112 problem behavior indicators are used in scoring children's behavior problems. Each of the 22 classroom situations has 3 to 7 corresponding indicators on which classroom teachers rated the presence or absence of certain behaviors exhibited by children in the last month, where teachers may endorse as many indicators as they observe.

The present study takes advantage of the ASETS' 'situtype' scores — from Latin for situation — which reflect the intensity of a child's behavior problems specifically in classroom peer, teacher, and learning contexts (McDermott et al., 2014). Reliable dimensional structure has been established with this sample through longitudinal exploratory and confirmatory factor analyses (McDermott et al., 2014). To establish a consistent scale accounting for heterotypic continuity in classroom behavior, each context dimension was vertically equated through multigroup IRT whereby Bayesian *expected* a posteriori (EAP) scaled scores (*SS*s) were produced with $M = 50$ and $SD = 10$ and PreK1 as the reference group. Scale development and psychometric procedures are detailed by McDermott et al. (2014) in addition to appreciable evidence of concurrent and predictive validity.

The current study focuses on the Teacher Context Problems and Learning Context Problems situtypes. Teacher context problems reflect the extent to which children display problematic behavior during teacher interactions (5 situations; e.g., "greeting teacher," "helping teacher with jobs," "answering questions"), whereas learning context problems reflect children's behavior in learning activities (7 situations; e.g., "getting involved in classroom activities," "paying attention in the classroom," "coping with new learning tasks"). Scores reflect cumulative problems in these situations. Internal consistency for the respective Teacher Context Problems and Learning Context Problems scales, as grounded in EAP *SS* estimates and measurement error, was $\alpha = 0.73$ and 0.83, respectively, and the scales were found to correlate at $r = 0.61$ across the four years (McDermott et al., 2014).

### *Distal outcome measures*

Latent subpopulations of change were evaluated against three sets of academic and social outcomes collected at the end of the 1st-grade year: teacher reports of teacher-child relationships, parent reports of children's internalizing and externalizing behaviors outside of the classroom, and direct assessments of early reading and math ability.

#### *Teacher-child relationships*

Teacher ratings were obtained with the Student Teacher Relationship Scale (STRS; Pianta, 1996). The scale contains 15 items on a 5-point scale (1 = "Definitely does not apply," 5 = "Definitely applies"). We employ two subscales: Conflict (8 items, e.g., "This child easily becomes angry at me") and Closeness (7 items, e.g., "If upset, the child will seek comfort from me"). Both subscales have sufficient internal consistency for the relevant HSIS developmental levels ($\alpha = 0.76$–$0.89$ for Conflict, $\alpha = 0.73$–$0.82$ for Closeness), and considerable concurrent and predictive validity evidence for the scales is available (e.g., Pianta & Stuhlman, 2004). Higher values indicate closer or more conflictual relationships.

#### *Parent-rated behavior problems*

Children's behavior problems outside of school were reported by parents on the Total Behavior Problems scale (TBP; DHHS, 2010). The TBP contains 14 dichotomous items reflecting children's internalizing and externalizing behavior (e.g., "Feels worthless or inferior," "Can't pay attention for long"), where higher scores indicate greater behavior problems. Internal consistency ranged from $\alpha = 0.78$–$0.79$ for the HSIS first-grade sample. Scale development and validity evidence have been provided for HSIS (DHHS, 2010), and additional validity evidence has been reported by other researchers (Vaden-Kiernan et al., 2010; Ziv, Alva, & Zill, 2010).

#### *Early reading and math*

Children's academic achievement was evaluated using the Basic Reading Skills and Mathematics Reasoning subscales from the Woodcock-Johnson III Tests of Academic Achievement (WJ; Woodcock, McGrew, & Mather, 2002). Basic Reading Skills incorporates letter and word reading and writing, phonemic and structural analyses ($\alpha = 0.91$; DHHS, 2010), and Mathematics Reasoning covers quantitative concepts, counting, and problem-solving ($\alpha = 0.71$–$78$; DHHS, 2010b). Ample validity support has been reported for both subscales (Willis & Dumont, 2006; McGrew, Woodcock, & Schrank, 2007; Salvia, Ysseldyke and Bolt, 2007).

## Analysis plan

Analyses took place in multiple stages. A number of preliminary analyses were conducted to inform MGMM modeling regarding the first research question. First, latent growth curves were estimated independently for each outcome (Teacher Context Problems and Learning Context Problems). Having found evidence of significant variation, growth mixture models (Ram & Grimm, 2009) were evaluated to inform the likely number of latent classes in the sample, as well as the shape of trajectory change. Estimated latent basis models were employed to characterize children's change trajectories; this flexibly allows the shape of change to vary for teacher and learning context problem outcomes and accords with prior related work (Weiss et al., 2021). Latent classification probabilities from the best-fitting Teacher Context and Learning Context models were obtained, and a contingency table of cross-classifications was inspected for preliminary evidence of trajectory co-occurrence.

Next, building on the best-fitting unidimensional models, a series of multidimensional growth mixture models (Wickrama et al., 2021, Chpt. 9) was estimated in which each latent subpopulation has an archetypal trajectory for Teacher Context Problems and an archetypal trajectory for Learning Context Problems. This extends the typical latent GMM, in which latent level (i.e., intercept) and growth (i.e., slope) factors for a single longitudinal outcome depend on a latent classification variable (e.g., Ram & Grimm, 2009), by parameterizing the latent factors for level and growth of both outcomes as conditional on a common latent classification term. Classification probabilities resulting from this model therefore reflect individuals' development in both Teacher and Learning Context domains.

First, a baseline bivariate latent growth curve model for Teacher and Learning problems with no mixture component (i.e., a parallel-process model, Wickrama et al., 2021) was estimated to inform subsequent models. Then, a series of MGMM models was tested in which two or more latent classes were extracted, guided by the plausible number of classes found in the single-outcome GMMs described above. To identify the most robust solution, different parameterizations were compared whereby observed Teacher and Learning context problems at each time point were regressed onto either common or separate latent factors for level and/or growth, with latent factors free to covary as needed. Parameters were fixed where needed to ensure model identification, and random starts were increased if required for convergence of the expectation-maximization algorithm. Where appropriate, residual

variance parameters with nonsignificant estimates were set to zero to enhance model fit. More complex models were also tested by freeing latent factor variances and latent growth factor loadings to vary across classes. All analyses were conducted in M*plus* version 8.7 (Muthen & Muthen, 2021).

Throughout this procedure, multiple criteria were used to select optimal models. Candidate models were evaluated based on (a) AIC, BIC, sample size adjusted BIC, and Integrated Classification Likelihood BIC (ICL-BIC), where lower values indicate better fit of the model to the data (Nylund, Asparouhov, & Muthén, 2007); (b) Vuong-Lo-Mendel-Rubin, adjusted Lo-Mendel-Rubin, and parametric bootstrap (with 500 draws) likelihood ratio tests (LRTs), where statistical significance indicates better model fit than an identically parameterized model with one fewer latent class (Nylund et al., 2007); and (c) average posterior classification accuracy and entropy, where higher values represent more distinct class separation (Greenbaum, Boca, Darkes, Wang, & Goldman, 2005; Nagin, 1999). Because GMM can be considered a constrained exploratory method, it is recommended that final models are selected based on statistical evidence of model fit in conjunction with theoretical considerations regarding parsimony, stability, and substantive utility (Grimm, Ram, Estabrook, & Little, 2017; Wickrama et al., 2021). With this in mind, preference was given to the more parsimonious models that best satisfied the stated criteria, and likelihood ratio tests were prioritized in the event that fit statistics produced contradictory evidence (Tofighi & Enders, 2008). Sensitivity analyses were also conducted to detect the effects of full information maximum likelihood (FIML) estimation, whereby candidate models were re-run with data for children present at all occasions and with data for children present at PreK1. Adequate recovery of original mean structure and covariance parameters was taken as evidence of model stability, and the best-fitting model that remained robust during sensitivity analyses was retained for interpretation and further investigation.

Given the final preferred model, RQ2 was addressed by regressing first-grade distal outcomes on latent class solutions while accounting for uncertainty in posterior classification (i.e., '3-step method', Asparouhov & Muthén, 2014). We expected to find that the trajectory classification variable would be significantly related to the dependent variables, such that class membership is differentially associated with academic and social-emotional outcomes. The class-specific means (and standard errors) of distal outcomes associated with each latent subpopulation were obtained through the M*plus* DU3STEP function and were compared for statistically meaningful differences using chi-square tests.

## Results

### *Preliminary analyses and model selection*

Preliminary analyses (results available upon request) revealed evidence of longitudinal change in both Learning and Teacher context problems, with meaningful variance in intercept and growth parameters suggesting that there may be unobserved subgroups of change within the sample. Subsequent mixture models treating each outcome independently indicated that there may be as many as four latent classes, and contingency tables of membership probabilities for separate Teacher and Learning problem classes revealed evidence of meaningful co-occurrence. In addition, a bivariate latent basis growth model (i.e., no mixture component) for Teacher and Learning problems resulted in very high covariance between growth terms for each outcome; the high correlation ($r = 0.84$) between terms suggested that the two distinct factors may be best characterized by common patterns of change among the full sample. This was born out in further analyses whereby teacher and learning trajectory parameters were both conditional on the same latent classification term, as described below.

Multidimensional mixture models indicated that latent subgroups were best characterized by trajectories of both Teacher and Learning context problems. Specifically, models in which observed teacher and learning problems across time points loaded onto a common latent level factor (i.e., $\eta_0$) and separate latent growth factors (i.e., $\eta_1$, $\eta_2$) offered the best model fit (see Supplementary Table A). Alternative parameterizations with separate latent level factors for each outcome, common growth factors for each outcome, or factor variances and/or loadings varying across classes consistently failed to converge properly (due to non-positive definite latent covariance matrices) or revealed evidence of problematic over-fitting. Among competitor models, the 3-class solution exhibited the best model fit (Table 1), having lower information criteria and higher class separation than the analogous 2-class model and statistically significant LRTs at the $p < .05$ level. The 4-class model had lower class separation, a higher ICL-BIC value, and most LRTs were not statistically significant. Unlike the 4-class model, the 3-class solution also remained stable during sensitivity analyses and was thus retained for interpretation and further investigation (parameter estimates for the final model are presented in Supplemental Table A).

### *RQ1: latent classes of learning and teacher context problem trajectories*

Children's Learning context and Teacher context problems were characterized by three sets of archetypal trajectories, as displayed in Figs. 1-3. Across classes, behavior problems generally started near the population mean at PreK1 and diverged considerably across time.

The first latent class (Class 1) reflected the most children in the sample (52.53%). This group had below-average behavior problems in both domains that declined from just below the population mean at PreK1 to almost 1 *SD* below the population mean by first grade (Fig. 1). Learning Context Problems showed slightly more improvement than Teacher Context Problems over time, although both outcomes had very similar average levels at all four time points. For convenience, this trajectory pattern is named Optimal because children with this classification show improving behavior over time and appear to adapt successfully to the school setting.

The second latent class (37.31%) was characterized by relatively stable Teacher Context Problems that remained near the population mean and Learning Context Problems that slightly increased during first grade (Fig. 2). Unlike other latent classes, the mean trajectories in each domain were not parallel, although Learning and Teacher context problems remained within 0.5 *SD* of each other over time. This trajectory pattern was named Moderate because scores remain near the population mean, yet, children with this classification appear to have more difficulty with school transitions than those in the Optimal class.

**Table 1**
Properties and fit statistics for candidate multivariate growth mixture models.

| | 2-Class model | 3-Class model | 4-Class model |
|---|---|---|---|
| Sample size | | | |
| Class 1, $N_{C1}$ | 2302.86 | 2033.83 | 1557.40 |
| Class 2, $N_{C2}$ | 1524.14 | 1411.18 | 982.93 |
| Class 3, $N_{C3}$ | | 381.99 | 996.03 |
| Class 4, $N_{C4}$ | | | 290.64 |
| Fit statistics | | | |
| # Free parameters | 25 | 27 | 31 |
| Akaike's Information Criterion (AIC) | 137,704.59 | 137,331.64 | 137,049.80 |
| Schwarz's Bayesian Information Criterion (BIC) | 137,860.84 | 137,500.39 | 137,243.55 |
| Sample size adjusted BIC (ABIC) | 137,781.40 | 137,414.59 | 137,145.05 |
| Integrated Classification Likelihood (ICL-BIC) | 139,691.18 | 139,829.62 | 140,203.93 |
| Entropy | 0.66 | 0.72 | 0.72 |
| Average class membership posterior probability | 0.87 | 0.86 | 0.83 |
| Vuong-Lo-Mendell-Rubin LRT, *p* | <0.001 | <0.001 | 0.054 |
| Lo-Mendell-Rubin adjusted LRT, *p* | <0.001 | <0.001 | 0.057 |
| Parametric bootstrap LRT (via 500 draws), *p* | <0.001 | <0.001 | <0.001 |

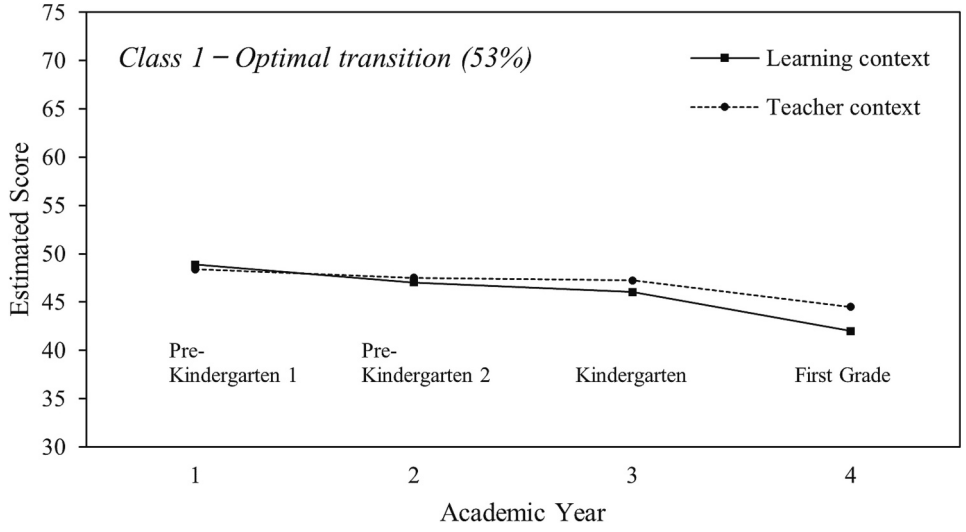


**Fig. 1.** Class 1 model-estimated trajectories and class proportions.

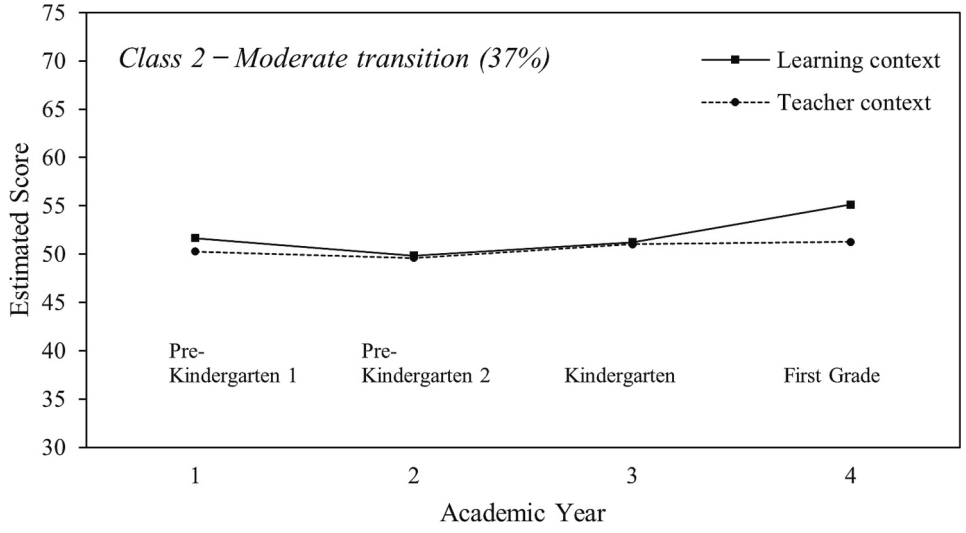


**Fig. 2.** Class 2 model-estimated trajectories and class proportions.

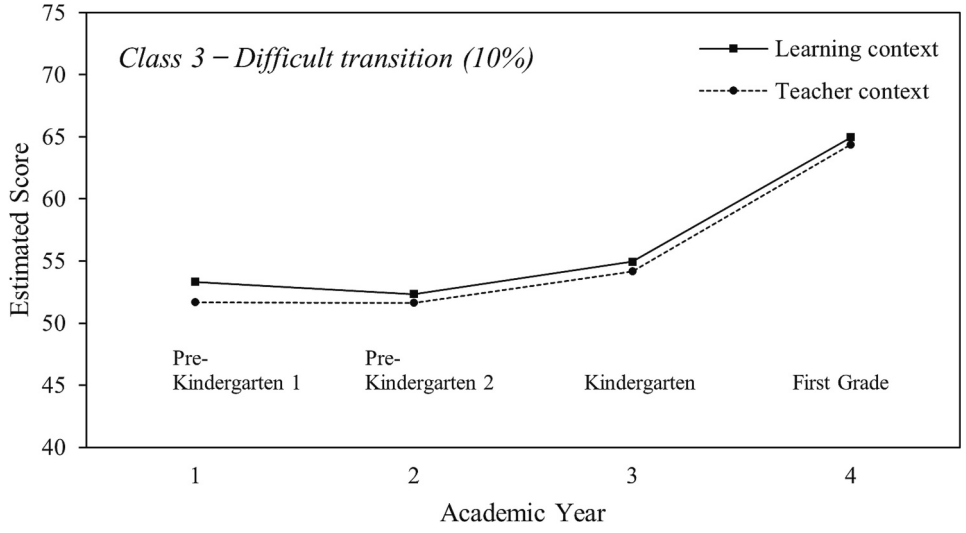


**Fig. 3.** Class 3 model-estimated trajectories and class proportions.

Finally, Class 3 comprised the smallest proportion of children (9.87%) who exhibited meaningful increases in Learning and Teacher Context Problems across the first four years of schooling (Fig. 3). Problems in both domains had trajectories that were similar and almost quadratic in shape: average problems during preschool were only slightly above the population mean, which grew to 0.5 *SD* above the population mean in kindergarten and 1.5 *SD*s above the population mean in first grade. Accordingly, this trajectory pattern was termed Difficult because children with this classification have the greatest difficulty with school transitions and can be considered the most at-risk in our sample.

### *RQ2: first grade outcomes*

To explore the implications associated with trajectory class membership (RQ2), first-grade academic and social-emotional outcomes were regressed onto the latent classification term of the final 3-class solution. Omnibus chi-square tests revealed significant differences among the latent classes; all but one pair-wise comparison was significant at the $p < .05$ level (Table 2).

Trajectory classes with greater Learning and Teacher Context Problems generally were at greater risk for difficulties in first grade. Children with Optimal transitions (Class 1) on average had the highest early math and reading scores, the most positive relationships with their teachers, and the fewest parent-rated behavior problems at home. Children with Moderate transitions (Class 2) had more advantageous first-grade outcomes than those with Difficult transitions (Class 3), with the exception of early reading; children in both classes appeared to struggle with their first-grade literacy, with scores significantly lower than children in Class 1. Notably, the average Teacher Conflict scores for children with Difficult transitions were 1.2 *SD*s greater than those with Moderate transitions and >2.28 *SD*s greater than those with Optimal transitions. Differences in Teacher Closeness were also pronounced, but somewhat less extreme: children with Difficult transitions scored 1.43 and 0.71 *SD*s lower than those with Optimal and Moderate transitions, respectively.

## Discussion

This study examined the development of young children's behavior problems in teacher and learning contexts from preschool to first grade. Analyses detected three subpopulations with distinct trajectories of change that were differentially associated with first-grade academic skills and social-emotional outcomes. Overall, more than half of the children in our sample had 'Optimal' transitions, characterized by improving behavior across the first years of school and the most advantageous first-grade outcomes. More than a third of the sample exhibited 'Moderate' transitions with near-mean levels of teacher and learning context problems, where the latter moderately increased at first grade; these children had lower academic achievement and more relational difficulties in first grade than children in class 1. The final 10% of the sample experienced 'Difficult' school transitions, based on steep increases in teacher and learning context problems and generally poorer first-grade outcomes than their peers.

The trajectories revealed by MGMM analyses highlight the transition to first grade as a particularly sensitive period for children's behavioral adjustment. All three classes had notable changes in the typical level of behavior problems between kindergarten and first grade, despite having relatively more stable trajectories during preschool and kindergarten (i.e., growth or decline <0.3 *SD*). The transition to first grade often brings meaningful changes in the classroom dynamics that children experience, with increases in teacher-direct instruction and seatwork, decreases in child-led centers and free time, and less emphasis on the development of social skills (La Paro, Rimm-Kaufman, & Pianta, 2006). Children with Difficult transitions displayed very large (~1*SD*) increases in behavior problems in both domains across the first-grade year, suggesting that they were not prepared to contend with the increased demands of the primary school classroom.

As hypothesized, children with fewer behavior problems in the classroom generally had better early academic skills, more positive teacher relationships, and fewer behavior problems at home by the close of first grade. Nonetheless, children with Difficult transitions did not significantly differ from those with Moderate transitions in their early reading skills, despite scoring about 1 *SD* greater in their learning context problems. Moreover, children with Moderate transitions did not have meaningful Teacher context problems. Taken together, these findings may suggest that even moderate degrees of problematic behavior during learning activities can impede children's literacy development.

Relative deficits in underlying cognitive and social-emotional capacities can give rise to classroom behavior problems insofar as children struggle to meet the demands of their immediate environment (Ladd, 2004). In this respect, our findings suggest that some of the skills that enable adaptive behavior in teacher interactions or in learning activities may only translate meaningfully across contexts for some children. Among most (~60%) children in our sample, the pattern of teacher and learning context problems was very similar, with increases or decreases in one domain mimicking those in the other. It may be that similar underlying capacities support these children's behavior in both domains. For example, in line with research linking self-regulation with classroom and social engagement (e.g., Coelho, Cadima, Pinto, & Guimarães, 2019; Eisenberg, Valiente, Eggum, Eisenberg, & Valiente, 2010), robust capacities for focusing, attention, and impulse control may allow children with Optimal transitions to stay engaged during learning activities and teacher interactions, whereas deficits in these abilities may result in problems such as those exhibited by children with Difficult transitions.

**Table 2**
Model estimated class means (and Standard Errors) and $\chi 2$ tests of continuous 1st grade outcomes.

| | *M* (*SD*) | Class 1 | Class 2 | Class 3 | Omnibus $\chi 2$ test | Class 1 vs. Class 2 | Class 1 vs. Class 3 | Class 2 vs. Class 3 |
|---|---|---|---|---|---|---|---|---|
| Reading | 449.73 (32.29) | 463.69 (0.85) | 435.56 (1.346) | 437.90 (2.73) | 370.90 | 265.30 | 80.95 | 0.46[†] |
| Math | 457.80 (17.22) | 463.89 (0.47) | 453.54 (0.78) | 446.28 (1.82) | 246.26 | 101.74 | 92.13 | 10.10 |
| Parent-rated Behavior Problems | 4.85 (9.70) | 3.18 (0.11) | 6.22 (0.22) | 7.69 (0.52) | 345.25 | 124.91 | 75.86 | 4.66 |
| Teacher Closeness | 29.68 (4.94) | 31.88 (0.12) | 28.33 (0.20) | 24.82 (0.41) | 572.66 | 197.99 | 281.27 | 44.59 |
| Teacher Conflict | 14.21 (6.87) | 9.56 (0.11) | 16.17 (0.36) | 25.23 (0.72) | 2039.38 | 89.37 | 460.43 | 418.40 |

Class 1 = "Optimal Transition".
Class 2 = "Moderate Transition".
Class 3 = "Difficult Transition".
All tests are statistically significant at $p < .05$ except where noted: [†]$p = .499$.

However, almost 40% of the children in our sample have somewhat divergent trajectories of learning and teacher context problems. Children with Moderate transitions have average behavior when interacting with teachers, but struggle more with their behavior in learning activities at major transition periods: whereas Teacher Context problems were relatively stable, these children's Learning Context problems were more variable over time and showed a marked increase in first grade. It may be that these children find academics more challenging or stressful than interactions with teachers, and difficulty managing these negative feelings results in more problematic behaviors. Alternatively, these children may possess relatively underdeveloped social-emotional skills that would allow them to navigate academic activities more successfully; for example, children who struggle with assertiveness may have difficulty asking questions or participating in group work in ways that support their learning (e.g., Rimm-Kaufman & Chiu, 2007). It should also be noted that instructional shifts between kindergarten and first grade, described above, are not necessarily accompanied by changes in teacher-child interactions or the overall relational quality of the classroom (La Paro et al., 2006). This may partly explain the difficulties children in Class 2 have with first-grade Learning Context problems, but not Teacher Context problems, to the extent that previously formed working models for teacher interactions remain applicable.

It is unclear what effect this behavior discrepancy has on academic outcomes for children with Moderate transitions. It may be that they do not reap the academic benefits of positive teacher relationships described above, or that the teacher support they receive does not completely ameliorate their struggles in academic settings. Nonetheless, insofar as their trajectories indicate difficulty adjusting to new types of learning activities, children with this behavioral trajectory may benefit from interventions designed to support positive learning behaviors.

### *Contributions, limitations and future directions*

This project sheds light on developmental patterns of important psychosocial outcomes; however, there are a few limitations. Our longitudinal data are limited to teacher reports of children's classroom behavior, and we were not able to examine cognitive, psychological, and/or environmental processes that give rise to intraindividual trajectories or interindividual differences. These phenomena should be explored with future research. Likewise, although the ASETS measure we employed was designed to minimize respondent bias (McDermott et al., 2013), future research could benefit from employing multiple raters or classroom observations in addition to teacher reports.

We also contribute to the field by employing an advanced modeling technique to explore multiple developmental processes. MGMM and related parallel-process growth mixture models—in which latent trajectory classifications for a single longitudinal outcome covary with those for another (e.g., McDermott, Rovine, Weiss, et al., 2022)—offer insights into the developmental course of interrelated phenomena, and MGMM in particular operationalizes a person-centered perspective by looking intraindividually at trajectories of related constructs. Yet these methods are somewhat underutilized in developmental psychology, likely due to researchers' unfamiliarity and the complexity of the modeling process. We hope this application will inspire other researchers to employ these techniques and illustrate some of the methodological considerations relevant to such endeavors.

That said, MGMM is an exploratory approach and our findings bear replication and extension in future work. We focus on a US national sample of children from low-income backgrounds, and the trajectories identified in this study may not generalize to children with more environmental resources or those in other cultural contexts. Education practices are shifting rapidly due to changes in policy (e.g., universal PreK) and the global COVID-19 pandemic, which will likely also shape how young children experience major school transitions.

### *Implications for practice*

Periods of transition provide a crucial opportunity in which to bolster children's development, and our results indicate that different children may benefit from different kinds of support. Researchers have studied several approaches to support young children during school transitions, including early intervention programs, the formation of transition teams, family involvement, and delay of school entry (O'Brien, 1991; Stormont, Beckner, Mitchell, & Richter, 2005). To overcome difficulties in learning contexts, children with 'Moderate' school transitions may benefit from more programmed instruction and modeling of learning behaviors as they transition to first grade. Learning behaviors, such as motivation, persistence, flexibility, and attention, are teachable behaviors that can protect young children against behavioral maladjustment in early grades (Domínguez, Vitiello, Maier, & Greenfield, 2010; George & Greenfield, 2005).

Meanwhile, children with 'Difficult' transitions will likely require more substantial intervention to help them successfully engage in new learning activities and meet behavioral expectations in kindergarten and first grade. Ideally, children at risk for severe behavior difficulties should be identified early and transition teams consisting of preschool and kindergarten teachers, school counselors, and psychologists should assist families during the transition period (Stormont et al., 2005). Individual-level interventions could target children's social-emotional development (e.g., developing closer relationships with teachers), learning behaviors, and academic skills, in conjunction with counseling or psychological support if needed. Educators and parents are also discouraged from delaying school entry for children at risk for difficult transitions, as evidence suggests that these practices are more often utilized for children from low-income or minority backgrounds (Cannon & Lipscomb, 2011) and lead to short-term, unstained gains in academic achievement (Greenburg & Winsler, 2020).

Head Start is one of the most studied early intervention programs that prepares low-income children for kindergarten by fostering early cognitive development and social adjustment (Snow, 2007). Yet, almost half of the children in our sample who attended Head Start or similar preschool programs still struggled to adapt to learning and/or teacher contexts in primary school. Several effective enrichment programs have been developed to support Head Start children transition to kindergarten, for example, by teaching social-emotional and early literacy skills through research-based practices (REDI program; Bierman et al., 2008) or engaging parents more closely in the transition period (STAR project; Stormshak, Kaminski, & Goodman, 2002).

However, in addition to helping preschool children develop school-related skills, policy-makers and school administrators should consider restructuring primary school environments to better accommodate a larger proportion of rising first-graders. Instead of the current trend of pushing down educational requirements from first grade into kindergarten and kindergarten into preschool (see Bassok, Latham, & Rorem, 2016), scholars have advocated for the adoption of child-centered learning approaches in primary school (Vitiello, Pianta, Whittaker, & Ruzek, 2020) and more collaboration and alignment in training for pre- and primary school teachers (Abry, Latham, Bassok, & LoCasale-Crouch, 2015). By realigning practices to accord with developmentally-appropriate expectations, fewer children may struggle to adapt to the primary school setting and intervention resources can be more efficiently allocated to children with greater needs. In this way, policy makers, schools and families can work together to support young students across this important transition so that every child, regardless of skill level, developmental progress, or family background, can succeed in school.

## Data availability

The data that has been used is confidential.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.appdev.2023.101538.

## References

Abry, T., Latham, S., Bassok, D., & LoCasale-Crouch, J. (2015). Preschool and kindergarten teachers' beliefs about early school competencies: Misalignment matters for kindergarten adjustment. *Early Childhood Research Quarterly, 31*, 78–88. https://doi.org/10.1016/j.ecresq.2015.01.001

Asparouhov, T., & Muthén, B. O. (2014). Auxiliary variables in mixture modeling: Three-step approaches using Mplus. *Structural Equation Modeling, 21*(3), 329–341. https://doi.org/10.1080/10705511.2014.915181

Baker, J. A., Clark, T. P., Maier, K. S., & Viger, S. (2008). The differential influence of instructional context on the academic engagement of students with behavioral problems. *Teaching and Teacher Education, 24*(7), 1876–1883. https://doi.org/10.1016/j.tate.2008.02.019

Bassok, D., & Galdo, E. (2016). Inequality in preschool quality? Community-level disparities in access to high-quality learning environments. *Early Education and Development, 27*(1), 128–144. https://doi.org/10.1080/10409289.2015.1057463

Bassok, D., Latham, S., & Rorem, A. (2016). Is kindergarten the new first grade? *AERA Open, 2*(1). https://doi.org/10.1177/2332858415616358

Bevilacqua, L., Hale, D., Barker, E. D., & Viner, R. (2018). Conduct problems trajectories and psychosocial outcomes: A systematic review and meta-analysis. *European Child & Adolescent Psychiatry, 27*(10), 1239–1260. https://doi.org/10.1007/s00787-017-1053-4

Bierman, K. L., Domitrovich, C. E., Nix, R. L., Gest, S. D., Welsh, J. A., Greenberg, M. T., … Gill, S. (2008). Promoting academic and social-emotional school readiness: The head start REDI program. *Child Development, 79*(6), 1802–1817. https://doi.org/10.1111/j.1467-8624.2008.01227.x

Bierman, K. L., Torres, M. M., Domitrovich, C. E., Welsh, J. A., & Gest, S. D. (2009). Behavioral and cognitive readiness for school: Cross-domain associations for children attending head start. *Social Development, 18*(2), 305–323. https://doi.org/10.1111/j.1467-9507.2008.00490.x

Birch, S. H., & Ladd, G. W. (1998). Children's interpersonal behaviors and the teacher–child relationship. *Developmental Psychology, 34*(5), 934–946. https://doi.org/10.1037/0012-1649.34.5.934

Bossaert, G., Doumen, S., Buyse, E., & Verschueren, K. (2011). Predicting children's academic achievement after the transition to first grade: A two-year longitudinal study. *Journal of Applied Developmental Psychology, 32*(2), 47–57. https://doi.org/10.1016/J.APPDEV.2010.12.002

Bronfenbrenner, U., & Morris, P. A. (1998). The ecology of developmental processes. In W. Damon, & R. M. Lerner (Eds.), *Handbook of child psychology: Theoretical models of human development* (pp. 993–1028). Wiley.

Bub, K. L., McCartney, K., & Willett, J. B. (2007). Behavior problem trajectories and first-grade cognitive ability and achievement skills: A latent growth curve analysis. *Journal of Educational Psychology, 99*(3), 653–670. https://doi.org/10.1037/0022-0663.99.3.653

Bulotsky-Shearer, R. J., Bell, E. R., & Domínguez, X. (2012). Latent profiles of problem behavior within learning, peer, and teacher contexts: Identifying subgroups of children at academic risk across the preschool year. *Journal of School Psychology, 50*(6), 775–798. https://doi.org/10.1016/J.JSP.2012.08.001

Bulotsky-Shearer, R. J., & Fantuzzo, J. W. (2011). Preschool behavior problems in classroom learning situations and literacy outcomes in kindergarten and first grade. *Early Childhood Research Quarterly, 26*, 61–73. https://doi.org/10.1016/j.ecresq.2010.04.004

Bulotsky-Shearer, R. J., Fantuzzo, J. W., & McDermott, P. A. (2008). An investigation of classroom situational dimensions of emotional and behavioral adjustment and cognitive and social outcomes for head start children. *Developmental Psychology, 44*(1), 139–154. https://doi.org/10.1037/0012-1649.44.1.139

Bulotsky-Shearer, R. J., Fernandez, V. A., Bichay-Awadalla, K., Bailey, J., Futterer, J., & Huaqing Qi, C. (2020). Teacher-child interaction quality moderates social risks associated with problem behavior in preschool classroom contexts. *Journal of Applied Developmental Psychology, 67*, Article 101103. https://doi.org/10.1016/j.appdev.2019.101103

Campbell, S. B. (1995). Behavior problems in preschool children: A review of recent research. *Journal of Child Psychology and Psychiatry, 36*(1), 113–149. https://doi.org/10.1111/j.1469-7610.1995.tb01657.x

Campbell, S. B., Spieker, S., Burchinal, M., Poe, M. D., & NICHD Early Child Care Research Network. (2006). Trajectories of aggression from toddlerhood to age 9 predict academic and social functioning through age 12. *Journal of Child Psychology and Psychiatry, 47*(8), 791–800. https://doi.org/10.1111/j.1469-7610.2006.01636.x

Cannon, J. S., & Lipscomb, S. (2011). *Early grade retention and student success: Evidence from Los Angeles*. Public Policy Institute of California.

Coelho, V., Cadima, J., Pinto, A. I., & Guimarães, C. (2019). Self-regulation, engagement, and developmental functioning in preschool-aged children. *Journal of Early Intervention, 41*(2), 105–124. https://doi.org/10.1177/1053815118810238

Collins, B. A., O'Connor, E. E., Supplee, L., & Shaw, D. S. (2017). Behavior problems in elementary school among low-income boys: The role of teacher–child relationships. *The Journal of Educational Research, 110*(1), 72–84. https://doi.org/10.1080/00220671.2015.1039113

Coplan, R. J., DeBow, A., Schneider, B. H., & Graham, A. A. (2009). The social behaviours of inhibited children in and out of preschool. *The British Journal of Developmental Psychology, 27*(4), 891–905. https://doi.org/10.1348/026151008X396153

Department of Health and Human Services [DHHS]. (2010). *Head start impact study technical report*. Washington, DC: Administration for Children and Families.

DiCarlo, C. F., Ota, C., & Deris, A. (2021). An ecobehavioral analysis of social behavior across learning contexts in kindergarten. *Early Childhood Education Journal, 49*, 657–668. https://doi.org/10.1007/s10643-020-01103-y

Domínguez, X., Vitiello, V. E., Maier, M. F., & Greenfield, D. B. (2010). A longitudinal examination of young children's learning behavior: Child-level and classroom-level predictors of change throughout the preschool year. *School Psychology Review, 39*(1), 29–47. https://doi.org/10.1080/02796015.2010.12087788

Downer, J. T., Booren, L. M., Lima, O. K., Luckner, A. E., & Pianta, R. C. (2010). The individualized classroom assessment scoring system (inCLASS): Preliminary reliability and validity of a system for observing preschoolers' competence in classroom interactions. *Early Childhood Research Quarterly, 25*(1), 1–16. https://doi.org/10.1016/j.ecresq.2009.08.004

Duncan, G. J., Magnuson, K., & Votruba-Drzal, E. (2017). Moving beyond correlations in assessing the consequences of poverty. *Annual Review of Psychology, 68*(1), 413–434. https://doi.org/10.1146/annurev-psych-010416-044224

Eisenberg, N., Valiente, C., Eggum, N. D., Eisenberg, N., & Valiente, C. (2010). Self-regulation and school readiness. *Early Education and Development, 21*(5), 681–698. https://doi.org/10.1080/10409289.2010.497451

Entwisle, D. R., Alexander, K. L., & Olson, L. S. (2003). The first-grade transition in life course perspective. In J. T. Mortimer, & M. J. Shanahan (Eds.), *Handbook of the life course* (pp. 229–250). Academic/Plenum.

Ettekal, I., & Shi, Q. (2020). Developmental trajectories of teacher-student relationships and longitudinal associations with children's conduct problems from grades 1 to 12. *Journal of School Psychology, 82*, 17–35. https://doi.org/10.1016/j.jsp.2020.07.004

Evans, G. W. (2004). The environment of childhood poverty. *The American Psychologist, 59*(2), 77–92. https://doi.org/10.1037/0003-066X.59.2.77

Fantuzzo, J., Bulotsky-Shearer, R., McDermott, P. A., McWayne, C., Frye, D., & Perlman, S. (2007). Investigation of dimensions of social-emotional classroom behavior and school readiness for low-income urban preschool children. *School Psychology Review, 36*(1), 44–62. https://doi.org/10.1080/02796015.2007.12087951

Fantuzzo, J. W., Bulotsky-Shearer, R., Fusco, R. A., & McWayne, C. (2005). An investigation of preschool classroom behavioral adjustment problems and social-emotional school readiness competencies. *Early Childhood Research Quarterly, 20*, 259–275. https://doi.org/10.1016/j.ecresq.2005.07.001

George, J., & Greenfield, D. B. (2005). Examination of a structured problem-solving flexibility task for assessing approaches to learning in young children: Relation to teacher ratings and children's achievement. *Journal of Applied Developmental Psychology, 26*(1), 69–84. https://doi.org/10.1016/j.appdev.2004.10.006

Greenbaum, P. E., Boca, F. K., Darkes, J., Wang, C., & Goldman, M. S. (2005). Variation in the drinking trajectories of freshmen college students. *Journal of Consulting and Clinical Psychology, 73*, 229–238. https://doi.org/10.1037/0022-006x.73.2.229

Greenburg, J. E., & Winsler, A. (2020). Delayed kindergarten entry among low-income, ethnically diverse children: Prevalence, predictors, and selection patterns. *Early Childhood Research Quarterly, 53*, 496–506. https://doi.org/10.1016/j.ecresq.2020.06.007

Grimm, K. J., Ram, N., Estabrook, R., & Little, T. D. (2017). *Growth modeling structural equation and multilevel modeling approaches*. The Guilford Press.

Huaqing Qi, C., & Kaiser, A. P. (2003). Behavior problems of preschool children from low-income families. *Topics in Early Childhood Special Education, 23*(4), 188–216. https://doi.org/10.1177/02711214030230040201

Jerome, E. M., Hamre, B. K., & Pianta, R. C. (2009). Teacher-child relationships from kindergarten to sixth grade: Early childhood predictors of teacher-perceived conflict and closeness. *Social Development, 18*(4), 915–945. https://doi.org/10.1111/j.1467-9507.2008.00508.x

Kulkarni, T., Sullivan, A. L., & Kim, J. (2021). Externalizing behavior problems and low academic achievement: Does a causal relation exist? *Educational Psychology Review, 33*, 915–936. https://doi.org/10.1007/s10648-020-09582-6

La Paro, K. M., Rimm-Kaufman, S. E., & Pianta, R. C. (2006). Kindergarten to 1st grade: Classroom characteristics and the stability and change of children's classroom experiences. *Journal of Research in Childhood Education, 21*(2), 189–202. https://doi.org/10.1080/02568540609594588

Ladd, G. W. (2004). Probing the adaptive significance of children's behavior and relationships in the school context: A child by environment perspective. In *, Vol. 31. Advances in child development and behavior* (pp. 43–104). Elsevier. https://doi.org/10.1016/s0065-2407(03)31002-x.

Ladd, G. W., & Price, J. M. (1987). Predicting children's social and school adjustment following the transition from preschool to kindergarten. *Child Development, 58*(5), 1168–1189. https://doi.org/10.2307/1130613

Lee, P., & Bierman, K. L. (2016). Profiles of kindergarten classroom and elementary school contexts: Associations with the first-grade outcomes of children transitioning from head start. *The Elementary School Journal, 117*(1), 119–142. https://doi.org/10.1086/687813

Lee, P., & Bierman, K. L. (2018). Longitudinal trends and year-to-year fluctuations in student-teacher conflict and closeness: Associations with aggressive behavior problems. *Journal of School Psychology, 70*, 1–15. https://doi.org/10.1016/j.jsp.2018.06.002

Maldonado-Carreño, C., & Votruba-Drzal, E. (2011). Teacher–child relationships and the development of academic and behavioral skills during elementary school: A within- and between-child analysis. *Child Development, 82*(2), 601–616. https://doi.org/10.1111/j.1467-8624.2010.01533.x

Mashburn, A. J., & Pianta, R. C. (2006). Social relationships and school readiness. *Early Education and Development, 17*(1), 151–176. https://doi.org/10.1207/s15566935eed1701_7

Masten, A. S., Roisman, G. I., Long, J. D., Burt, K. B., Obradović, J., Riley, J. R., … Tellegen, A. (2005). Developmental cascades: Linking academic cchievement and externalizing and internalizing symptoms over 20 years. *Developmental Psychology, 41*(5), 733–746. https://doi.org/10.1037/0012-1649.41.5.733

McCoy, D. C., Connors, M. C., Morris, P. A., Yoshikawa, H., & Friedman-Krauss, A. H. (2015). Neighborhood economic disadvantage and children's cognitive and social-emotional development: Exploring head start classroom quality as a mediating mechanism. *Early Childhood Research Quarterly, 32*, 150–159. https://doi.org/10.1016/j.ecresq.2015.04.003

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 pre-kindergarten children. *Social Development.*. https://doi.org/10.1111/sode.12606

McDermott, P. A., Rovine, M. J., Weiss, E. M., Gladstone, J. N., Fatima, S. F., & Reyes, R. S. (2022). Latent change and co-occurrence of overactive and underactive behavior problems in American early education. *School Psychology Review, 1–14*. https://doi.org/10.1080/2372966X.2021.2000842

McDermott, P. A., Watkins, M. W., Rovine, M. J., & Rikoon, S. H. (2013). Assessing changes in socioemotional adjustment across early school transitions—New national scales for children at risk. *Journal of School Psychology, 51*(1), 97–115. https://doi.org/10.1016/j.jsp.2012.10.002

McDermott, P. A., Watkins, M. W., Rovine, M. J., & Rikoon, S. H. (2014). Informing context and change in young children's sociobehavioral development – The national adjustment scales for early transition in schooling (ASETS). *Early Childhood Research Quarterly, 29*(3), 255–267. https://doi.org/10.1016/j.ecresq.2014.02.004

McGrew, K. S., Woodcock, R. W., & Schrank, K. A. (2007). *Woodcock-Johnson III normative update technical manual.* Riverside Pub.

Mejia, T. M., & Hoglund, W. L. (2016). Do children's adjustment problems contribute to teacher–child relationship quality? Support for a child-driven model. *Early Childhood Research Quarterly, 34*, 13–26. https://doi.org/10.1016/j.ecresq.2015.08.003

Mischel, W., Shoda, Y., & Mendoza-Denton, R. (2002). Situation-behavior profiles as a locus of consistency in personality. *Current Directions in Psychological Science, 11*(2), 50–54. https://doi.org/10.1111/1467-8721.00166

Montes, G., Lotyczewski, B. S., Halterman, J. S., & Hightower, A. D. (2012). School readiness among children with behavior problems at entrance into kindergarten? Results from a US national study. *European Journal of Pediatrics, 171*, 541–548. https://doi.org/10.1007/s00431-011-1605-4

Muthen, L. K., & Muthen, B. O. (2021). *Mplus (ver. 8.7). Authors*.

Nagin, D. S. (1999). Analyzing developmental trajectories: A semiparametric, group-based approach. *Psychological Methods, 4*, 139–157. https://doi.org/10.1037//1082-989x.4.2.139

Nurmi, J. E. (2012). Students' characteristics and teacher-child relationships in instruction: A meta-analysis. *Educational Research Review, 7*(3), 177–197. https://doi.org/10.1016/j.edurev.2012.03.001

Nylund, K. L., Asparouhov, T., & Muthén, B. O. (2007). Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. *Structural Equation Modeling: A Multidisciplinary Journal, 14*, 535–569. https://doi.org/10.1080/10705510701575396

O'Brien, M. (1991). *Promoting successful transition into school: A review of current intervention practices.* Kansas Early Childhood Research Institute: University of Kansas.

O'Connor, E. E., Dearing, E., & Collins, B. A. (2011). Teacher-child relationship and behavior problem trajectories in elementary school. *American Educational Research Journal, 48*(1), 120–162. https://doi.org/10.3102/0002831210365008

Okano, L., Jeon, L., Crandall, A., Powell, T., & Riley, A. (2020). The cascading effects of externalizing behaviors and academic achievement across developmental transitions: Implications for prevention and intervention. *Prevention Science, 21*(2), 211–221. https://doi.org/10.1007/s11121-019-01055-9

Olivier, E., Morin, A. J. S., Langlois, J., Tardif-Grenier, K., & Archambault, I. (2020). Internalizing and externalizing behavior problems and student engagement in elementary and secondary school students. *Journal of Youth and Adolescence, 49*(11), 2327–2346. https://doi.org/10.1007/s10964-020-01295-x

Olson, S. L., Sameroff, A. J., Lunkenheimer, E. S., & Kerr, D. C. (2009). Self-regulatory processes in the development of disruptive behavior problems: The preschool-to-school transition. In S. L. Olson, & A. J. Sameroff (Eds.), *Biospsychosocial regulatory processes in the development of childhood behavioral problems* (pp. 144–185). Cambridge University Press.

Pianta, R., Steinberg, M., & Rollins, K. (1995). The first two years of school: Teacher-child relationships and deflections in children's classroom adjustment. *Development and Psychopathology, 7*(2), 295–312. https://doi.org/10.1017/S0954579400006519

Pianta, R. C. (1996). *Student–Teacher Relationship Scale*. University of Virginia.

Pianta, R. C., & Stuhlman, M. W. (2004). Teacher-child relationships and children's success in the first years of school. *School Psychology Review, 33*(3). https://doi.org/10.1080/02796015.2004.12086261

Ram, N., & Grimm, K. J. (2009). Growth mixture modeling: A method for identifying differences in longitudinal change among unobserved groups. *International Journal of Behavioral Development, 33*, 565–576. https://doi.org/10.1177/0165025409343765

Rimm-Kaufman, S. E., & Chiu, Y. J. I. (2007). Promoting social and academic competence in the classroom: An intervention study examining the contribution of the responsive classroom approach. *Psychology in the Schools, 44*(4), 397–413. https://doi.org/10.1002/PITS.20231

Rimm-Kaufman, S. E., Pianta, R. C., & Cox, M. J. (2000). Teachers' judgments of problems in the transition to kindergarten. *Early Childhood Research Quarterly, 15*(2), 147–166. https://doi.org/10.1016/S0885-2006(00)00049-1

Rojas, N. M., & Abenavoli, R. M. (2021). Preschool teacher-child relationships and children's expressive vocabulary skills: The potential mediating role of profiles of children's engagement in the classroom. *Early Childhood Research Quarterly, 56*, 225–235. https://doi.org/10.1016/j.ecresq.2021.04.005

Ryan, R. M., Fauth, R. C., & Brooks-Gunn, J. (2014). Childhood poverty: Implications for school readiness and early childhood education. In B. Spodek, & O. N. Saracho (Eds.), *Handbook of research on the education of young children* (pp. 341–364). Routledge. https://doi.org/10.4324/9781315045511.

Salvia, J., Ysseldyke, J., & Bolt, S. (2007). In Wadsworth (Ed.), *Assessment in special and inclusive education* (11th ed.).

Skalická, V., Stenseng, F., & Wichstrøm, L. (2015). Reciprocal relations between student–teacher conflict, children's social skills and externalizing behavior: A three-wave longitudinal study from preschool to third grade. *International Journal of Behavioral Development, 39*(5), 413–425. https://doi.org/10.1177/0165025415584187

Smith-Adcock, S., Leite, W., Kaya, Y., & Amatea, E. (2019). A model of parenting risk and resilience, social-emotional readiness, and reading achievement in kindergarten children from low-income families. *Journal of Child and Family Studies, 28*(10), 2826–2841. https://doi.org/10.1007/s10826-019-01462-0

Snow, K. L. (2007). Integrative views of the domains of child function: Unifying school readiness. In R. C. Pianta, M. J. Cox, & K. L. Snow (Eds.), *School readiness and the transition to kindergarten in the era of accountability* (pp. 197–216). Brookes Publishing.

Steinberg, L., & Avenevoli, S. (2000). The role of context in the development of psychopathology: A conceptual framework and some speculative propositions. *Child Development, 71*(1), 66–74. https://doi.org/10.1111/1467-8624.00119

Stormont, M., Beckner, R., Mitchell, B., & Richter, M. (2005). Supporting successful transition to kindergarten: General challenges and specific implications for students with problem behavior. *Psychology in the Schools, 42*(8), 765–778. https://doi.org/10.1002/pits.20111

Stormshak, E. A., Kaminski, R. A., & Goodman, M. R. (2002). Enhancing the parenting skills of head start families during the transition to kindergarten. *Prevention Science, 3*(3), 223–234. https://doi.org/10.1023/A:1019998601210

Tofighi, D., & Enders, C. K. (2008). Identifying the correct number of classes in growth mixture models. In G. R. Hancock, & K. M. Samuelson (Eds.), *Advances in Latent Variable Mixture Models* (pp. 317–341). Information Age Publishing.

Vaden-Kiernan, M., D'elio, M. A., O'brien, R. W., Tarullo, L. B., Zill, N., & Hubbell-McKey, R. (2010). Neighborhoods as a developmental context: A multilevel analysis of neighborhood effects on head start families and children. *American Journal of Community Psychology, 45*(1–2), 49–67. https://doi.org/10.1007/s10464-009-9279-z

Vitaro, F., Brendgen, M., Larose, S., & Trembaly, R. E. (2005). Kindergarten disruptive behaviors, protective factors, and educational achievement by early adulthood. *Journal of Educational Psychology, 97*(4), 617–629. https://doi.org/10.1037/0022-0663.97.4.617

Vitiello, V. E., Pianta, R. C., Whittaker, J. E., & Ruzek, E. A. (2020). Alignment and misalignment of classroom experiences from pre-K to kindergarten. *Early Childhood Research Quarterly, 52*, 44–56. https://doi.org/10.1016/j.ecresq.2019.06.014

Wadsworth, M. E., Evans, G. W., Grant, K., Carter, J. S., & Duffy, S. (2016). Poverty and the development of psychopathology. In D. Cicchetti (Ed.), *Developmental psychopathology* (pp. 1–44). John Wiley & Sons, Inc.. https://doi.org/10.1002/9781119125556.devpsy404

Wang, M., Sinclair, R. R., Zhou, L., & Sears, L. E. (2013). Person-centered analysis: Methods, applications, and implications for occupational health psychology. In R. R. Sinclair, M. Wang, & L. E. Tetrick (Eds.), *Research methods in occupational health psychology: Measurement, design, and data analysis* (pp. 349–373). Routledge/Taylor & Francis Group.

Weiss, E. M., McDermott, P. A., Rovine, M. J., & Oh, J. (2021). Latent growth trajectories of peer context behavior problems across preschool, kindergarten and first grade. *Early Education and Development, 1-19*. https://doi.org/10.1080/10409289.2021.1928445

Wickrama, K. A. S., Lee, T. K., O'Neal, C. W., & Lorenz, F. (2021). *Higher-order growth curves and mixture modeling with Mplus* (2nd ed.). Routledge. https://doi.org/10.4324/9781003158769

Williford, A. P., Maier, M. F., Downer, J. T., Pianta, R. C., & Howes, C. (2013). Understanding how children's engagement and teachers' interactions combine to predict school readiness. *Journal of Applied Developmental Psychology, 34*(6), 299–309. https://doi.org/10.1016/j.appdev.2013.05.002

Willis, J. O., & Dumont, R. (2006). And never the twain shall meet: Can response to intervention and cognitive assessment be reconciled? *Psychology in the Schools, 43*(8), 901–908. https://doi.org/10.1002/pits.20197

Woodcock, R. W., McGrew, K. S., & Mather, N. (2002). *Woodcock-Johnson III tests of achievement. Riverside*.

Zatto, B. R. L., & Hoglund, W. L. G. (2019). Children's internalizing problems and teacher–child relationship quality across preschool. *Early Childhood Research Quarterly, 49*, 28–39. https://doi.org/10.1016/j.ecresq.2019.05.007

Ziv, Y., Alva, S., & Zill, N. (2010). Understanding head start children's problem behaviors in the context of arrest or incarceration of household members. *Early Childhood Research Quarterly, 25*, 396–408. https://doi.org/10.1016/j.ecresq.2009.12.002