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Latent profiles of problem behavior within learning, peer, and teacher contexts: Identifying subgroups of children at academic risk across the preschool year☆

Rebecca J. Bulotsky-Shearer [a,*], Elizabeth R. Bell [a], Ximena Domínguez [b]

[a] University of Miami, Department of Psychology, 5665 Ponce de Leon Boulevard, Coral Gables, FL 33146, USA
[b] SRI International, 333 Ravenswood Ave. BN345, Menlo Park, CA 94025, USA

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ABSTRACT

Employing a developmental and ecological model, the study identified initial levels and rates of change in academic skills for subgroups of preschool children exhibiting problem behavior within routine classroom situations. Six distinct latent profile types of emotional and behavioral adjustment were identified for a cohort of low-income children early in the preschool year ($N = 4417$). Profile types provided a descriptive picture of patterns of classroom externalizing, internalizing, and situational adjustment problems common to subgroups of children early in the preschool year. The largest profile type included children who exhibited low problem behavior and were characterized as well-adjusted to the preschool classroom early in the year. The other profile types were characterized by distinct combinations of elevated internalizing, externalizing, and situational problem behavior. Multinomial logistic regression identified younger children and boys at increased risk for classification in problem types, relative to the well-adjusted type. Latent growth models indicated that children classified within the extremely socially and academically disengaged profile type, started and ended the year with the lowest academic skills, relative to all other types. Implications for future research, policy, and practice are discussed.

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* Corresponding author at: Department of Psychology, University of Miami, 5665 Ponce de Leon Blvd, Coral Gables, FL 33146, USA.
E-mail address: rshearer@miami.edu (R.J. Bulotsky-Shearer).

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1. Introduction

It is widely recognized that acquiring early literacy, language, and mathematics skills during the preschool years supports future reading and mathematics achievement (Duncan et al., 2007; Justice, Mashburn, Hamre, & Pianta, 2008). The mastery of these skills prior to kindergarten entry is particularly important for low-income children who are at risk for poor academic achievement as they transition to formal schooling (Rouse, Brooks-Gunn, & McLanahan, 2005). Unfortunately, there is growing national concern that many preschool children are entering school not yet "ready to learn" because they lack requisite social emotional skills to participate successfully in learning contexts (Raver & Knitzer, 2002; Rimm-Kaufman, Pianta, & Cox, 2000). Studies suggest that 8% to 22% of preschool children exhibit moderate to clinically significant emotional and behavioral problems (Brauner & Stephens, 2006; Lavigne et al., 1996) and that this percentage is elevated for low-income children (Barbarin, 2007; Feil et al., 2005; Qi & Kaiser, 2003). Concerns are heightened within early childhood programs serving low-income communities where research suggests that problem behavior negatively influences children's ability to engage effectively within social and instructional interactions that support early learning (Denham, 2006; Raver, 2002; Thompson & Raikes, 2007).

Several recent longitudinal studies identify negative associations between early problem behavior and academic skills (e.g., reading and mathematics) across the transition to elementary school (Bub, McCartney, & Willett, 2007; Duncan et al., 2007; Grimm, Steele, Mashburn, Burchinal, & Pianta, 2010). However, the application of this research is limited to inform intervention efforts within early childhood educational programs serving culturally diverse, low-income children for several reasons. First, many large-scale studies rely on national early childhood samples [e.g., the National Institute of Child Health and Human Development Study of Early Child Care and Youth Development (NICHD SECCYD) or Early Childhood Longitudinal Study (ECLS-K)] that may not include adequate representation of diverse, low-income children (Lopez, Tarullo, Forness, & Boyce, 2000; Okazaki & Sue, 1995).

Second, in these longitudinal studies, researchers have typically relied on teacher- or parent-report measures that are checklists of severe behavioral problems such as the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2000). These measures were developed to identify clinical levels of problems based on the frequency and severity of symptoms. While useful for clinical purposes, these measures have limited application for use within early childhood programs to identify a broad range of problem behavior within the classroom context, and to provide practical information to teachers that support classroom-based intervention (Bulotsky-Shearer, Fantuzzo, & McDermott, 2008; Fantuzzo & Mohr, 2000). In addition, the reliability and validity of these measures for low-income, diverse populations have been questioned (Lambert, Rowan, Lyubansky, & Russ, 2002; Lopez et al., 2000). For example, recent studies examining the dimensionality of the CBCL for preschool-age children reveal inconsistent factor structures and poor fit of the scales with ethnically diverse low-income samples (Gross et al., 2006; LeBoeuf, Fantuzzo, & Lopez, 2010).

To provide timely and appropriate classroom-based interventions, a developmentally and contextually appropriate understanding of mutable patterns of emotional and behavioral adjustment is needed using reliable and valid multidimensional tools (Cooper et al., 2008; Klein & Knitzer, 2007). To inform interventions that address the specific needs of subgroups of preschool learners, more research is needed applying a person-centered approach to identify distinct profile types of emotional and behavioral adjustment and to identify the associated academic needs of each subgroup of children (Hirsh-Pasek & Burchinal, 2006; McWayne, Fantuzzo, & McDermott, 2004). Therefore, the purpose of the present study was to extend previous research by employing a latent profile analytic approach (a) to identify a typology of emotional and behavioral adjustment early in the preschool year, using a multidimensional, contextually relevant assessment tool and (b) to examine associations between children's profile classification and rates of change in literacy and mathematics skills across the preschool year.

1.1. Developmental and ecological systems approach to studying problem behavior

A developmental–ecological framework provides a conceptual model for understanding children's problem behavior as it emerges within the context of the demands of proximal settings (Bronfenbrenner & Morris, 1998). Within this model, the preschool classroom is viewed as a unique context composed of dynamic activity settings in which children are provided opportunities to practice and master routine developmental (social and academic) challenges (Friedman & Wachs, 1999; Kontos & Keyes, 1999).

Activity settings include situations such as interactions among children, teachers, and instructional materials that provide direct opportunities for children to learn (Downer, Booren, Lima, Luckner, & Pianta, 2010; Pianta, 2006). In this model, children's problem behavior emerges as a function of the mismatch between children's developmental skills and the demands of each activity setting (McEvoy & Welker, 2000). Therefore, problem behavior is understood as transactional and as an indicator of a child's difficulty in navigating the developmental demands of classroom situations, rather than as a problem residing only within the child (Sameroff & Fiese, 2000; Sroufe, 1997).

In accord with this model, a line of research has developed the Adjustment Scales for Preschool Intervention (ASPI; Bulotsky-Shearer et al., 2008; Lutz, Fantuzzo, & McDermott, 2002), a multisituational assessment of problem behavior as it is observed within the context of developmentally salient activities by early childhood teachers who are familiar with the child. In this research, two sets of reliable dimensions of problem behavior have been validated: (a) five behavioral dimensions, assessing types of externalizing problem behaviors (aggressive, inattentive/hyperactive, and oppositional) and internalizing problem behaviors (withdrawn/low energy and socially reticent) across 22 routine classroom situations (Lutz et al., 2002) and (b) three situational dimensions, assessing situations where problem behavior occurs (including both teacher- and peer-mediated structured learning activities, peer interactions, and teacher interactions; Bulotsky-Shearer et al., 2008). If used at the beginning of the year, the ASPI can provide a snapshot of children's adjustment to the preschool classroom along these dimensions.

Initial research conducted within Head Start has identified differential associations among the ASPI behavioral and situational dimensions and academic skills (Fantuzzo, Bulotsky, McDermott, Mosca, & Lutz, 2003). In general, this research suggests that externalizing behavior is associated with socially disruptive play experiences, lower levels of cooperative, attentive, and persistent behavior within the context of learning within the Head Start classroom, and lower language ability (Fantuzzo, Bulotsky-Shearer, Fusco, & McWayne, 2005). Internalizing problems are associated with lower literacy, lower mathematics skills, lower adaptive emotional regulation and affective engagement, lower competence motivation with respect to learning, and disconnected peer play within the classroom (Domínguez, Vitiello, Maier, & Greenfield, 2010; Fantuzzo et al., 2003, 2007). With respect to situational dimensions, problems in structured learning and teacher interactions are associated with lower literacy, mathematics, and approaches to learning outcomes in preschool (Bulotsky-Shearer, Fernandez, Domínguez, & Rouse, 2011; Bulotsky-Shearer et al., 2008; Domínguez, Vitiello, Fuccillo, Greenfield, & Bulotsky-Shearer, 2011), and language and reading outcomes in kindergarten and first grade (Bulotsky-Shearer & Fantuzzo, 2011).

A consistent finding from these studies is that children exhibiting internalizing problem behavior, problem behavior within structured learning activities, and problem behavior in teacher interactions, are differentially at risk for poor academic outcomes. From an ecological perspective, negative associations between problem behavior within the context of learning and teacher situations and academic outcomes make sense, given that teachers intentionally teach academic skills such as literacy and mathematics in these specific classroom situations. However, more research is needed to examine why children exhibiting socially withdrawn behavior are at risk for poor academic outcomes. One hypothesis is that children who are socially withdrawn in the classroom initiate fewer social interactions with teachers and peers and are less actively socially engaged; given that learning is highly socially mediated within the preschool classroom, they may be less likely to gain academic benefits from their participation in learning activities (Booth-LaForce & Oxford, 2008; Bulotsky-Shearer, Bell, Romero, & Carter, 2012; Domínguez et al., 2010; Eisenberg, Shepard, Fabes, Murphy, & Guthrie, 1998; Hughes & Coplan, 2010; Rydell, Bohlin, & Thorell, 2005). More studies are needed to examine these associations, and specifically, to examine the academic trajectories of subgroups of children exhibiting early patterns of internalizing problems within the context of learning situations.

1.2. Need for a latent profile (or person-centered) approach

Increasingly, researchers are employing person-centered approaches to examine variations in patterns of social emotional functioning. When children enter preschool settings, they enter with distinct profiles of emotional reactivity, self-regulation, and attention skills that may facilitate or impede their engagement with peers, teachers, and instructional tasks (Degnan, Calkins, Keane, & Hill-Soderlund, 2008; Hill, Degnan, Calkins, & Keane, 2006). A person-centered approach allows the researcher to identify homogeneous subgroups of children who share common patterns on the variables of interest (Curby et al., 2009; Glutting, McDermott, & Konold, 1997; Hirsh-Pasek & Burchinal, 2006). In the present study, this approach allowed for identification of individual profiles of internalizing, externalizing, and situational adjustment that were common to subgroups of children. Once these common profile groups are identified within the population, further examination of associated demographic characteristics, and social and academic needs, can facilitate identification of subgroups of children that may require individualized intervention efforts (Konold & Pianta, 2007; McWayne et al., 2004).

A recent study using the ASPI employed a cluster analytic approach to identify an empirical typology of emotional and behavioral adjustment within Head Start classrooms (Bulotsky-Shearer, Fantuzzo, & McDermott, 2010). This study used multistage hierarchical cluster analyses to identify six distinct and reliable profile types of classroom adjustment. The profile types were differentiated by high and low levels of types of behavioral problems as well as situational problems. The typology was comparable to other recently derived preschool behavioral typologies based on other teacher rating scales in national samples (Beg, Casey, & Saunders, 2007; DiStefano, Kamphaus, Horne, & Winsor, 2003) as well as those derived for elementary school samples (McDermott, 1993).

In the ASPI typology, the most prevalent profile type (26% of the sample) was a well-adjusted group of Head Start children exhibiting low levels of classroom behavioral and situational problems early in the year. Children composing this profile type were more likely to be older children and girls, and children with higher levels of social skills, literacy, language, and mathematics skills (Bulotsky-Shearer et al., 2010). One profile type, “Some Peer Problems,” was composed of children with elevated problems in peer interactions but otherwise low levels of adjustment problems. Two socially disruptive profile types (“Mildly Socially Disruptive” and “Extremely Socially Disruptive”) were composed of children who exhibited aggressive, oppositional, and inattentive behavior in addition to problems in peer interactions and learning activities. In addition, two profile types (“Mildly Socially and Academically Disengaged” and “Extremely Socially and Academically Disengaged”) were differentiated by high levels of socially and academically disengaged behavior (e.g., withdrawn and socially reticent behavior in addition to problems in teacher interactions and structured learning activities). Among the profile types, children classified in the Extremely Socially and Academically Disengaged type demonstrated the lowest mean levels of academic skills and interactive peer play skills at the end of the preschool year.

1.3. Summary and critique of the literature

Previous research has identified behavioral typologies based on teacher rating scales in national preschool samples (Beg et al., 2007; DiStefano et al., 2003) and in elementary school samples (McDermott, 1993). However, to date, only one recent study has identified a behavioral typology using a contextually sensitive teacher rating scale such as the ASPI validated for Head Start children (Bulotsky-Shearer et al., 2010). This initial study identified behavioral types associated with poor academic and social outcomes during preschool; however, the study had several limitations. First, this study examined whether ASPI profile types were differentiated by academic skills using a short-term predictive design. Children's academic outcomes were examined at only one point in time (at the end of the preschool year). Longitudinal studies are needed to examine whether ASPI profile types are differentiated by initial levels and rates of change (growth) in academic skills across the preschool year. Statistically, latent growth curve modeling can estimate children's initial status upon school entry as well as determine the rate of improvement in academic skills that children experience during their time in the classroom (Singer & Willett, 2003). Recent studies conducted within Head Start document that children experience positive growth in literacy and mathematics skills across the preschool year (Hindman, Skibbe, Miller, & Zimmerman, 2010; McDermott et al., 2009). To date, however, very few studies have examined whether behavioral problems are associated with rates of change in these academic outcomes, and no study to date has examined whether children classified within profile types of emotional and behavioral adjustment are differentiated by initial levels and rates of change in academic skills across the Head Start year. Given previous research, we were especially interested in whether children who early in the year displayed patterns of elevated internalizing behavior in combination with problems in learning situations, were at greatest risk for lower initial levels and rates of change in academic skills assessed across the preschool year.

Therefore, the purpose of the present study was to employ latent profile analysis to extend previous research by specifically (a) determining the nature and prevalence of latent profile types of emotional and behavioral adjustment for an entire cohort of urban Head Start children using the ASPI behavioral and situational dimensions, (b) examining whether profile types were differentiated by child demographic characteristics, and (c) identifying the unique academic needs of children classified within each profile type by examining whether profile types were differentiated by initial levels and rates of change in literacy and mathematics skills assessed across the preschool year. Based on previous cluster analytic research (e.g., Bulotsky-Shearer et al., 2010), we hypothesized that at least six distinct profile types would be identified in this new sample of Head Start children, with the largest group being characterized by well-adjusted (or low problem) behavior. In addition, we expected that older children and girls would be more likely classified within the well-adjusted profile type, with younger children more likely classified within profile types reflecting higher levels of internalizing behavior, and boys more likely classified within profile types characterized by higher levels of externalizing behavior. To inform practical application of findings, it was important to examine child demographic characteristics associated with increased risk or protection for classification in profile types. Specifically, to inform teachers' instructional interventions at the beginning of the year, more information would be needed regarding the emotional, behavioral, and academic needs of a diverse group of children, who vary in age, gender, ethnic and cultural background. Finally, we hypothesized that children classified within problem behavior profile types, especially those classified within profile types reflecting elevated internalizing problem behavior within classroom learning activities and teacher interactions, would demonstrate lower initial levels and rates of change in literacy and mathematics skills relative to the well-adjusted profile type.

2. Method

2.1. Participants

An entire cohort of prekindergarten Head Start children from a large urban school district in the Northeast participated in this study. Of the 4417 children, sex was split evenly with 52% girls composing the sample. In the fall of the Head Start year, children in the study ranged in age from 2.72 to 5.67 years ($M = 4.17$, $SD = 0.55$). They were predominantly African American (71%). The remaining children were 16% Hispanic, 7% White, and 5% Asian or other. Children lived in predominantly low-income households with annual income for 93% of the families being below $15,000.

Children were enrolled in 268 classrooms throughout the school district (across 100 centers) geographically dispersed across the city. All teachers in the Head Start program participated and completed assessments on their children as part of the program requirements. Program information indicated that all teachers were credentialed in early childhood education and all had at least a bachelor's degree. The majority (61%) had experience teaching in Head Start for at least 5 years, and 35% had more than 10 years' experience. Teachers were predominantly White (62%) with 29% African American, 3% Hispanic, and 6% Asian or other.

2.2. Measures

2.2.1. Preschool emotional and behavioral adjustment

The Adjustment Scales for Preschool Intervention (ASPI; Bulotsky-Shearer et al., 2008; Lutz et al., 2002) was used to assess emotional and behavioral problems at the beginning of the year. The ASPI is a 144-item multidimensional instrument based on teacher observations of adaptive and maladaptive behaviors across 22 routine, preschool classroom situations and 2 categories of non-situationally specific behavior problems (e.g., unusual habits or outbursts; Lutz et al., 2002). The behavioral items reflect both problem behavior (122 items) as well as adaptive behavior (22 items) within the context of interactions with the teacher, relationships with peers, involvement in structured and unstructured classroom activities, and games and play. Teachers complete the scale by endorsing as many behaviors as apply in each of the 22 classroom situations. For example, for the situation "How does the child greet you as the teacher?" the teacher endorses as many of the following child behaviors that apply: "Greets as most other students do," "Waits for you to greet him/her first," "Does not greet you even after you greet him/her," "Seems too unconcerned about people to greet," "Welcomes you loudly, Responds with an angry look or turns away," or "Clings to you."

The ASPI was standardized on a sample of urban Head Start children and extensive validity evidence exists for use with this population. The scale was developed in partnership with teachers, special needs coordinators, and parents who created the scale to ensure its developmental appropriateness for preschool children. Construct validity studies with urban, low-income preschool children have revealed two distinct and reliable sets of dimensions: (a) five behavioral dimensions: aggressive, inattentive/hyperactive, oppositional, withdrawn/low energy, socially reticent behavior (Lutz et al., 2002) and (b) three situational dimensions: problems in structured learning, peer interactions, and teacher interactions (Bulotsky-Shearer et al., 2008). Each of the behavioral dimensions demonstrated adequate internal consistency, with Cronbach's alpha coefficient estimates of .92, .78, .79, .85, and .79, respectively. The three situational dimensions also demonstrated adequate internal consistencies, with Cronbach's alpha coefficient estimates of .84, .81, and .75, respectively.

Both sets of ASPI dimensions were found to be replicable and generalizable to important subgroups of the standardization sample (i.e., younger and older children, boys and girls, African American, Latino and Caucasian ethnicities). Convergent validity and divergent validity of the five behavioral dimensions have been supported through associations with constructs of interactive peer play, behavior problems, temperament, emotion regulation, classroom learning competencies, receptive language skills, learning behaviors, and observations of classroom behavior problems (Bulotsky-Shearer & Fantuzzo, 2004; Fantuzzo, Bulotsky-Shearer et al., 2005; Fantuzzo et al., 2003, 2007). Convergent validity and divergent validity of the three ASPI situational dimensions have been supported by associations with preschool constructs of interactive peer play and classroom learning competence (Bulotsky-Shearer et al., 2008), approaches to learning (Bulotsky-Shearer et al., 2011; Domínguez et al., 2011), and mathematics and literacy (Bulotsky-Shearer et al., 2011). In the present study, standardized *T* scores were used. Raw score item totals for each of the five behavioral and three situational scales were obtained by summing items endorsed by teachers based on the published factor structure. Raw score totals for each scale were converted to *T* scores based on the standardization sample of Head Start children (see Bulotsky-Shearer et al., 2008; Lutz et al., 2002).

2.2.2. Literacy and mathematics skills

The Child Observation Record, Second Edition (COR; High Scope Educational Research Association, 2003) was used to assess children's literacy and mathematics skills across the preschool year. The COR is a 32-item observation-based tool designed for use by classroom teachers with children ages 2 1/2 to 6 years in early childhood educational settings. It measures several development domains, including emergent literacy, mathematics, social, and motor skills. For the present study two subscales were used, Language and Literacy and Mathematics and Science. Language and Literacy is composed of 12 items such as "showing awareness of sounds in words," "using letter names and sounds, beginning reading," "beginning writing," and "demonstrating knowledge about books." The Mathematics and Science subscale consists of 8 items, including "sorting objects, identifying patterns, counting, comparing numbers of objects." Internal consistency reliability estimates as reported by the publisher, ranged from .80 to .85 for Language and Literacy, and from .75 to .88 for Mathematics (High Scope Educational Research Association, 2003). In the present sample, internal consistency reliability estimates were high: with Cronbach's alpha estimates for the Language and Literacy subscale ranging from .93 to .94 and for Mathematics ranging from .94 to .95 across the three assessment time points during the year.

2.3. Procedures

Data were collected in cooperation with the participating school district's Office of Research and Evaluation and the Head Start program. These data included (a) demographic information routinely collected by the program on Head Start children and staff, (b) teacher assessments of classroom behavior collected in the fall (via the ASPI), and (c) teacher assessments of language and mathematics (via the COR) collected at three time points across the preschool year (mid-October, February, and mid-May). Head Start teachers completed these assessments throughout the year as required programmatically by the federal Head Start Performance Standards 1304.20 (U.S. DHHS, 1996). Teachers entered children's scores for the

ASPI in the fall and for the COR at three time points during the year directly into the school district's computer network via a web-based interface.

Before archival data were obtained, permission to use the child assessment data was requested and approved by the participating school district's Office of Research and Evaluation's Research Review Committee, the participating school district's Office of Early Childhood Education, as well as the first author's University Institutional Review Board. Data were extracted from the school district's computer network and linked by school district personnel using students' unique district identification numbers. School district personnel then provided the first author with an integrated, de-identified dataset to protect the confidentiality of the participants.

2.4. Data-analytic approach

A series of latent profile analysis (LPA) and latent growth curve models (LGM) was employed in a structural equation modeling framework (SEM) using Mplus Version 6.0 (Muthén & Muthén, 1998–2010). LPA and LGM were chosen as the most appropriate statistical approaches to identify profile types of emotional and behavioral adjustment early in the Head Start year and to examine whether children's classification within the latent profile types was differentially associated with initial status and rates of change in literacy and mathematics skills across the year. Mplus can be used to estimate both LPA and LGM models (a) estimating parameters accounting for children nested within classrooms through use of a sandwich estimator to adjust the standard errors of the parameters as would be done within a multilevel framework (Muthén, du Toit, & Spisic, 1997) and (b) allowing for the inclusion of all available data by using full information maximum likelihood (FIML) estimation to account for data incompleteness (Baraldi & Enders, 2009). FIML uses all available data for each case when estimating parameters, and in recent simulation studies, has been shown to be unbiased when data are missing at random and to be robust to non-normal distributions (Enders, 2010; Schafer & Graham, 2002).

2.4.1. Latent profile analysis

Based on prior cluster-analytic research with the ASPI (Bulotsky-Shearer et al., 2010), a series of latent profile analyses were estimated to identify distinct profiles of classroom emotional and behavioral adjustment early in the Head Start year. LPA is a model-based approach in which the population is considered to consist of k latent groups where the number of groups is not known a priori. In the current study, the child was assigned to the latent group for which their posterior probability was the highest. Profiles of homogeneous groups of children are estimated by maximizing within group similarity according to the mean level, dispersion, and profile shape of observed variables and maximizing between-type separation. In our models, we estimated profiles based on children's ASPI T scores on the five behavioral dimensions and three situational dimensions, using the Mplus syntax TYPE=COMPLEX to account for the nested nature of the data (children nested within classrooms) as would be done in a multilevel analytic framework (Raudenbush & Bryk, 2002). Variances of the ASPI indicators were constrained to be equal across profiles and the covariance among these indicators within profiles were constrained to zero.

Five general sets of criteria were used to determine the model with the optimal number of profiles as recommended by Vermunt (2008) and Jung and Wickrama (2008). First, we examined the following fit indices: the Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC), and the Adjusted Bayesian Information Criterion (adjusted BIC; Nylund, Asparouhov, & Muthén, 2007). Second, we examined relative entropy values with a value greater than .70, indicating acceptable classification accuracy (Jung & Wickrama, 2008). Entropy is a measure of classification uncertainty that measures the probability that person i is a member of profile p. Values near zero suggest low certainty in classification and values near one suggest high certainty in classification. Third, we examined the Lo–Mendell–Rubin Likelihood Ratio test (LMR-LRT; Lo, Mendell, & Rubin, 2001) to assess the relative fit of a k-profile solution with a (k–1) profile solution. A significant LMR value ($p<.05$) suggested that the current model with k profiles fit the data better than the k–1 class model. Fourth, we considered profile size to ensure that all profile types included at least 1% of the sample to support generalizability and replicability (Nylund et al., 2007). Fifth, we considered whether the solution made psychological sense in terms of parsimonious coverage and the relevant literature.

Once the best fitting latent profile model was identified, children's profile type (based on the latent group for which their posterior probability was the highest) was saved in an output file as a categorical variable. The categorical variable was then dummy coded so that each child received a code of "1" for classification in one profile type based on their most likely latent profile membership. These dummy-coded variables were entered as predictors in the latent growth models as detailed below, leaving out the largest profile type (including well-adjusted children) as the reference group.

2.4.2. Child demographic predictors of profile membership

A separate set of analyses examined whether child demographic variables were associated with children's classification in the latent profile types identified in the LPA above. In this analysis in Mplus, the categorical latent profile types were regressed on child sex, age, and ethnicity to obtain the probability of classification in profile types based on these demographic characteristics. Child sex and ethnicity were dummy-coded as follows: girl = 1 or boy = 0; African American, Hispanic, or Asian or other = 1 (with White as the reference group). Child age was entered as a continuous variable and was based on children's age in months at the first wave of assessment in the fall. In this analysis, a multinomial logistic regression analysis yielded an odds ratio (a.k.a., relative risk ratio) indicating the increase in the log-odds of being classified in each of the problem profile types (relative to the normative group) as a function of children's demographic characteristics (Jung & Wickrama, 2008). All odds ratios were compared against the normative profile type. An odds ratio greater than one indicated that for every one unit increase in a demographic characteristic (e.g., age in months), the child's likelihood (or risk) for classification was increased in a behavioral problem type as compared to classification in the normative type. An odds ratio less than one indicated that the demographic variable decreased a child's likelihood (or risk) for classification in a behavior problem profile type relative to the normative type.

2.4.3. Latent growth curve analyses

Once the optimal number of latent profiles was identified, two sets of latent growth curve models (one for literacy and one for mathematics skills) were estimated in a series of steps. First, unconditional linear latent growth models were estimated independently for children's literacy and mathematics growth across the three times points (fall, winter, and spring) during the preschool year. In SEM, LGM conceptualizes change over time as a latent process (Kline, 2005). This analysis is done by estimating latent growth factors' (intercept and slope) means and variances. The mean of the intercept describes the average score at the beginning of the preschool year. The mean of the slope describes the average rate of change across the three time points during the year.

For all models, the χ^2 test of model fit was used to assess the fit of the overall model to the data; lack of significance ($p < .05$) indicated acceptable model fit (Kline, 2005). However, a significant χ^2 test of model fit was still considered acceptable because the χ^2 statistic is sensitive to sample size and is often statistically significant when model misfit might be of little practical significance (Bollen & Long, 1993). Two additional fit indices were used to assess closeness of fit: the Bentler comparative fit index (CFI; Bentler, 1990) and the root mean square error of approximation (RMSEA; Steiger & Lind, 1980). Values for CFI greater than .90 and values for the RMSEA of .08 or less were considered acceptable and indicated adequate model fit. Given the large sample size of this study, if the χ^2 was significant and the other fit indices met the predetermined criteria, models were retained and considered to have an adequate fit (Kline, 2005).

In the unconditional growth models, variance terms for intercept and slope parameters were inspected to determine whether there was significant variability in initial status and growth parameters to be predicted by child demographic and ASPI profile classification variables. Child demographic covariates (child age, sex, and ethnicity) were then entered in the models, as predictors of initial status and growth. In the final step, children's dummy-coded profile types (with the normative profile type as the reference group) were entered into the growth models as predictors of initial status and rate of change in literacy and mathematics skills across the preschool year. To minimize potential collinearity problems and to examine associations between children's ASPI profile classification and rates of change in academic skills, children's dummy-coded profile types were extracted from the initial LPA described above which included

ASPI indicators only (profile types were not extracted from the conditional LPA which included child demographic variables as covariates).[1]

3. Results

Descriptive statistics are presented in Table 1. The ASPI behavioral and situational dimensions were examined to assess the percent of children with elevated scores in the clinical range (e.g., equal to or greater than 65, 1.5 standard deviations above the mean; Fantuzzo et al., 2003). This percentage of children ranged from 1.6% to 3.4% for the behavioral dimensions and 6.6% to 8.4% for the situational dimensions. Due to the archival nature of these data, there was some missing data with the COR at each time point. Of the children with fall ASPI scores, 5.5% of children were missing COR data in the fall. Of the children with COR data, the percent of missing data at each subsequent time point ranged from 7.3% to 16.5%. Reasons for missing data were likely programmatic (e.g., teacher did not enter a score for a child at a specific time point via the web-based interface) or children were no longer enrolled in the program. By using FIML to handle missing data, all available data for all children were utilized when conducting the LPA and the LGM.

Bivariate correlations between ASPI dimensions and COR literacy and mathematics skills are displayed in Table 2. Among the ASPI dimensions, the pattern of highest correlations was found between fall ASPI Problems in Structured Learning, Withdrawn/Low Energy, and Socially Reticent problem behavior and COR literacy and mathematics scores across all time points.[2]

3.1. Latent profiles of preschool emotional and behavioral adjustment

A series of latent profile analyses was estimated (beginning with 1 through 8 profile groups) guided by prior research (Bulotsky-Shearer et al., 2010) and aforementioned fit indices. Table 3 shows the fit statistics for each model specification. The best fitting latent profile model consisted of six distinct profile types. Fit indices for the final model, were as follows: Loglikelihood = −109804.11, AIC = 219730.22, BIC = 220120.21 and the sample size adjusted BIC = 219926.37. In addition, overall classification quality for the final model was very high, as indicated by an entropy value of 0.98, with average latent class probabilities within each of the six profiles ranging from .97 to 1.00 for each child. Furthermore, the final profile solution satisfied the constraints of the Lo–Mendell–Rubin Likelihood Ratio test (LMR-LRT; Lo et al., 2001) and minimum profile size (each comprised at least 1% of children within the overall sample) and was psychologically meaningful. Table 4 shows the prevalence and mean ASPI *T* scores and their respective standard errors for the six latent profile types. Variances for the ASPI dimensions were constrained to be equal across profiles. For the behavioral dimensions, variance estimates were 19.92 for Aggressive, 35.75 for Oppositional, 34.07 for Hyperactive/Inattentive, 0.44 for Withdrawn/Low Energy, and 40.90 for Socially Reticent. For the situational dimensions variance estimates were 38.62 for Problems in Structured Learning, 41.81 for Problems in Peer Interactions, and 55.79 for Problems in Teacher Interactions. Fig. 1 presents a graphic display of the patterns of classroom behavioral adjustment characterizing the six distinctive profiles. In the paragraphs that follow, profile types are described.

[1] It is important to note that it is possible to estimate LGM and LPA models simultaneously within Mplus, and this strategy is often the preferred analytic strategy given that children's classification within profile types is based on posterior probabilities which are not always equal to 1 (meaning that children may not be classified within a latent profile with 100% certainty). In this strategy, however, it is not yet possible to conduct simultaneous, multiple pairwise comparisons of differences in the estimated growth parameters across profile types (L. Muthén, personal communication, 5/19/2011). In addition, we were interested in examining children's classification in latent types as a function purely of the variation in ASPI subscale scores. When LPA and LGM are estimated simultaneously, latent profile types are formed using the observed indicators of the profiles (ASPI subscales) as well as the observed indicators for the growth parameters (COR).

[2] The percent of variance in outcomes attributable to differences within children, between children, and between classrooms was calculated based on our unconditional multilevel models. For literacy, 41% of the variance in children's scores was attributable to differences within children over time, 45% of the variance was attributable to differences between children, and 14% was attributable to differences between classrooms. For mathematics, 43% of the variance in children's scores was attributable to differences within children, 35% of the variance was attributable to differences between children, and 22% was attributable to differences between classrooms.

Table 1
Descriptive statistics for emotional and behavioral adjustment, literacy, and mathematics skills across the Head Start year.

	n	*M*	*SD*	Range
Preschool measure				
Behavioral and situational problems (ASPI)				
Aggressive (fall)	4417	48.15	7.17	43–73
Oppositional (fall)	4417	48.30	7.33	42–73
Hyperactive/inattentive (fall)	4417	48.36	7.87	42–73
Withdrawn/low energy (fall)	4417	48.68	6.73	45–73
Socially reticent (fall)	4417	48.84	7.74	40–73
Problems in structured learning (fall)	4417	49.71	10.42	39–88
Problems in peer interactions (fall)	4417	49.67	10.31	40–86
Problems in teacher interactions (fall)	4417	49.74	9.96	38–82
Language and literacy skills (COR)				
Language/literacy (fall)	3884	49.62	9.71	26–73
Language/literacy (winter)	3540	55.15	9.57	26–73
Language/literacy (spring)	3725	59.77	9.43	26–73
Mathematics skills (COR)				
Mathematics (fall)	3789	49.54	9.75	29–73
Mathematics (winter)	3499	55.20	9.66	29–73
Mathematics (spring)	3700	59.83	9.49	29–73

Note. ASPI = Adjustment Scales for Preschool Intervention. COR = Child Observation Record. Values are *T* scores ($M = 50$, $SD = 10$).

Profile type 1: well-adjusted to the preschool classroom. This profile type was composed of the largest percentage of children (53%). Children classified within this profile type exhibited overall well-adjusted classroom behavior early in the year. On average, children classified within this profile type were characterized by low levels of both ASPI behavioral and situational adjustment problems (with *T* scores less than 0.5 *SD* below the mean of 50).

Profile type 2: adjusted with mild disengagement. This profile type (8%) was composed of children demonstrating mildly elevated levels of Withdrawn/Low Energy ($M = 56.00$) and Socially Reticent problem behavior ($M = 52.88$), with Problems in Structured Learning and Problems in Teacher Interactions at or slightly above the sample mean (*M*s = 50.33 and 51.65, respectively). Children exhibited low levels of externalizing problems (Aggressive, Oppositional, Inattentive/Hyperactive problem behavior) and Problems in Peer Interactions.

Profile type 3: moderately socially and academically disengaged. This profile type (9%) was composed of children who early in the Head Start year exhibited moderately elevated levels of internalizing behavior, including Withdrawn/Low Energy problem behavior ($M = 61.35$) and Socially Reticent behavior ($M = 57.36$) as well as high levels of Problems in Structured Learning and Problems in Teacher Interactions

Table 2
Bivariate correlations between fall emotional and behavioral adjustment and literacy and mathematics skills across the year.

ASPI behavioral and situational problems	Literacy skills (COR)			Mathematics skills (COR)		
	Fall	Winter	Spring	Fall	Winter	Spring
Aggressive (fall)	−.17**	−.16**	−.16**	−.15**	−.16**	−.17**
Oppositional (fall)	−.02	−.02	−.02	−.03	−.04*	−.05*
Hyperactive/inattentive (fall)	−.24**	−.23**	−.22**	−.22**	−.22**	−.23**
Withdrawn/low energy (fall)	−.32**	−.31**	−.30**	−.28**	−.26**	−.25**
Socially reticent (fall)	−.37**	−.34**	−.33**	−.31**	−.28**	−.28**
Problems in structured learning (fall)	−.40**	−.38**	−.38**	−.36**	−.34**	−.34**
Problems in peer interactions (fall)	−.16**	−.15**	−.16**	−.15**	−.17**	−.16**
Problems in teacher interactions (fall)	−.29**	−.26**	−.26**	−.25**	−.25**	−.23**

Note. ASPI = Adjustment Scales for Preschool Intervention. COR = Child Observation Record.
* $p < .01$.
** $p < .001$.

Table 3
Fit criteria for preschool emotional and behavioral adjustment latent profile model specifications.

Number of latent profiles	Loglikelihood	AIC	BIC	Adjusted BIC	LMR-LRT	Entropy
1	−125016.19	250064.39	250166.68	250115.84	n/a	1.00
2	−118385.90	236821.81	236981.64	236902.20	$p<.001$	0.95
3	−115589.28	231246.55	231463.92	231355.88	$p<.001$	0.95
4	−113532.76	227151.51	227426.42	227289.78	$p<.001$	0.97
5	−111390.49	222884.97	223217.42	223052.18	$p<.001$	0.97
6	−109804.11	219730.22	220120.21	219926.37	$p=.006$	0.98
7	−109765.55	219671.09	220118.62	219896.19	$p=.508$	0.94
8	−108608.90	217375.79	217880.85	217629.82	$p=.367$	0.94

Note. AIC = Akaike Information Criterion. BIC = Bayesian Information Criterion. Adjusted BIC = Adjusted Bayesian Information Criterion. LMR-LRT = Lo–Mendell–Rubin Likelihood Ratio test. All models were estimated with 1000 random starts and 100 iterations to avoid local maxima in Mplus v. 6.0 (Hipp & Bauer, 2006).

(*M*s = 61.13 and 59.66, respectively). Children within this profile type, however, demonstrated low or average levels of Aggressive, Inattentive, or Oppositional behavior, and Problems in Peer Interactions.

Profile type 4: disruptive with peers. This profile type was the second most prevalent (22%) and was composed of children demonstrating very high levels of Problems in Peer Interactions (*M* = 61.54) as well as elevated overactive problem behavior 0.5 standard deviations above the mean: Aggressive (*M* = 56.77), Oppositional (*M* = 54.83), and Inattentive/Hyperactive behavior (*M* = 56.32). Children within this profile type also demonstrated elevated Problems in Structured Learning situations (*M* = 56.12).

Profile type 5: extremely socially and academically disruptive. This profile type (5%) was composed of children demonstrating extremely high levels of situational Problems in Structured Learning (*M* = 63.72) and Problems in Peer Interactions (*M* = 63.38), as well as high levels of overactive behavior problems, on Aggressive and Inattentive/Hyperactive dimensions (*M*s = 58.60, 58.12, respectively) and Problems in Teacher Interactions (*M* = 58.71).

Profile type 6: extremely socially and academically disengaged. This profile type was composed of a small percentage of children (3%) who early in the preschool year demonstrated extremely high levels of underactive behavior (*M*s = 68.25 and 60.55, for Withdrawn/Low Energy and Socially Reticent problem behavior) and extremely high levels of Problems in Structured Learning (*M* = 68.55) and Problems in Teacher Interactions (*M* = 66.65).

3.2. Child demographic variables associated with profile membership

Parameter estimates and odds ratios for the multinomial logistic regression analyses are presented in Table 5. Child age and sex were the only significant demographic predictors of children's latent profile membership. As indicated in Table 6, all ages were represented across each profile type. However, as indicated by the significant odds ratios, younger children were less likely to be classified within profile type 1 (well-adjusted), as compared to all other profile types. Each month increase in age decreased the risk for children's classification in these problem profile types as compared to the well-adjusted profile type. In addition, girls were less likely to be classified within profile types 3, 4, 5, and 6 as compared to the well-adjusted type (in other words, being a girl decreased children's risk for classification in these problem profile types, relative to the well-adjusted type).

3.3. Associations with growth in literacy and mathematics across the preschool year

3.3.1. Associations with language and literacy skills

The unconditional growth model using fixed time points (4 month interval between time 1 [October] and time 2 [February] and 3 month interval between time 2 [February] and time 3 [May]) for language and literacy skills fit the data well, $\chi^2(1) = 3.01$, $p = .08$; CFI = .99; TLI = .996; RMSEA = .022; and SRMR = .008. The estimated grand mean score for language and literacy at the beginning of the year was 47.87 ($SE = 0.49$, $p < .001$). For each month of preschool, children's language and literacy skills increased

Table 4
Mean ASPI *T* scores (and standard errors) for the latent profile types.

Profile type	ASPI behavioral problems				ASPI situational problems			
	Aggressive	Oppositional	Inattentive/ hyperactive	Withdrawn/low energy	Socially reticent	Structured learning	Peer interaction	Teacher interaction
1. Well-adjusted (*n* = 2324, 53%)	44.07 (0.10)	45.15 (0.20)	44.34 (0.15)	45.00 (0.00)	45.79 (0.22)	42.46 (0.19)	43.29 (0.20)	44.10 (0.26)
2. Mildly disengaged (*n* = 340, 8%)	44.36 (0.25)	45.69 (0.40)	45.39 (0.40)	*56.00* (0.00)	*52.88* (0.43)	50.33 (0.46)	45.26 (0.52)	51.65 (0.55)
3. Moderately socially and academically disengaged (*n* = 414, 9%)	48.88 (0.54)	49.00 (0.45)	49.87 (0.50)	**61.35** (0.08)	*57.36* (0.37)	**61.13** (0.42)	52.64 (0.64)	**59.66** (0.47)
4. Disruptive with peers (*n* = 988, 22%)	*56.77* (0.28)	*54.83* (0.34)	*56.32* (0.39)	45.00 (0.00)	48.22 (0.29)	*56.*12 (0.36)	**61.54** (0.36)	53.82 (0.42)
5. Extremely socially and academically disruptive (*n* = 201, 5%)	*58.60* (0.84)	55.92 (0.74)	*58.12* (0.76)	*56.12* (0.12)	54.21 (0.47)	**63.72** (0.89)	**63.38** (0.99)	*58.71* (0.70)
6. Extremely socially and academically disengaged (*n* = 150, 3%)	47.47 (0.60)	47.97 (0.54)	48.09 (0.69)	**68.25** (0.21)	**60.55** (0.71)	**68.55** (0.80)	54.23 (0.62)	**66.65** (0.58)

Note. ASPI = Adjustment Scales for Preschool Intervention. Values are mean *T* scores ($M = 50$, $SD = 10$). *T* scores 1.0 standard deviations above the mean are italicized and in boldface type. *T* scores 0.5 standard deviations above the mean are italicized.

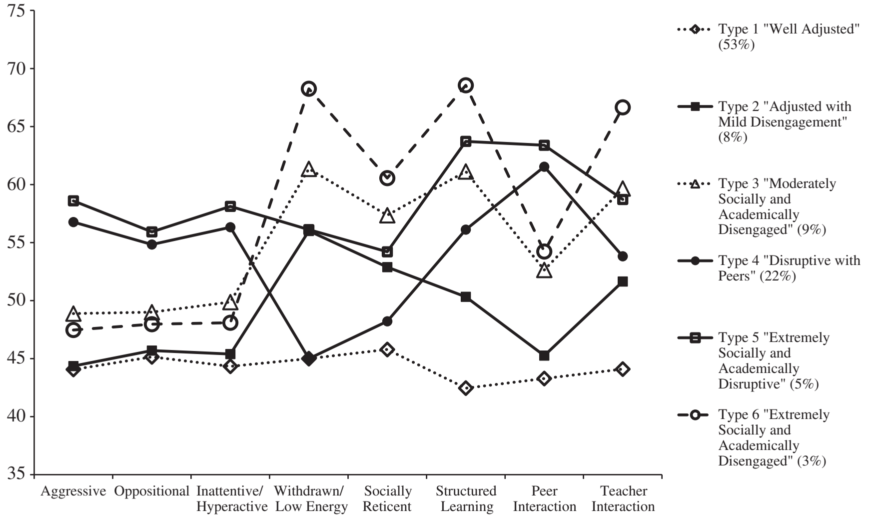

Fig. 1. Observed mean *T* scores for classroom situational and behavioral adjustment across the six profile types.

approximately 1.47 *T* score points ($SE=0.04$, $p<.001$). The variance terms for both intercept and slope estimates were significant, indicating variation in initial status and rates of change within the Head Start sample. Variances were 99.23($SE=4.55$, $p<.001$) and 0.73 ($SE=0.08$, $p<.001$) for intercept and slope parameters, respectively. Initial language and literacy skills were significantly and negatively correlated with the slope parameter in the growth model ($r=-.46$, $p<.001$). Children who started out the preschool year with lower language and literacy skills demonstrated significantly more growth in these skills across the year, whereas children who came into preschool with higher skills grew more slowly.

In the second step, child demographic variables were entered as predictors of intercept and slope parameters. All demographic variables were centered at the grand mean per Enders and Tofighi (2007). Child age and sex were significant predictors of initial language and literacy skills; older children and girls were rated higher than younger children and boys by teachers at initial assessment in the fall. None of the child demographic variables were, however, significantly associated with rates of change in language skills across the preschool year.

The final model including child demographic variables as well as children's latent profile classification, demonstrated a good fit to the data, $\chi^2(11)=11.07$, $p=.44$; CFI = 1.00; TLI = 1.00; RMSEA = .001; and SRMR = .003. Table 7 displays the unstandardized estimates for all child demographic variables and ASPI profile types within the final growth model. All five problem profile types were negatively associated with initial language and literacy skills, relative to the well-adjusted profile type, with children classified within profile types 3, 5, and 6 starting out at least 5 *T* score points (1/2 of a standard deviation) below the well-adjusted group. With regard to rates of change in language and literacy skills across the year, profile types 3 and 5 demonstrated significantly greater rates of change relative to the well-adjusted group. Table 8 reports mean and standard deviations for language and literacy skills at each time point for each profile type. Fig. 2 graphically depicts the observed means at each time point for each profile type.

3.3.2. Associations with mathematics skills

The unconditional growth model using fixed time points for mathematics skills fit the data well, $\chi^2(1)=1.26$, $p=.26$; CFI = 1.00; TLI = 0.999; RMSEA = .008; SRMR = .007. The estimated grand mean score for mathematics at the beginning of the year was 47.77 ($SE=0.42$, $p<.001$). For each month of preschool, children's language and literacy skills increased approximately 1.49 *T* score points ($SE=0.05$,

Table 5
Multinomial logistic regression estimates and odds ratios for child demographic covariates.

Child demographic variables	Latent profile type									
	Type 2: mildly disengaged ($n=340$, 8%)		Type 3: moderately socially and academically disengaged ($n=414$, 9%)		Type 4: disruptive with peers ($n=988$, 22%)		Type 5: extremely socially and academically disruptive ($n=201$, 5%)		Type 6: extremely socially and academically disengaged ($n=150$, 3%)	
	B (*SE*)	Odds ratio	*B* (*SE*)	Odds ratio	*B* (*SE*)	Odds ratio	*B* (*SE*)	Odds ratio	*B* (*SE*)	Odds ratio
Age (in months)	−.32** (.11)	.73**	−1.02*** (.11)	.36***	−.33*** (.09)	.72***	−.99*** (.16)	.37***	−1.53*** (.15)	.22***
Sex (1 = girl)	−.01 (.13)	.99	−.47*** (.11)	.62***	−.78*** (.09)	.46***	−1.20*** (.21)	.30***	−.76*** (.17)	.47***
African American	−.32 (.24)	.73	.36 (25)	1.43	.17 (.21)	1.19	−.61 (.33)	.54	.22 (.48)	1.24
Latino	−.04 (.31)	.96	.40 (.29)	1.49	.01 (.23)	1.01	−.11 (.38)	.90	−.20 (.53)	.82
Asian/other	.31 (.29)	1.37	.40 (.35)	1.49	−.12 (.29)	.89	−.30 (.52)	.74	.67 (.57)	1.96

Note. Parameter estimates for each profile type are relative to the reference profile type 1 (well-adjusted to the preschool classroom), adjusted for all other variables in the model. Odds-ratios are exponentiated parameter estimates presented in the second column.

* $p<.05$.
** $p<.01$.
*** $p<.001$.

Table 6
Distribution of 3 and 4 year olds across profile types.

Age group	Latent profile type						
	Type 1: well-adjusted to classroom	Type 2: mildly disengaged	Type 3: moderately socially and academically disengaged	Type 4: disruptive with peers	Type 5: extremely socially and academically disruptive	Type 6: extremely socially and academically disengaged	Total sample
	% (*n*)	% (*n*)	% (*n*)	% (*n*)	% (*n*)	% (*n*)	% (*n*)
3-year-olds	28.1% (653)	37.1% (126)	51.5% (213)	35.2% (348)	51.7% (104)	60.0% (90)	34.7% (1534)
4-year-olds	71.4% (1659)	62.7% (213)	48.1% (199)	64.1% (633)	48.1% (97)	39.3% (59)	64.8% (2860)

Note. Percentages do not add up exactly to 100.0% because a small number of children were missing date of birth.

$p<.001$). The variance terms for both intercept and slope estimates were significant, indicating significant variation in initial status and rates of change. Variances were 102.14 ($SE=6.47$, $p<.001$) and 0.97 ($SE=0.10$, $p<.001$) for intercept and slope parameters, respectively. Initial mathematics skills (intercept) was significantly and negatively correlated with the slope parameter in the growth model ($r=-.48$, $p<.001$). Children who started out with lower mathematics skills demonstrated more growth in these skills across the year, whereas children who entered with higher skills grew more slowly.

Child age and sex were both significant predictors of children's initial mathematics skills, with older children and girls rated higher by teachers at initial assessment in the fall, than younger children and boys. Child demographic variables were not, however, significantly associated with rates of change in mathematics skills across the preschool year.

The final model including child demographic variables as well as children's latent profile classification, demonstrated a good fit to the data, $\chi^2(11)=12.00$, $p=.36$; CFI = 1.00; TLI = .99; RMSEA = .005; and SRMR = .005. Table 7 displays the unstandardized estimates for all child demographic variables and ASPI latent profile types within the final growth model. All five ASPI profile types were negatively associated with initial mathematics skills, relative to the well-adjusted profile type, with profile types 3 and 6 starting

Table 7
Parameter estimates for intercept and slope in latent growth models for literacy and mathematics skills by latent profile type.

Predictor	Literacy initial status (β_{11})		Literacy growth (β_{12})		Math initial status (β_{11})		Math growth (β_{12})	
	B	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*
Grand mean	49.99	0.37	1.35	0.04	49.38	0.45	1.46	0.06
Child demographic variables								
Age (months)	8.40***	0.32	0.03	0.04	8.41***	0.39	−0.02	0.05
Sex (0 = boy; 1 = girl)	1.25***	0.26	0.04	0.03	0.90**	0.30	0.01	0.04
Hispanic	−1.53	1.03	0.09	0.13	−3.03*	1.29	0.17	0.16
African American	1.25	0.88	0.05	0.12	0.16	1.15	0.10	0.15
Asian/other	−2.59*	1.27	0.24	0.13	−2.34	1.78	0.23	0.20
Profile type								
Type 2: mildly disengaged	−3.30***	0.65	0.13	0.07	−2.92***	0.68	0.19*	0.09
Type 3: moderately disengaged	−7.08***	0.56	0.23**	0.07	−5.83***	0.60	0.18*	0.07
Type 4: disruptive with peers	−2.10***	0.43	0.06	0.05	−1.98***	0.45	0.02	0.06
Type 5: extremely disruptive	−5.61***	0.78	0.19*	0.09	−4.45***	0.78	0.17	0.11
Type 6: extremely disengaged	−8.83***	0.81	0.10	0.13	−6.91***	0.88	0.06	0.15

Note. Estimates represent unstandardized coefficients. Estimates are relative to the reference profile type 1 (well-adjusted to the preschool classroom). Type 3 = moderately socially and academically disengaged. Type 5 = extremely socially and academically disruptive. Type 6 = extremely socially and academically disengaged.
* $p<.05$.
** $p<.01$.
*** $p<.001$.

Table 8
Literacy and mathematics observed mean scores across three time points for all latent profile types.

Profile type	Language and literacy			Mathematics		
	Time 1 *M* (*SD*)	Time 2 *M* (*SD*)	Time 3 *M* (*SD*)	Time 1 *M* (*SD*)	Time 2 *M* (*SD*)	Time 3 *M* (*SD*)
Type 1: well-adjusted	52.14 (9.02)	57.44 (8.90)	61.93 (8.63)	51.71 (9.35)	57.30 (9.04)	61.83 (8.84)
Type 2: mildly disengaged	47.82 (9.36)	53.92 (9.17)	58.58 (8.79)	47.89 (9.37)	54.37 (9.39)	59.41 (8.81)
Type 3: moderately disengaged	43.09 (8.52)	48.84 (8.65)	54.08 (9.23)	43.54 (8.63)	49.79 (9.39)	54.63 (9.58)
Type 4: disruptive with peers	49.10 (9.37)	54.81 (9.35)	59.52 (9.36)	49.02 (9.47)	54.42 (9.54)	59.19 (9.31)
Type 5: extremely disruptive	43.35 (9.26)	50.08 (9.15)	54.78 (9.04)	44.41 (8.94)	51.37 (9.27)	56.05 (9.16)
Type 6: extremely disengaged	39.81 (8.64)	45.78 (9.35)	50.01 (9.89)	41.40 (8.69)	47.02 (10.14)	51.01 (10.73)

Note. Values are *T* scores ($M=50$, $SD=10$) based on area conversion of raw factor score totals derived from the standardization sample. Type 3 = moderately socially and academically disengaged. Type 5 = extremely socially and academically disruptive. Type 6 = extremely socially and academically disengaged.

out the lowest. With regard to rates of change in mathematics skills across the preschool year, profile types 2 and 3 demonstrated significantly greater rates of change relative to the well-adjusted type.

3.3.3. Follow-up analyses to examine significant differences at time 3

As Table 8 and Fig. 2 display, whereas children within some profile types exhibited significantly higher rates of change in literacy and mathematics relative to children classified within the well-adjusted type, they still appeared to maintain a disadvantage (ending the year with lower skills, relative to the well-adjusted type). To examine whether children within the five problem profile types had significantly lower literacy and mathematics skills at time 3, additional growth models were analyzed. These models were identical to the final growth models for literacy and mathematics skills except that the intercept was fixed to the third time point. This approach allowed us to examine the associations between problem behavior types (relative to the well-adjusted profile type) and academic skills in the spring (the intercept in these growth models). For both literacy and mathematics, the problem behavior types significantly negatively predicted the intercept, with all five profile types exhibiting lower literacy and mathematics skills at the end of the year relative to the well-adjusted type. For literacy skills, profile type 6 (extremely socially and academically disengaged) demonstrated the greatest disadvantage relative to the well-adjusted profile group ($b=-8.02$, $SE=0.88$, $p<.001$), followed by profile type 3 (moderately socially and academically disengaged; $b=-5.15$, $SE=0.56$, $p<.001$), profile type 5 (extremely socially and academically disruptive; $b=-4.00$, $SE=0.73$, $p<.001$), profile type 2 (mildly disengaged; $b=-2.25$, $SE=0.55$, $p<.001$), and profile

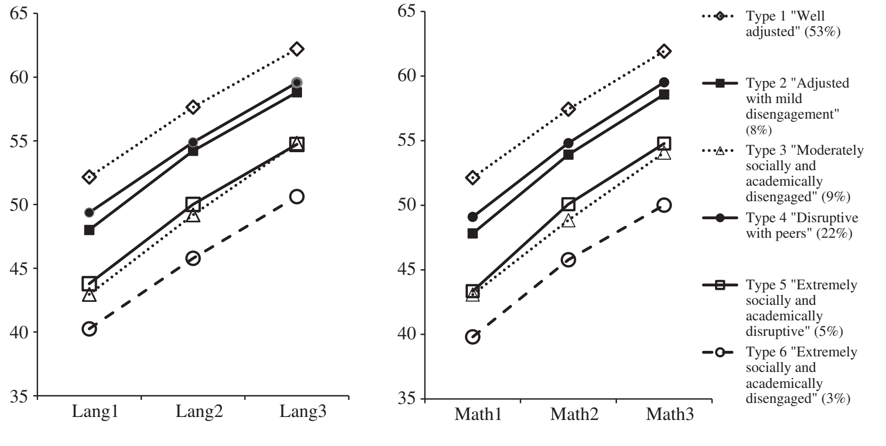

Fig. 2. Observed mean *T* scores across the preschool year for COR literacy and mathematics by profile type.

type 4 (disruptive with peers; $b = -1.62$, $SE = 0.37$, $p < .001$). For mathematics skills, the results were very similar; profile type 6 had the lowest scores relative to the well-adjusted type ($b = -6.94$, $SE = 1.05$, $p < .001$), followed by profile type 3 ($b = -4.53$, $SE = 0.56$, $p < .001$), profile type 5 ($b = -3.16$, $SE = 0.78$, $p < .001$), profile type 4 ($b = -1.93$, $SE = 0.42$, $p < .001$), and profile type 2 ($b = -1.43$, $SE = 0.56$, $p < .05$).

4. Discussion

The present study advances the knowledge base in several ways. First, latent profile analysis identified six profile types of classroom emotional and behavioral adjustment early in the year for an entire cohort of urban Head Start children. Second, in order to support classroom-based interventions by early childhood teachers, findings identified which demographic variables placed children at risk for classification in problem behavior profile types early in the year. Third, profile types were differentiated by both initial status and rates of change in children's literacy and mathematics skills across the preschool year. Findings provide useful information to guide our understanding of (a) which subgroups of children early in the preschool year started out at the greatest disadvantage academically, (b) which subgroups of children started out and maintained an academic disadvantage throughout the year, and (c) which subgroups of children despite starting out at an academic disadvantage made significantly more progress than the well-adjusted group across the preschool year.

The six profile types identified early in the year were comparable to those identified through multistage hierarchical cluster analyses using a smaller representative sample of Head Start children (Bulotsky-Shearer et al., 2010). As in this previous study, the largest profile group identified in the present study was the well-adjusted profile type, including over 50% of the children within the sample who displayed low levels of classroom problem behavior early in the year. Other profile types were also comparable to those identified previously; they provide evidence for the generalizability of these types in a new sample of Head Start children. In addition, the study extends previous work that has focused on estimating profiles of preschool externalizing behavior and concomitant skills deficits, such as self-regulation or temperament difficulties (Degnan et al., 2008; Hill et al., 2006), or that has identified profiles of problem behavior for clinical populations of preschool children (McGuire & Richman, 1986; Richman, Stevenson, & Graham, 1982; Wolkind & Everitt, 1974). The present study identified profile types based on a comprehensive assessment of internalizing, externalizing, and situational problem behavior for an entire population of low-income children.

In the present study, the six latent profile types were distinguished by child age and sex. Whereas younger and older children were represented across all profile types (see Table 6), younger children were more likely than older children to be classified in problem behavior profile types as compared to the well-adjusted type. Each month increment in age served a protective function, in that it decreased the likelihood that children would be classified in a problem profile type. With respect to gender differences, girls were less likely to be classified in all profile types (relative to the well-adjusted type) except for profile type 2 (adjusted with mild disengagement). This gender finding comports with research documenting that boys typically exhibit more behavioral problems than girls, particularly externalizing behavior (Lumley, McNeil, Herschell, & Bahl, 2002). Our study extends prior research, however, by identifying these child demographic variables as relative risk or protective influences for children's classification in the ASPI profile types.

In accord with the developmental–ecological framework (and the ASPI assessment), it is important to acknowledge that children's profile classification is not an indication of a clinical diagnosis, but rather its purpose was to provide a descriptive picture of children's adaptation at this particular point in time. During the preschool period, self-regulation, emotion regulation, and attention skills are rapidly developing through maturation and experience (Bulotsky-Shearer et al., 2008; Fantuzzo et al., 2001; Lutz et al., 2002). Age distinctions among the profile types were examined to provide a picture of the developmental characteristics of children as they adapted to the classroom early in the year. In addition, within this Head Start program as in many other early childhood programs, classrooms included mixed ages ranging from 3 to 5 years old (NIEER, 2007). To individualize instruction to meet children's needs, teachers need information regarding the behavioral and academic needs of children of all ages, particularly young children newly transitioning into the classroom environment.

4.1. Latent profile classification and initial literacy and mathematics skills

Children classified in problem behavior profile types started out the school year with lower literacy and mathematics skills relative to the well-adjusted group. Two subgroups of children demonstrated the lowest level of initial skills and thus were at the greatest disadvantage at the beginning of the year: those classified within profile type 3 (moderately socially and academically disengaged) and profile type 6 (extremely socially and academically disengaged). This finding comports with research documenting that children who display problem behavior have concurrent difficulties adjusting to the preschool classroom and engaging in classroom learning activities (Fantuzzo et al., 2003; McClelland, Morrison, & Holmes, 2000).

Our findings extend this research by highlighting the concurrent academic needs of children exhibiting elevated socially reticent and withdrawn behavior. Although most research on early problem behavior has focused on externalizing behavior, emerging research suggests that it is equally if perhaps even more important to attend to children exhibiting internalizing behavior within the classroom (Bulotsky-Shearer, Domínguez, & Bell, 2012; Fantuzzo et al., 2003). Children who are socially disengaged in the classroom also have been found to initiate fewer social interactions with teachers and peers, and as a consequence, exhibit lower academic readiness skills (Bulotsky-Shearer et al., 2012; Rydell et al., 2005). These interactions are crucial to the learning process in early childhood classrooms, where instruction is highly socially mediated by teachers and peers. Shy or withdrawn children may be less actively engaged and thus less likely to gain academic benefits from their participation in socially mediated learning activities (Domínguez et al., 2010; Eisenberg et al., 1998).

4.2. Children's profile classification and growth in literacy and mathematics skills

Fortunately, all children in the six profile types demonstrated overall positive rates of change in both literacy and mathematics skills across the preschool year. Two profile types started out at a disadvantage and exhibited similar rates of growth as the well-adjusted group, thus maintaining their initial disadvantage in these skills throughout the year. Three profile types also started out at a disadvantage but demonstrated faster rates of growth in literacy and mathematics across the year relative to the well-adjusted group. These statistically significant differences in rates of change, however, were relatively small and imply that all children classified in profile types characterized by problematic adjustment early in the year did not “catch up” academically to their peers in the well-adjusted profile group. In fact, compared to children in the well-adjusted type, children in the problem behavior groups maintained their relative disadvantage across the preschool year.

Profile types associated with lower initial status and similar rates of growth relative to the well-adjusted profile type. Profile type 4 (disruptive with peers) and profile type 6 (extremely socially and academically disengaged) did not experience significantly faster rates of growth in either literacy or mathematics, relative to the well-adjusted group; in other words, they experienced similar rates of growth to the well-adjusted group. Children within profile type 4 (disruptive with peers) started out the year with the closest mean scores to the well-adjusted type (e.g., with the highest mean scores in literacy and mathematics among the five behavior problem types), and profile type 6 started out with the lowest mean academic skills relative to all profile types. Neither group, however, made greater gains than the well-adjusted group, maintaining their relative disadvantage across the school year.

Profile types associated with lower initial academic skills but experienced faster rates of growth relative to the well-adjusted profile type. Children in profile type 3 (moderately socially and academically disengaged) and profile type 5 (extremely socially and academically disruptive) exhibited faster rates of growth in literacy relative to children in the profile type 1 (well-adjusted). With respect to mathematics skills, children within profile type 2 (adjusted with mild disengagement) and profile type 3 (moderately socially and academically disengaged) demonstrated significantly faster rates of growth, relative to children within the well-adjusted profile type. One potential reason for the higher rates of growth in either academic domain is that children in these problem behavior profile types (in particular, types 3 and 5) started out the year with extremely low baseline literacy scores and, therefore, had more room for improvement across the year.

Possible explanations for the differences in rates of change across the year could be that classroom teachers were more likely to identify these specific subgroups of children and implement instructional practices to attend to their academic and behavioral needs. This explanation might have been the case, especially for children classified within profile type 5 (extremely socially and academically disruptive) who displayed elevated externalizing problems in structured learning and peer interactions. Research suggests that externalizing problem behavior within the preschool classroom is more likely to be identified by teachers and to receive attention within early childhood programs, because it is often disruptive to classroom routines (Campbell, 2002; Fantuzzo et al., 2003).

It is important to note, however, that these statistically significant differences in rates of change relative to the well-adjusted group were small, suggesting that these children maintained their relative disadvantage across the year. Children classified in the problem behavior profile types did not ever reach the academic level of their peers in the well-adjusted profile group. Our follow-up analyses showed that children in all problem profile types started and ended the year with lower literacy and mathematics scores relative to the well-adjusted group, therefore maintaining their initial disadvantage. In fact, as indicated above children with the highest internalizing behavioral needs (i.e., profile type 6) started and ended the year with the lowest literacy and mathematics scores of all children. These findings are concerning given literature documenting negative associations between internalizing behavior, and approaches to learning (Arbeau, Coplan, & Weeks, 2010; Domínguez et al., 2010), early literacy (Fantuzzo et al., 2003), and mathematics (Dobbs, Doctoroff, Fisher, & Arnold, 2006). Problems in structured learning and teacher interactions also have been linked to lower classroom engagement and academic learning (Bulotsky-Shearer et al., 2008; Domínguez et al., 2011; Hamre & Pianta, 2005).

It is of concern that despite a full year of Head Start intervention, children in profile type 6 (many of whom were leaving Head Start to enter kindergarten classrooms) remained at significant risk emotionally, behaviorally, and academically. Research suggests that children displaying problem behavior and academic difficulties at kindergarten entry are at continued risk for poor school adjustment (Booth-LaForce & Oxford, 2008; Bub et al., 2007; Duncan et al., 2007; Grimm et al., 2010; Hughes & Coplan, 2010). In our study, children displaying extremely socially reticent and withdrawn behavior, as well as problems initiating and engaging effectively within structured learning and teacher interactions, were at greatest risk for failing to acquire literacy and mathematics skills needed to establish a strong foundation for kindergarten success. This pattern is concerning given research in Head Start programs suggesting that children with internalizing behavioral needs are systematically under-identified and least likely to be referred for intervention services (Fantuzzo et al., 2003; Lopez et al., 2000). Despite being at risk for poor academic readiness, children exhibiting emotional and behavioral problems within early childhood programs, particularly those who are shy or withdrawn, may be least likely to be identified and referred for intervention.

4.3. Limitations and future directions

The present study advances our understanding of the academic trajectories of subgroups of children exhibiting distinct profiles of emotional and behavioral needs within routine Head Start classroom situations. However, it is important to acknowledge our study limitations. First, the purpose of our study was to examine these academic trajectories for a population of urban-residing low-income children. Therefore, our findings are limited to a predominantly African American urban Head Start population in the Northeast. Future research is needed to investigate the generalizability of our findings to other ethnically and linguistically diverse groups of children in other geographic regions.

In addition, our study relied on teacher reports of preschool problem behavior and teacher observations of literacy and mathematics skills across the year. We specifically chose teacher measures that had extensive validity evidence supporting their use with populations of low-income preschool children (Rogers, 1998; U.S. DHHS, 2002). Within schools, teachers are one of the most reliable sources for providing summative observational assessments of children's behavior and learning (McDermott, 1986). However, it is important to acknowledge that when teacher measures are used to assess qualities of the children, characteristics of teachers themselves may contribute to children's ratings (Hamre, Pianta, Downer, & Mashburn, 2007; Mashburn, Hamre, Downer, & Pianta, 2006). The amount of assessor variance (versus child variance) attributed to teachers can be substantial with teacher-administered assessments (Waterman, McDermott, Fantuzzo, & Gadsden, 2012). In addition, we must acknowledge the potential limited content validity for the use of the COR to assess literacy and mathematics skills given the relatively small number of items on each of its scales, which could affect the COR's sensitivity to detect change over time in skill development. Future studies should incorporate a multi-method, multi-informant approach including ratings of children's behavior from additional sources, direct observation of classroom behavior, and direct assessments of academic outcomes (American Educational Research Association (AERA), American Psychological Association (APA), & National Council on Measurement in Education (NCME), 1999; Lidz, 2003; Nuttall, Romero, & Kalesnik, 1999).

Additionally, studies could examine stability and change in the composition of latent profile types across the preschool year using latent transition analysis, a longitudinal extension of LPA. Latent transition analysis would permit examination of which children "stay in" or "move out" of profile groups over time (Kaplan & Walpole, 2005; Nylund, 2007). It would be important to use latent transition analysis to identify factors (both within the child and within the classroom) that promote children's movement among profile types (Asparouhov & Muthén, 2008). In these analyses, potential child- or classroom-level protective factors could be examined to determine whether they predict the probability of children's transition into more adjusted behavior profile types. Early childhood research highlights the importance, for example, of high-quality classroom practices (such as emotionally supportive and instructionally stimulating interactions) to children's social outcomes (Howes et al., 2008; Mashburn, 2008; Mashburn & Pianta, 2006). For children demonstrating behavior problems, classroom quality–in particular classroom process quality–can serve as a protective factor (Hamre & Pianta, 2005). When children with behavior problems establish a warm, sensitive, and supportive relationship with their teachers they have better work-habits and fewer disciplinary infractions, as well as decreases in internalizing and externalizing behavior (O'Connor, Dearing, & Collins, 2011; Silver, Measelle, Armstrong, & Essex, 2005). In addition, emotionally supportive practices and well-organized classroom routines can buffer the negative associations between problem behavior and approaches to learning (Domínguez et al., 2011) and academic skills for temperamentally difficult children (Curby, Rudasill, Edwards, & Pérez-Edgar, 2011; Hamre & Pianta, 2005). These effects are most pronounced for low-income children (Magnuson, Ruhm, & Waldfogel, 2007).

4.4. Implications for policy and practice for schools psychologists working with early childhood programs

The present study underscores the importance of early identification of problem behavior within routine classroom interactions for low-income preschool children. Using a contextually relevant, multidimensional assessment such as the ASPI provides the opportunity for early childhood programs to assess multiple dimensions of problem behavior within social interactions and academically-focused activities. Most importantly, use of such tools provides a means for teachers, disability specialists, and school psychologists to identify specific subgroups of children exhibiting unique patterns of co-occurring behavioral needs within the preschool classroom context.

In addition, findings can inform the development of interventions that are individualized to the unique academic and behavioral needs of children within each profile type. By the end of the preschool year, it was clear that despite overall positive rates of change in academic skills, "business as usual" (e.g., the daily curriculum provided within the classroom) was not sufficient to support "catch up" for children classified within problem behavior types. Each of these groups exhibited distinct and unique patterns of emotional and behavioral needs within specific classroom situations that might require specialized intervention approaches targeted to children's type of behavior and situational need. However, future studies are needed to examine the efficacy of such targeted interventions for specific groups of children. For example, those children exhibiting high levels of externalizing problem behavior within peer interactions and structured learning situations might benefit most from interventions that reinforce positive behavior or that teach social skills strategies to improve self-control, emotional regulation, and communication skills (Domitrovich, Cortes, & Greenberg, 2007; Fox, Dunlap, Hemmeter, Joseph, & Strain, 2003). For children exhibiting extremely or moderately disengaged behavior within learning or teacher interactions, other approaches might be beneficial. They include social skills training or the assistance of a "play buddy" to encourage social participation with peers and scaffold learning through peer-mediated activities (Fantuzzo, Manz, Atkins, & Meyers, 2005; Fantuzzo et al., 1996). The development of interventions targeting the emotional, behavioral, and academic needs of children is greatly needed, particularly for those children displaying problem behavior within the context of structured learning and peer-mediated learning contexts.

Finally, the ASPI latent profile types derived in the present study can be used to support teacher professional development and consultation efforts by school psychologists within early childhood programs serving children living in low-income families. Teachers can use the profile types to observe and better understand patterns of problem behavior as they occur within their classroom. Professional development and consultation support can be developed that promote teachers' understanding of children's behavioral needs, within the context of the resources and demands of classroom situations (Downer et al., 2010). This ecological approach to intervention provides an opportunity to support teachers' efforts to modify the classroom environment and promote children's adaptive behavior, and therefore, more successful engagement in the learning opportunities present. Once teacher professional development interventions are developed, the efficacy of these interventions should be tested to unpack which specific types of strategies are most effective for what group of children. Presently there is a push to identify which types of interventions work, for whom, and under which circumstances (Raudenbush, 2005, 2011). Using these latent profile classifications as a stepping stone to examine intervention effects would be beneficial to inform future early intervention efforts that can reach more low-income children within school settings.

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