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Peer Play as a Context for Identifying Profiles of Children and Examining Rates of Growth in Academic Readiness for Children Enrolled in Head Start

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PEER PLAY AS A CONTEXT FOR IDENTIFYING PROFILES OF CHILDREN AND EXAMINING RATES OF GROWTH IN ACADEMIC READINESS FOR CHILDREN ENROLLED IN HEAD START

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Head Start has a unique opportunity to alleviate the negative effects of poverty in young children prior to entry into formal schooling. Research has shown that early interventions are most successful when they have a comprehensive focus that is individualized to children's needs. In order to maximize children's early experiences in Head Start, research must identify what types of early learning experiences work best for specific groups of children. The present study employed a child-centered approach to identify profiles, or subgroups, of children displaying early patterns of peer play behaviors in an ethnically and linguistically diverse Head Start program and examined the academic trajectories of these children during one school year. Four profile groups of children were identified with most children represented in a group of children who engaged in behaviors that facilitated quality interactions with peers. Children in this profile had the highest academic skills throughout the school year. Interestingly, children in a profile characterized by a combination of play interaction skills and play disruption had the second highest academic skills throughout the year compared to children in a profile characterized by below average play interaction skills but little disruptive behavior during play. A small number of children were represented in a profile

characterized by high problems interacting with peers; these children had the lowest academic skills throughout the year. The associations between the profiles of peer play behaviors and academic skills were present at the beginning of the year and remained stable across the year (i.e., all children displayed the same rates of growth). These findings have implications for future research and educational practice surrounding the utility of play in the Head Start classroom to improve academic learning.

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Introduction: Chapter 1

Children from low-income families are at risk for poor school adjustment due to multiple stressors associated with living in poverty (e.g., family stress, lack of desirable housing, exposure to community violence; Duncan, Brooks-Gunn, & Klebanov, 1994). Early intervention programs, such as Head Start, have the potential to alleviate these school related risks of poverty (Lee & Burkam, 2002; Shonkoff & Phillips, 2000). Research has shown that such interventions are most successful when they are comprehensive and flexible in order to meet each individual child's specific needs (Ramey & Ramey, 1998). Since its inception, Head Start's comprehensive intervention approach has focused on promoting the development of the whole child (Zigler & Bishop-Josef, 2006). Head Start provides educational, health, and social services to low-income, children and their families with the goal of promoting children's development across multiple domains including cognitive, social, emotional, and physical. Specifically, Head Start performance standards mandate that classrooms must utilize social interactions to support each child's cognitive and language skills by "using various strategies including experimentation, inquiry, observation, play and exploration" (1304.21 (a) (4) (i); USDHHS, 2006, p.70).

Developmental theory and research suggest that peer play in the preschool classroom is a naturally occurring context through which children acquire knowledge and skills (Coplan & Arbeau, 2009; Singer, Golinkoff, & Hirsch-Pasek, 2006). A growing body of research conducted in Head Start classrooms provides concurrent and longitudinal evidence for the positive associations between behaviors that facilitate peer play and language and mathematics skills in preschool, kindergarten, and third grade

(Bulotsky-Shearer, Bell, Romero & Carter, 2012; Fantuzzo, Sekino, & Cohen, 2004; Hampton & Fantuzzo, 2003; Mendez & Fogle, 2002). However, more research is needed to confirm this association in an ethnically and linguistically diverse Head Start program and to extend these findings by examining the influence of these behaviors on trajectories of academic growth. The current study employed a child-centered approach by utilizing peer play as a context to identify profiles, or subgroups, of children who displayed specific patterns of behavior using latent profile analysis (LPA) in a sample of culturally and linguistically diverse children enrolled in Head Start. In addition, this study examined the initial academic skills and academic trajectories of these profiles of children across one year of Head Start using latent growth curve analysis (LGCA).

Importance of Peer Play in Preschool

Developmental theories support the notion that children's early social interactions serve an integral role in development. Bronfenbrenner and Morris (1998) state that proximal processes – interactions between the child and his or her environment – are the primary mechanisms through which children develop cognitively and socially. Consistent with this idea, Hamre & Pianta (2007), state that school readiness skills are fostered through children's interactions with teachers as well as with peers, usually through the context of play. For preschoolers, peer play becomes more frequent and complex, providing opportunities for children to understand the connections between words, concepts, and objects in their environment (Coplan & Arbeau, 2009). Children are intrinsically motivated to actively engage in their environment through play (Rubin, Fein, & Vandenberg, 1983). In essence, children "take learning into their own hands" during peer play. Research suggests that this active participation in learning leads to increased

self-regulation, cognitive flexibility, language skills, perspective-taking skills, problem-solving strategies, and creativity (Coplan & Arbeau, 2009). These critical social and cognitive skills are the same skills necessary for learning during classroom instructional activities (Thompson & Raikes, 2007).

Several studies have found that engagement in peer play interactions fosters the development of academic skills, including, literacy, mathematics, and science in preschool and kindergarten (for a review see Fisher, Hirsh-Pasek, Golinkoff, Singer, & Berk, 2011). Research has shown that peer play provides a natural context for practicing languages skills and influences the development of early literacy skills including phonological awareness, rhyming, and vocabulary (Bergen & Mauer, 2000; Fantuzzo et al., 2004; Nicolopoulou, McDowell, & Brockmeyer, 2006). Other research has shown that when children play together, part of their play naturally includes engaging in activities that promote mathematics and science learning (e.g., identifying patterns and shapes, examining spatial relations, and classifying objects) and that this occurs in a majority of their time spent playing (Ginsburg, Pappas, & Seo, 2001). In addition, studies have shown that incorporating opportunities for play into curriculum increases children's understanding of mathematics and science concepts and future mathematics achievement (Arnold, Fisher, Doctoroff & Dobbs, 2002; Ginsburg, 2006; Hampton & Fantuzzo, 2003; Ness & Farenga, 2007, Sekino, 2006).

In summary, there is a great deal of research documenting the important role of peer play in promoting academic achievement, especially in preschool-aged children. However extant research, with a few exceptions, has been conducted in samples of predominantly middle- to high-income, Caucasian children. Our knowledge base about

the associations between engagement in peer play and academic learning is limited for ethnically diverse, low-income children (Bulotsky-Shearer, Manz et al., 2012). Given the critical need to understand the precursors of academic achievement for at-risk children, more research is needed. The current study extended this research by examining the associations between peer play behaviors and academic readiness in a sample of multiethnic, low-income children enrolled in Head Start.

Peer Play Behaviors and Learning

In order to understand how peer play influences learning, it is important to examine the behaviors that characterize children's peer play interactions, such as behaviors that facilitate or interfere with peer play. Behaviors that promote positive engagement in peer play include initiating or joining ongoing play with peers, being cooperative, regulating emotions, resolving conflicts between peers, and complying with peer rules (Cumberland-Li, Eisenberg, & Reiser, 2004; Denham et al., 2003; Ladd & Hart, 1992; Vaughn, 2001). In contrast to these positive peer play skills, there are two distinct types of negative behaviors that may interfere with a child's ability to engage in productive peer play interactions: disruptive play behaviors and withdrawn or disconnected play behaviors (Arnold, Homrok, Ortiz, & Stowe, 1999; Hart et al., 2000; Sekino, 2006; Winsler & Wallace, 2002). Disruptive play behaviors are characterized by overt and relationally aggressive behaviors that actively interfere with peer play, including starting physical fights with peers, taking objects from peers, excluding peers from play, and tattling to the teacher (Arnold, et al., 1999; Wood, Cowan, & Baker, 2002). Disconnected play behaviors are characterized by a lack of engagement in play with peers either due to the child being withdrawn, solitary, passive, socially anxious, or

fearful (Hart et al., 2000). These children often play alone or anxiously hover around the play of their peers (Hart et al., 2000).

Research in Head Start conducted by Fantuzzo and colleagues has examined associations between these peer play behaviors and children's academic outcomes. In collaboration with Head Start teachers, Fantuzzo and colleagues conducted careful observations of children's peer play behaviors in Head Start classrooms and created a teacher rating scale of behaviors that facilitated or interfered with play (The Penn Interactive Peer Play Scale, PIPPS; Fantuzzo, Coolahan, Mendez, McDermott, & Sutton-Smith, 1998). Three dimensions of peer play behaviors were derived: Play Interaction, Play Disruption, and Play Disconnection (Fantuzzo, et al., 1998). The Play Interaction scale consists of behaviors that promote the engagement of play, and the Play Disruption and Play Disconnection dimensions consist of behaviors that interfere with engagement in peer play by actively interfering with on-going play or preventing the initiation of play with peers.

Research utilizing this teacher rating scale in Head Start has found evidence that peer play behaviors are associated with children's academic outcomes in preschool, kindergarten, and third grade (Bulotsky-Shearer, Manz et al., 2012). Children who displayed more interactive play behaviors in preschool also performed better on direct assessments of receptive vocabulary and were reported by their teacher as having higher cognitive skills in preschool (Bulotsky-Shearer, Bell et al., 2012; Fantuzzo et al., 2004). In addition, these children received higher grades in several disciplines (e.g., language, mathematics, science, social studies) in kindergarten and demonstrated higher mathematics achievement in third grade (Hampton & Fantuzzo, 2003; Sekino, 2006).

Conversely, children who displayed disruptive or disconnected behaviors during peer play in preschool had lower receptive vocabulary and cognitive skills in preschool, received lower grades in kindergarten, and demonstrated poorer reading and mathematics achievement in third grade (Fantuzzo et al., 2004; Hampton & Fantuzzo, 2003; Sekino, 2006).

These studies provide evidence for the concurrent and longitudinal influence of peer play behaviors in preschool on academic outcomes. More research is needed to replicate these findings and to extend our understanding of the influence of peer play behaviors, particularly on academic readiness skills for a culturally and ethnically diverse population of Head Start children. The present study extended this research in two important ways. First, initial research was conducted within one specific School District Head Start program in the Northeast, serving a population of predominantly African American children. The present study extended this research to include a different urban Head Start program in the Southeast, serving a diverse population of both African American and Hispanic/Latino children. Second, although prior research examined longitudinal associations between preschool peer play behaviors and academic outcomes, none of the studies has examined children's growth in academic skills over time. The present study examined the influence of early patterns of peer play behaviors on *rates of growth* in a comprehensive set of academic skills across one year of Head Start.

Child-Centered Approach to Developing Profiles of Peer Play Behaviors

This study utilized a child-centered theoretical and statistical approach to examine peer play behaviors. In a child-centered approach, behavior is examined at an individual child level with each child displaying a specific pattern of behavior (Bergman & Trost,

2006). This approach is in contrast to a variable-centered approach in which associations among variables such as measures of children's behavior and specific academic outcomes are examined (Beg, Casey, & Saunders, 2007). In a child-centered approach, children who display similar patterns of behavior are grouped into profiles (Bulotsky-Shearer, Fantuzzo, & McDermott, 2010). These profiles represent within-child variation in behavior that reflect children's unique profile of strengths and needs observed by teachers in the classroom (Curby et al., 2010). Peer play behaviors constitute a set of behaviors that may vary within children. A child-centered statistical approach can reveal the network of relationships among patterns of peer play behaviors within children (Curby et al., 2010). For this specific study, the interactive nature of behaviors that promote peer play as well as behaviors that interfere with peer play were examined, and profiles of children's peer play behaviors were identified.

One way to statistically identify profiles of children based on dimensions of behavior is through cluster analysis (Aldenderfer & Blashfield, 1984; Bergman & Magnusson, 1997). In a doctoral dissertation, Sekino (2006) used this technique to identify groups of children based on their peer play behaviors and examined how these groups differed on their preschool and third grade social and academic outcomes. In a sample of 737 predominantly African-American children enrolled in an urban Head Start program in the Northeast, Sekino (2006) identified six profiles of children using the three dimensions of the Penn Interactive Peer Play Scale (PIPPS; Fantuzzo et al., 1998). Longitudinal findings from this study suggested differential outcomes among these preschool profiles of peer play behaviors. Specifically, Sekino (2006) found that children who displayed lower disconnected behavior during play and average or above average

play interaction skills, had better social outcomes in preschool and better reading and mathematics achievement outcomes in third grade than children who were categorized in types characterized by high disconnected play behavior. This study shows the importance of identifying children's peer play behaviors because these early patterns of behavior continued to be associated with children's learning longitudinally into third grade. It is necessary to extend these findings by examining the nature and prevalence of profiles of children in a more diverse sample of Head Start children.

A second way to statistically identify subgroups of children based on behavior is through latent profile analysis (LPA; Muthén & Muthén, 2000; Vermunt & Magidson, 2002). While cluster analysis and LPA have similar objectives, there are a few distinctions that make LPA a more efficient and statistically verifiable technique. Cluster analysis uses observed variables when creating groups of children making the estimation of these groups scale-dependent. LPA uses latent variables in which measurement error is partitioned from within-class variance creating estimates that are not dependent on the scale of measurement (DiStefano & Kamphaus, 2006). In addition, cluster analysis has been criticized for the lack of availability of statistical indices that help determine the final solution for the number of identifiable groups, making it susceptible to researcher subjectivity (Steinley, 2003). In contrast, there are a number of statistical indices available in LPA that can be used to objectively determine the appropriate final solution for the number of profiles (DiStefano & Kamphaus, 2006).

In summary, LPA is a recommended statistical technique because it controls for measurement error when determining profiles and provides objective statistical fit indices to help determine the number of profiles derived from the data. To date, there are no

studies that have utilized LPA to identify profiles of children based on peer play behaviors. The present study extended this research by identifying profiles of children based on their peer play behaviors using LPA in an ethnically and linguistically diverse population of Head Start children and determined how these profiles differ in their academic readiness.

Examining Precursors to Academic Achievement

Academic school readiness encompasses multiple domains of learning that are considered precursors to academic achievement (Blair, 2002; Kagan, Moore, & Bredekamp, 1995). Two academic school readiness domains consistently emphasized in early childhood are early literacy and mathematics. Because reading and mathematics are critical areas for academic achievement, it is important to examine skills that are considered precursors to learning in these domains. Early literacy skills evident in preschool include phonological awareness, letter knowledge, and the use and understanding of language that are precursors to future achievement in reading and writing (Whitehurst & Lonigan, 1998). Early literacy skills have been found to be predictors of children's future school achievement and to serve as protective factors for children at risk for poor academic outcomes (Burchinal, Roberts, Zeisel, Hennon, & Hooper, 2006; Burchinal, Roberts, Zeisel, & Rowley, 2008). Early mathematics skills include general knowledge of numbers such as knowing the names of numbers as well as the cardinal and ordinal properties of numbers (Kagan et al., 1995). These skills have been strongly and directly linked to later mathematics achievement as well as achievement in other domains, such as reading (Duncan et al., 2007; Jordan, Kaplan, Ramineni, & Locuniak, 2009).

While previous studies have examined the influence of peer play behaviors on literacy and mathematics, the present study was the first study to examine associations between peer play behaviors and preschool science. Preschool science has recently been defined as its own domain of academic school readiness, distinct from general cognition or knowledge (Greenfield et al., 2009). Preschool science encompasses three content areas (life, earth/space, and physical/energy science) as well as a several process skills (e.g., observing, questioning, predicting, and reflecting; Greenfield et al., 2009). While a relatively underexplored domain in early childhood education, preschool science provides a unique context for learning because it capitalizes on young children's natural curiosity about their world (Eshach & Fried, 2005). Similar to play, preschool science provides a context for active exploration and analysis of a child's environment and has been found to promote "domain-general" skills that can support learning in other domains of school readiness, such as literacy and mathematics (Greenfield et al., 2009).

Examining Academic Growth Trajectories

Longitudinal examinations can provide a richer understanding of how peer play behaviors influence children's academic skills as compared to cross-sectional models which examine concurrent or short-term predictive associations. Statistically, latent growth curve modeling of academic skills controls for children's initial status upon school entry and identifies the rate of improvement children experience during their time in the classroom (Singer & Willet, 2003). By utilizing growth curve modeling, the present study examined both the academic skills that children had at the beginning of the year and examined change in these skills throughout the year. Therefore, we were able to statistically compare the academic trajectories of children across profiles classification

(reflecting early patterns of peer play behaviors) to determine if there were differential associations between patterns of peer play behaviors and children's initial status as well as change in academic skills across the Head Start school year. Previous research in Head Start has found that children experience significant growth in literacy and mathematics across the preschool year (Bell, Greenfield, & Bulotsky-Shearer, 2013; McDermott et al., 2009). Currently, there are no published studies examining growth in preschool science skills, most likely due to the lack of available measurement of preschool science achievement (Greenfield et al., 2009).

Present Study

The present study extended existing research in at-risk, low-income children by examining the associations between peer play behaviors and academic readiness in an ethnically and linguistically diverse population of children, in a large urban Head Start program in the Southeastern U.S. This study had two specific research objectives:

(1) To empirically identify profiles of Head Start children based on their peer play behaviors using a child-centered approach.

This study extended the work of Sekino (2006) by examining the nature and prevalence of profiles of children based on their peer play behaviors using LPA. Because LPA is a more parsimonious analytical technique than cluster analysis (DiStefano & Kamphaus, 2006), it was expected that fewer profiles would be identified. However, based on the results of Sekino (2006), it was expected that most children would be categorized into a "normative" profile, characterized by average or high play interaction and few behaviors that interfere with play. In addition to this "normative" profile, it was

expected that two or more profiles would be characterized by children who display moderate to high levels of behavior that interfere with play.

(2) To examine whether these profiles of children are differentially associated with growth in a comprehensive set of school readiness domains.

Growth in science, mathematics, and literacy was modeled using latent growth curve analysis (LGCA). Based on previous research (Fantuzzo et al., 2004; Sekino, 2006), it was expected that children in the "normative profile" or any profile characterized by high play interaction at the beginning of the school year would have higher initial academic skills and would experience faster rates of growth in science, mathematics, and literacy across the school year. In contrast, it was expected that children in profiles characterized by behaviors that interfere with peer play, particularly children who display high disconnected play behaviors, would experience lower rates of growth in literacy, mathematics, and science. Finally, differential influences of peer play behaviors on the domains of mathematics, literacy, and science were examined to determine if these behaviors influence these three academic domains in distinct ways. Because this was the first study examining the influence of peer play behaviors on science, mathematics, and literacy, these analyses were exploratory.

Chapter 2: Method

Participants

This study took place within a larger research project conducted in a Head Start program serving an ethnically diverse, low income population in a large urban city in the Southeastern U.S. Ninety-one classrooms across 20 Head Start centers participated in the project. Approximately 10 children were randomly selected, stratified by age and gender, from each classroom to participate in data collection. The remaining 10 children in the classroom were available to be used as alternates if the originally selected children could not be assessed. The final sample consisted of 908 children. The average age of children at the beginning of the school year was 48.9 months (SD = 6.78). Half of the children were female (50%). Children in the sample were predominantly Black or African American (54%) and Hispanic or Latino (45%) with a small percentage of children identified as Other (1%). In addition, there were a significant number of children who were identified as dual-language learners (33%).

In the 91 classrooms, 98% of the lead teachers were female. The average age of the teachers was 46 years (*SD* = 10.63) but ages ranged from 24 to 70 years. Ninety-five percent of teachers reported their ethnicity; most of the teachers were Hispanic (55%) and African-American (40%) with 3% Caucasian and 2% other ethnicity. Ninety-seven percent of teachers reported their years of experience and education. On average, teachers had 13.5 years of experience (*SD* = 7.90), and this ranged from 1 to 35 years. Most teachers reported having a Bachelor's degree (54%) or an Associate's degree (34%), and 9% of teachers reported having a Master's degree

Procedure

Approval for this study was obtained from the director of Miami-Dade County Head Start, the Miami-Dade County Head Start Parent Policy Council, and the University of Miami's Institutional Review Board. In the spring of 2011, the University of Miami research team and the director of Miami-Dade County Head Start recruited Head Start centers to participate in this project. Demographic information for all children was obtained through center records. All direct assessments of academic readiness skills were conducted in English due to the lack of appropriate assessments available in Spanish (Espinosa, 2005). In early fall, children were screened for their English language proficiency based on the criteria described below. In this specific study, 126 children who were originally sampled were determined to lack English proficiency and were replaced by alternates of the same sex and within the same age group.

Data collection for this project occurred in three waves (fall, winter, and spring). Prior to the fall wave of data collection, a team of research assistants were trained to reliably conduct direct assessments with the children. Once the screening process and staff training was completed, children were assessed on their science knowledge using the Preschool Science Assessment (PSA, Greenfield et al., 2013). Immediately following this assessment, children were assessed on their mathematics and literacy skills using the Learning Express (LE; McDermott et al., 2009). In October, teachers were given a packet of questionnaires containing a rating scale of children's peer play behaviors, the Penn Interactive Peer Play Scale (PIPPS, Fantuzzo et al., 1998). Packets contained a cover letter with information regarding the purpose of the questionnaire as well as very clear instructions for how to complete the questionnaires. The questionnaires were labeled with

each participating child's name. In addition, research staff distributed the packets, verbally explained how to complete the packet, pointed out the cover letter with written instructions, and answered any remaining questions. Teachers were given one week to fill out the packets. Upon, completion, teacher received a gift card in appreciation for their time. In the winter and spring of the school year, children were again assessed on their science, mathematics, and literacy skills.

Measures

Peer play behaviors. The teacher version of the Penn Interactive Peer Play Scale (PIPPS; Fantuzzo, et al., 1998) was used to assess children's peer play behaviors within the classroom at the beginning of the preschool year. The PIPPS-T is a 32-item rating scale used to measure common play behaviors that facilitate or interfere with prosocial peer interactions in the classroom. Teachers rate each item on a 4-point likert-scale (Never, Seldom, Often, Always). The PIPPS-T was developed in collaboration with Head Start parents and teachers specifically for use with low income, urban Head Start children. Construct validity studies of the PIPPS-T have revealed three dimensions: Play Interaction, Play Disruption and Play Disconnection, each demonstrating high internal consistency (Cronbach's alpha = .92, .91, and .89, respectively). For the present study, raw score totals for each of the three dimensions were created based on the published factor structure, and the total scores were converted to standardized *T* scores based on the normative sample of Head Start children (Fantuzzo et al., 1998).

Items on the Play Interaction scale reflect prosocial, creative, and cooperative behaviors that facilitate successful peer play interactions, such as "shares toys with other children," "helps settle peer conflicts," "encourages others to join play," "comforts others

who are hurt or sad," "verbalizes stories in play," "shows positive emotions in play," and "shows creativity in making up play stories and activities." Items on the Play Disruption scale reflect aggressive and antisocial play behaviors that interfere with play interactions, such as "starts fights and arguments," "does not take turns," and "disrupts play of others." Items on the Play Disconnection scale reflect withdrawn and avoidant play behaviors that are characterized by a lack of play interactions, such as "hovers outside play group," "wanders aimlessly," and "confused in play." Convergent and divergent validity has been established using direct observations of play, peer sociometrics, and measures of learning behaviors, temperament, emotion regulation, psychological adjustment, and social skills (Coolahan et al., 2000; Fantuzzo et al., 1998; Mendez, McDermott, & Fantuzzo, 2002).

English language screener. Prior to conducting direct assessments, children were screened for their English proficiency using the PreLAS2000 (Duncan & De Avila, 1998). The PreLAS2000 is an individually administered norm-referenced test consisting of five subscales that measure children's receptive and expressive language skills, syntax, vocabulary, and command of grammatical phrases. For the present study, the first two subtests were used: "Simon Says" and "Art Show" to screen for minimal English proficiency in receptive and expressive English language skills. According to the published manual, reliability for the PreLAS2000 is high with a Cronbach's alpha of .88 for "Simon Says" and .90 for "Art Show" (Duncan & De Avila, 1998). The two subscales of the PreLAS2000 consist of a total of 20 items, yielding a total observed score ranging from 0 to 20. There are no current guidelines for determining the level of English proficiency required in order for children to be assessed in English (Rainelli, Bulotsky-Shearer, & Fernandez, 2011; Wolf, Farnsworth, & Herman, 2008). Therefore, the

research team determined a cutoff score that was most appropriate for this particular study. Due to the likelihood that a large proportion of children in this sample would be dual language learners, the cutoff score for children to be proficient enough to be tested in English was a total score of 5 or more. While this cutoff score is fairly low, it was justified by the use of growth analyses to determine their growth in academic skills in English across the year. In addition, all analyses were conducted while controlling for children's status as a dual language learner. Setting the cutoff score at 5 allowed for children who were dual-language learners to be appropriately represented in this sample.

Science. Science content knowledge and process skills were directly assessed using the Preschool Science Assessment (PSA; Greenfield et al., 2013). The PSA is an Item-Response-Theory (IRT)-based test designed to assess science school readiness in Head Start preschoolers. The conceptual framework for this assessment is composed of three content areas (Life Science, Earth and Space Science, and Physical and Energy Science) as well as eight process skills (Observing, Describing, Comparing, Questioning, Predicting, Experimenting, Reflecting, and Cooperating). Items were created based on this content analysis and were reviewed by a panel of experts in preschool science. After two phases of pilot testing of items in two separate samples of Head Start children Miami-Dade County, a set of 76 items were selected for the final measure representing varying difficulty levels and covering the science content areas and process skills derived from the content analysis.

The PSA is conducted in a flipbook format where one side of the book contains pictures visible to the child and the other side contains prompts for the instructor. A trained assessor administers items verbally and the child responds by pointing to pictures,

verbalizing, sorting, sequencing, and measuring. A total score is calculated and converted into an ability score through IRT analyses. Convergent and divergent validity for the PSA has been established using teacher-rated science readiness, direct assessments of literacy and mathematics, and teacher-rated adaptive and problem behavior (Greenfield et al., 2013). In addition, preliminary analyses indicate that this assessment is sensitive to detect growth in Head Start preschoolers' science school readiness across a school year (Greenfield et al., 2013).

Literacy and mathematics. Literacy and mathematics skills were directly assessed using the Learning Express (LE; McDermott, et al., 2009). The Learning Express is an Item-Response-Theory (IRT)-based test designed to detect growth of cognitive competencies in the Head Start population. The content of the test is based on national and regional standards for academic school readiness. A total of 325 items were created and divided between two equivalent forms, each containing items in four subscales: Vocabulary, Mathematics, Listening Comprehension, and Alphabet Knowledge. Items in each subscale are ordered by difficulty according to results from 2-parameter IRT analyses. The number of items administered to the child is determined by basal and ceiling rules. In the present study, raw score totals on each of the four subscales were converted into ability scores derived from IRT analyses.

In a large, ethnically-diverse Head Start sample, ages three to five, the Learning Express demonstrated high internal consistency across subscales and across measurement occasions (composite internal consistency estimates were .98 for Alphabet Knowledge, .96 for Vocabulary, .93 Listening Comprehension, and .96 Mathematics). This measure was also sensitive in detecting both a wide range of individual differences among Head

Start preschoolers and growth within the course of one preschool year after controlling for children's age, sex, language status, and prior preschool experience. Convergent and divergent validity for the measure was indicated by significant correlations between the four subscales and teacher ratings of related school readiness domains using the teacher ratings of children's literacy, mathematics, and science skills, as well as direct assessments of early reading ability, receptive vocabulary, and early mathematics ability (McDermott et al., 2009).

Data Analytic Strategy

Prior to analyses, all variables of interest were examined for outliers, homeoscedasticity, skewness, and kurtosis. After data were examined, a series of structural equation models (SEM) were conducted using the software Mplus Version 6.0 (Muthén & Muthén, 1998-2010). SEM was chosen as the most appropriate data analytic strategy due to its ability to empirically identify latent profiles of children based on observed variables, to model growth by creating latent intercept and growth parameters, and to examine predictors of intercept and growth parameters (Kline, 2005). In addition, SEM allows for all analyses to be conducted while accounting for the nested (or hierarchical nature) of the data (Iacobucci, Saldanha, & Deng, 2007). Children in the proposed study were nested within classrooms violating the assumption of independence between observations and thus making non-nested analyses biased (Raudenbush & Bryk, 2002). In all analyses, a sandwich estimator was used to account for this bias by adjusting the standard errors of the parameters as would be done within a multilevel framework (Muthén, du Toit, & Spisic, 1997). Finally, missing data were accounted for in the models using full information maximum likelihood (FIML; Hancock & Mueller, 2006;

Kline, 2005). FIML uses all available data for each case when estimating parameters and has been shown to be unbiased when data are missing completely at random (MCAR; Enders & Bandalos, 2001).

(1) To empirically identify profiles of Head Start children based on their peer play behaviors, controlling for child demographics. A Latent Profile Analysis (LPA) was conducted in SEM to empirically derive profiles of children based on their peer play behaviors. LPA identifies patterns of relationships among variables and categorizes individuals who display similar patterns of behavior into homogenous groups (Giang & Graham, 2008). Using an iterative estimation function, LPA assigns children to latent profile groups until an optimal number of distinguishable groups are identified. A series of model fit indices were used to compare the fit of various models with increasing numbers of profiles. An optimal solution was determined when a minimal number of profiles were identified while achieving an acceptable model fit (Distefano & Kamphaus, 2008). LPA was conducted in a series of steps. First, a model with only one group was estimated. Then a model with two groups was estimated and compared to the model with one group. The number of profile groups estimated was then added incrementally until the model fit indices indicated that adding one more group did not significantly improve model fit. There are four fit indices for LPA that were used to compare the fit of each model estimated.

The first two model fit indices were the Akaine information criteria (AIC) and the Bayesian information criteria (BIC; Vermunt & Magidson, 2002). For each model, AIC and BIC values were provided, and lower values indicated better model fit (Muthén & Muthén, 1998-2010). When these values no longer declined with the addition of another

group, this indicated that an optimal solution had been achieved. A third index used was entropy, which is the average probability that each individual is correctly classified into a specific group (Distefano & Kamphaus, 2008). The entropy value indicated how accurate the specified model was predicting children's classification in the latent profile groups. Entropy values closer to 1.00 indicate better classification accuracy (Distefano & Kamphaus, 2008). Finally, a likelihood difference test, the Vuong-Lo-Mendell-Rubin (VLMR; Lo, Mendell, & Rubin, 2001), tested the difference in fit between the two models and provided a *p* value to indicate if this difference was statistically significant. A *p* value greater than .05 indicated that the model fit of the current model was not significantly different from the model with one less group, and the more parsimonious model (i.e., the model with fewer groups) should be retained (Herman, Ostrander, & Tucker, 2007).

For this study, children's *T* scores on the three dimensions of the PIPPS (Play Interaction, Play Disruption, and Play Disconnection) were used to categorize children into latent profiles. The four model fit indices were utilized to determine an optimal solution for the number of distinguishable profiles in the data. Once an optimal solution was determined, child demographic covariates (age, sex, ethnicity, and dual language learner status) were entered as predictors of profile membership. Age was calculated in months. Sex, ethnicity, and dual language learner status were dummy-coded with Male, Black, and non-Dual Language Learner set as the reference groups. Using multinomial logistic regression, regression coefficients for each demographic covariate indicated the increase in log-odds of being in each profile in comparison to a reference profile (Jung & Wickrama, 2008). Based on the examinations of the profiles, the profile considered to be

the most "normative" in the sample (most prevalent) was used as the reference profile. This analysis determined whether children were more likely to be categorized into a specific profile given these demographic covariates. The final LPA is shown in Figure 1.

(2) To examine whether these profiles of children are differentiated by growth in school readiness domains. This aim was carried out in two steps. First, the intercept (initial status) and slope (rates of growth) for science, mathematics, and literacy were determined by conducting a series of latent growth curve analysis (LGCA). LGCA is an advanced SEM technique that considers change over time as a latent process and allows for the examination of individual differences in change over time (Kline, 2005). Data from the three time points of the Learning Express and the Preschool Science Assessment (fall, winter, and spring) were used to estimate the latent variables of the intercept and slope. Separate models were estimated for the three literacy subscales of the Learning Express (vocabulary, listening comprehension, and alphabet knowledge), the mathematics subscale of the Learning Express, and the science scale of the Preschool Science Assessment. For LGCA, 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, if additional fit criteria were adequate, a significant χ^2 test of model fit was still considered acceptable because the statistical significance the χ^2 statistic can be influenced by the sample size (Bollen & Long, 1993). Two additional fit indices were used to assess closeness of fit: the Bentler comparative fit index (CFI; Bentler, 1990), and standardized root mean square residual (SRMR; Hu & Bentler, 1999). Values for CFI greater than .90 and values for the SRMR of .08 or less are considered acceptable and indicated adequate model fit (Hu & Bentler, 1999).

Second, the LGCA and the final LPA, controlling for demographics, were estimated simultaneously in order to examine differences in intercept and slope parameters for readiness outcomes across profiles. A series of pair-wise comparisons were conducted to examine differences in intercept and slope parameters across all profiles; all possible comparisons across all profiles were examined. The Wald Test of Parameter Constraints was used to determine if these differences were statistically significant (Asparouhov, 2007). A *p*-value of less than 0.05 indicated a significant difference in intercept or growth parameters between each set of profiles compared. The final LGCA-LPA is shown in Figure 2.

Additional analyses. The main objectives of this study involved examining peer play behaviors using a child-centered approach. However, to supplement these analyses, a set of analyses examining peer play behaviors using a variable-centered approach were conducted. An LGCA was conducted to model growth in literacy, math, and science in the same way as described previously. The three subscales of the PIPPS were entered directly as predictors of the intercept and slope. The fit of these models was determined using the same tests of model fit described previously. The results of these analyses were examined in conjunction with the results of the analyses using a child-centered approach to compare the information provided by each approach. It was expected that complementary information would be provided by each analytic approach. The final model for the variable-centered analyses is shown in Figure 3.

Chapter 3: Results

Descriptive Statistics

Descriptive statistics can be found in Table 1. All variables were examined for outliers, skewness, and kurtosis. No violations were found. Bivariate correlations are shown in Table 2. Moderate and positive correlations were found between play interaction and all school readiness scores. Small to moderate negative correlations were found between play disconnection and all school readiness scores. Small negative correlations were found between play disruption and most school readiness scores (with the exception of vocabulary).

Latent Profile Analysis

The optimal solution was determined based on multiple fit criteria described previously. Table 3 displays the fit statistics starting at a solution of 1 profile group and ending with a 5-profile group solution. The AIC and BIC statistics continued to decline with each profile addition. The VLMR indicated that adding a third profile did not significantly improve fit for the two-profile model. However, because the AIC and BIC values continued to decline and entropy was still high, a four-profile model was estimated. The addition of a fourth profile did significantly improve model fit and increase entropy. Finally, the addition of a fifth profile did not significantly improve fit and decreased entropy. Therefore, a four-profile solution was considered an optimal solution based on the fit criteria. The four-profile solution also comported best practically and theoretically. The four profiles are described below, and means across profiles are displayed in Table 4 and Figure 4.

1) *High Engagement*[1] *with Peers* (*n* = 624, 70%): Most children in the sample were classified in this profile. Children in this profile group displayed moderately high play interaction (between 0.5 to 1 standard deviations above the mean), below average play disruption (between 0.5 and 1 standard deviations below the mean), and low play disconnection (more than 1.0 standard deviation below the mean).

2) *Below Average Engagement with Peers* (*n* = 137, 15%): This profile represented the second largest number of children. Children in this profile displayed below average play interaction and play disruption (between 0.5 and 1 standard deviations below the mean), and average play disconnection.

3) *Average Engagement and Moderate Disruption with Peers* (*n* = 100, 11%): This profile included the third largest number of children. Children in this profile were characterized by average play interaction, moderate play disruption (between 0.5 to 1 standard deviations above the mean), and below average play disconnection (between 0.5 and 1 standard deviations below the mean).

4) *Low Interaction, Very High Disruption, and Moderate Disconnection* (*n* = 37, 4%): This profile represented the smallest number of children in the sample. Children in this profile were characterized by low play interaction (more than 1.0 standard deviation below the mean), very high play disruption (more than 1.5 standard deviations above the mean), and moderate play disconnection (more than 0.5 standard deviations above the mean).

Next, child demographics were included in the latent profile analysis to determine if profiles were differentiated by child demographics. Table 5 displays the multinomial

[1] For the purpose of labeling the profiles, the term engagement refers to the combination of play interaction and play disconnection.

logistic regression coefficients and odds ratios associated with child demographic variables. Profile 1 (*High Engagement with Peers*) was used as the reference group; therefore, the coefficients represent the probability of being classified in Profile 2-4 compared to Profile 1 given a specific demographic variable. For ethnicity, only comparisons between Hispanic and Black children could be made. Children identified as "other" were not represented in all profiles and caused errors in model estimation. Significant differences were found for child age and sex. Older children were more likely to be represented in Profile 1 (*High Engagement with Peers*) compared to Profile 2 (*Below Average Engagement with Peers*). In addition, girls were more likely to be represented in Profile 1 (*High Engagement with Peers*) compared to Profile 3 (*Average Engagement and Moderate Disruption*). Profiles were not differentiated by ethnicity or dual language learner status.

Latent Profile Analysis and Latent Growth Curve Analysis

First, LGCA were conducted to determine if there was significant variance in children's initial status (intercept) and rates of growth (slope) in academic school readiness[2]. Fit statistics for the five LGCA are provided in Table 6. While three of the χ^2 tests of model fit were significant, all of the values for the CFI and the SRMR were well within the range considered to be good fit to the data. Therefore, it was concluded that the data fit the model well indicating that all children experienced growth in academic school readiness throughout the year. For all academic school readiness outcomes, there was significant variance at the intercept indicating that there was inter-individual variability in where children started out the year in science, mathematics, vocabulary, listening

[2] Half of the children were receiving a science intervention. However, analyses revealed that intervention status did not predict children's initial status or growth in science. Therefore, intervention status was not included as a covariate in the LGCA for science in order to maintain a more parsimonious model.

comprehension, and alphabet knowledge. With the exception of listening comprehension, all models also showed significant variance around the slope, indicating that there was also inter-individual variability in rates of growth in science, mathematics, vocabulary, and alphabet knowledge. For listening comprehension, there was no significant variance associated with the slope. All children experienced the same rates of growth in listening comprehension; therefore, in all of the following models, the variance associated with the slope of listening comprehension was fixed to zero.

Next, the LGCA were estimated simultaneously with the LPA. This was done separately for each outcome. Table 7 provides the means of the intercept and slope for each outcomes across profiles. All comparisons of means across profiles were examined using the Wald Test of Parameter Constraints which provides a *p*-value to indicate a significant or non-significant difference ($p < .05$ was considered statistically significant).

Differences across profiles in initial status. First, the mean intercepts for Profile 1 were compared to the mean intercepts for Profiles 2, 3, and 4. For science, mathematics, listening comprehension, and alphabet knowledge, children in Profile 1 (*High Engagement with Peers*) had the highest intercepts (initial skills) for all five outcomes as compared to children in Profile 2 (*Below Average Engagement with Peers),* Profile 3 (*Average Engagement and Moderate Disruption)*, and Profile 4 (*Low Interaction, Very High Disruption, and Moderate Disconnection)*. For vocabulary, there were no significant differences between Profiles 1 and 2. However, children in Profile 3 and 4 had significantly lower mean intercepts in vocabulary compared to Profiles 1 and 2.

Next, the mean intercepts were compared among Profiles 2, 3 and 4. For science, mathematics, listening comprehension, and alphabet knowledge, children in Profile 3 had

significantly higher mean intercepts than children in Profile 2 and Profile 4. For science, mathematics, and alphabet knowledge, children in Profiles 2 and 4 did not differ on their mean intercepts. For vocabulary, children in Profile 2 had significantly higher initial skills than children in Profile 4. However, for listening comprehension, children in Profile 4 had higher initial skills than children in Profile 2.

Differences across profiles in rates of growth. There were no significant differences across profiles in rates of growth for any of the academic domains. On average, all children experienced growth in academic skills across the year. However, these non-significant differences in growth indicate that children maintained their relative advantage or disadvantage in academic skills throughout the year and ultimately ended the year with the same relative academic standing. In summary, for all academic domains, children in Profile 1 had the highest academic skills throughout the year. Children in Profile 3 had the second highest academic skills, with the exception of vocabulary. Children in Profile 2 had similarly high vocabulary skills to Profile 1; however, they had the lowest skills in listening comprehension across all profiles. Finally, children in Profile 4 had the lowest academic skills across all profiles, with the exception of listening comprehension.

Additional Analyses

Variable-centered analyses were conducted to determine if the three dimensions of peer play behaviors predicted initial status and rates of growth in academic school readiness, controlling for child demographics. Separate models were analyzed for each outcome. Results are displayed in Table 8. The models for mathematics, vocabulary, and alphabet knowledge had excellent fit to the data with non-significant χ^2 test statistics, CFI

values greater than or equal to .99, and SRMR values less than .01. The models for science and listening comprehension resulted in adequate fit to the data. These models had significant χ^2 test statistics; however, they also had CFA estimates greater than or equal to .95, and SRMR estimates less than .07.

Play Interaction positively predicted the intercepts for science, mathematics, listening comprehension, and alphabet knowledge. Children who displayed high play interaction in the fall had higher initial skills in these domains. In addition, Play Disconnection negatively predicated listening comprehension; children who displayed higher play disconnection in the fall had lower initial skills in listening comprehension. Similarly to the child-centered analyses, there were no significant associations between peer play behaviors and rates of growth. Children who displayed play interaction in the fall maintained their academic advantage throughout the year, and children who displayed play disconnection in the fall maintained their disadvantage in listening comprehension throughout the year.

Chapter 4: Discussion

This study extended existing research by capitalizing on Head Start teachers' observations of children during peer play in the classroom to identify latent profiles of children's behaviors during play and their associations with academic trajectories. This study was the first to utilize latent profile analyses to take a child-centered approach in examining the patterns of behavior children display during peer play. This study was also the first to examine associations between peer play behaviors and rates of growth in academic readiness during one year of Head Start. Results identified four profiles of children. As hypothesized, most children were categorized into a "normative" profile displaying strengths engaging with peers, and higher science, mathematics, and literacy skills at the beginning of the school year. Interestingly, when comparing the academic skills of children who were categorized in the non-normative profiles, children categorized in a profile simultaneously displaying average play interaction skills and above average disruption during play had better academic skills than children in a profile displaying below average play interaction skills but very little disruption during play. Finally, there were no differences among the four profiles in rates of growth in academic skills across the Head Start school year. Children in each profile maintained their relative academic advantage or disadvantage throughout the year. In other words, the associations between the profiles of peer play behaviors and academic skills were present at the beginning of the year and did not change across the year. Implications for these results are discussed below.

Profiles of Children's Peer Play Behaviors

In this sample of children, four distinct profiles of children were identified based on the behavior they displayed during play with peers. As expected, a large majority of children were classified into a profile of children who display behaviors that promoted "*High Engagement with Peers*" (Profile 1). Most children were rated by their teachers as consistently displaying behaviors that facilitate peer play, such as taking initiative in engaging peers, being creative during play, and problem-solving during play. These children were rarely or never disruptive with or disconnected from peers. This finding is consistent with previous research and theory highlighting that the ability to engage in play with peers as an important and normative developmental milestone at this age (Coplan & Arbeau, 2009; Sekino, 2006).

Approximately a third of children in this sample were classified into one of three profiles characterized by moderate to severe problems engaging in play with peers. The second largest profile group was characterized by behaviors that indicated "*Below Average Engagement with Peers*" (Profile 2). These children were rated by their teachers as seldom displaying behaviors that facilitate play. However, they were also rated as rarely engaging in disruptive play and sometimes engaging in disconnected play. These children were not highly engaged nor were they causing problems with other children. Identifying this group of children represents a unique contribution because a majority of previous literature focuses on examining children who are considered "high-risk," particularly when examining classroom behavior (Campbell, 2006; Qi & Kaiser. 2003). By utilizing a child-centered approach, this study goes beyond examining either high or low levels of behavior by identifying groups of children whose behavior is closer to the

mean (e.g., not necessarily indicative of high problem behavior or high prosocial skills). In other words, using a child-centered approach permits a more nuanced description of the unique profile of subtle risks that some groups of children might display; this information would not be provided within a variable-centered approach.

The third profile group identified included children characterized by "*Average Engagement and Moderate Disruption with Peers*" (Profile 3). These children were rated by their teachers as often displaying behaviors that facilitate play and also often displaying behaviors that disrupt play, such as overt or relationally aggressive behavior. It is clear that these children were interacting with their peers and were often able to do so successfully; however, there were times when they displayed behaviors that were disruptive during play. In a previous study utilizing a child-centered approach to examine children's behavior in preschool, Bulotsky-Shearer et al. (2010) identified a similar profile type (through the use of cluster analysis) that included children who were characterized by low problem behavior, high interactive play skills, and slightly elevated disruptive behavior during peer play. Despite evidence that peer aggression, both relational and physical, tends to be stable over time (Crick et al., 2006), a recent study conducted in Head Start by Cohen and Mendez (2009) showed that children who displayed moderate disruptive behavior with peers in the fall decreased these behaviors in the spring, implying that children tend to outgrow these behaviors across the school year. In the present study, children who displayed these patterns of behavior may have lacked some regulatory skills at the beginning of the school year that led to occasional disruptive behavior during play; however, it is likely that they adjusted to the social nature of the classroom and displayed disruptive play behavior less frequently throughout the year.

The final profile group represented the smallest percentage of children; these children were characterized as displaying "*Low Interaction, Very High Disruption, and Moderate Disconnection*" (Profile 4). Children in this group did not display behaviors that facilitated play, were often very disruptive with peers, and were disconnected from peers. Teachers rated children in this group as displaying the most difficulty in peer play. This profile of behavior is the most concerning. Previous research in Head Start has found that when children display high levels of both disruptive and disconnected play behaviors, they are the least likely to improve these behaviors during the preschool year placing them at great risk for peer rejection in preschool and elementary school (Cohen & Mendez, 2009).

Differentiating Profile Types based on Academic Trajectories

Examining differences in the academic skills among these four profile groups yielded some expected and unexpected findings. For science, mathematics, and alphabet knowledge, similar patterns of findings among the four profiles were discovered. As expected, children in Profile 1 "*High Engagement with Peers*" started out the year with the highest skills in these domains. Interestingly, children in Profile 3 "*Average Engagement and Moderate Disruption with Peers*" started out the year with the second highest skills in these academic domains. Finally, children in Profiles 2 "*Below Average Engagement with Peers*" and 4 "*Low Interaction, Very High Disruption, and Moderate Disconnection*" started out the year with the lowest skills in these academic domains and were not significantly different from each other. For vocabulary, children in Profile 1 and 2 had equally higher skills, and children in Profiles 3 and 4 had equally lower skills. For

listening comprehension, all profiles were differentiated with children in Profile 1 displaying the highest skills, following by children in Profile 3, Profile 4, and Profile 2.

Prior to exploring the implications of these associations, it is important to note that there were no differential associations among the profiles with regards to rates of growth in academic skills. On average, all children experienced positive growth in all of the academic skills, and each profile group experienced similar rates of growth in all of the academic skills. As we explore the differences in initial skills amongst the four groups, we must also understand that while each group experienced positive growth in academic skills, they ended the year in the same academic standing order that they started the year.

Profile groups and relative academic standing early in the preschool year. Previous research in Head Start supports the finding that children in Profile 1 who displayed many behaviors that facilitated high quality peer interactions also had the highest skills in science, mathematics, and literacy (Fantuzzo et al., 2004; Sekino, 2006). In addition, research supports the finding that children in Profile 4 who display behaviors that are maladaptive during play had the lowest or second lowest skills in science, mathematics, and literacy (Bulotsky-Shearer, Bell et al., 2012; Cohen & Mendez, 2009). A unique contribution of this study emerges when examining the differences in academic skills between Profiles 2 "*Below Average Engagement with Peers*" and 3 "*Average Engagement and Moderate Disruption with Peers.*"

Based on the findings of research examining problem behavior in the preschool classroom, it was expected that children who displayed disruptive behaviors during play with peers would have lower academic skills than children who displayed very few

behaviors that interfered with play (Bulotsky-Shearer, Fanutuzzo, & McDermott, 2008; Fantuzzo et al., 2004). Instead, the results of this study showed that children who displayed disruptive behavior during play and concurrently displayed interactive play behavior that facilitated play displayed higher academic skills in science, mathematics, and literacy skills (with the exception of vocabulary) compared to children who seldom displayed interactive play behavior but also did not engage in behavior that interfered with play. As mentioned previously, Bulotsky-Shearer et al. (2010) identified a similar profile type of children; when examining their learning outcomes at the end the year, these children did not differ from the normative (or well-adjusted) profile type in their teacher-rated cognitive skills. Because children in this study were rated on their behavior toward the beginning of the school year, they may have been adjusting to the social nature of the preschool classroom and at times engaged in disruptive behavior during play, but they had also already acquired skills that helped facilitate interactions with peers. Children in Profile 3 may have been more likely to build on their play interaction skills throughout the year. In contrast, children in Profile 2 started with lower play interaction skills and had more room for improvement; given that these children were also disconnected from their peers, they may have had fewer opportunities to build on their play interaction skills than children in Profile 3.

A series of studies examining disruptive behaviors, such as overt and relational aggression, in the preschool classroom have called into question the conceptual framework positing that disruptive behavior signals some sort of social deficit (Pelligrini, et al., 2007; Underwood, 2003). According to Vaughn, Vollenweider, Bost, and Azria-Evans (2003), the assumption of a negative linear relationship between aggressive or

disruptive behavior and social competence ignores the potential utility of these behaviors in establishing social dominance. In a sample of Head Start children as well as a community sample, Vaughn and colleagues (2003) found that socially dominant children often exhibited aggressive or disruptive behaviors with their peers but also frequently exhibited prosocial, cooperative behaviors. They argued that this wass particularly salient for young children in preschool because socially competent children will develop other strategies to maintain their social status as they get older. The findings of this study, particularly for Profile 3, are in alignment with this conceptualization of the utility of disruptive or aggressive behavior with peers, particularly early in the preschool year.

As mentioned previously, the identification of Profile 2 is a unique contribution of this study. In the current literature examining social skills, having poor social skills is often conceptualized as displaying problem behavior. Instead, children in this profile lacked certain skills by seldom displaying behaviors that facilitated play. These children were also rated by their teachers as sometimes displaying behaviors that contributed to their disconnection from peers. Recent research has identified disconnected peer play behavior as well as shy and withdrawn behavior (often referred to as internalizing behavior problems) as placing children at risk for poor social and academic outcomes (Dobbs, Doctoroff, Fisher, & Arnold, 2006; Fantuzzo, Bulotsky, McDermott, Mosca, & Lutz, 2003). Children who display internalizing behavior problems tend to be academically disengaged in the classroom and often miss out on important learning experiences in the classroom (Hughes & Coplan, 2010). However, because these children are not causing problems in the classroom, such as distracting or disrupting the classroom, the teacher is less likely to intervene (Fantuzzo et al, 2003; Rydell, Bohlin, &

Thorell, 2005). This specific study extends this literature by identifying both a lack of engagement in positive play behaviors in addition to occasionally displaying disconnected play behaviors as risk factors for lower academic skills. In fact, children in this profile group had similar academic skills in all academic domains (with the exception of vocabulary and listening comprehension) to children in Profile 4, who displayed the greatest level of difficulty engaging with peers.

For listening comprehension, children in Profile 2 actually displayed the lowest skills at the beginning of the year. Listening comprehension requires children to listen to a set of increasingly complicated phrases and to respond to a set of pictures that match each phrase. While literature examining associations between behavior and listening comprehension is scarce, a recent study conducted examining bidirectional associations between problem behavior and literacy in Head Start may provide insight into this finding. Domínguez, Bell, Bulotsky-Shearer, and Greenfield (2013) found that children who had difficulties in listening comprehension at the beginning of the preschool year were more likely to display internalizing behavior at the end of the year; the opposite directional association, that fall internalizing behavior predicted spring listening comprehension, was not supported. It is possible that deficits in listening comprehension may be a contributing factor to their inability to engage with peers, rather than a consequence of their peer play behaviors. However, the results of this study are correlational and not causal in nature. Future research would need to examine this possibility.

For vocabulary, a different pattern of results emerged. Children in Profiles 1 and 2, who were rated by their teacher as rarely displaying disruptive peer play behavior,

demonstrated higher vocabulary skills compared to children in Profiles 3 and 4, who more frequently displayed disruptive behavior during play. While a great deal of research has highlighted the importance of vocabulary development, particularly for low-income children, very little is known about how to promote vocabulary development in the preschool classroom (Wasik, 2010). In fact, a review of early literacy programs discovered that very few programs actually increase vocabulary skills in preschool children (Preschool Curriculum Evaluation Research Consortium, 2008). Therefore, it appears that children are more likely to gain vocabulary knowledge informally (Dobbs-Oates, Kadaravek, Guo, & Justice, 2011). It is possible that children who display disruptive play behavior miss out on informal learning experiences that promote vocabulary development; however, more research is needed to understand this finding, particularly examining how vocabulary development is unique from other forms of language and literacy development.

Profile groups and academic growth. This study is the first to examine associations between peer play behaviors and growth in academic skills during preschool. Interestingly, while the profiles differed in terms of their academic skills at the beginning of the school year, they did not differ in the rates of growth that they displayed across the year. Based on theory suggesting that the skills acquired in play are the same ones necessary for academic learning (Thompson & Raikes, 2007), it was expected that children who started out the year displaying behaviors that facilitated peer play would experience faster rates of growth in academic skills. Instead, children who highly engaged with peers started out the year with an academic advantage and maintained that same advantage throughout the year. Children who displayed difficulties engaging in peer

play at the beginning of the school year did not catch up to children who were able to engage with peers.

A notable study conducted by Duncan et al (2007) utilizing several national datasets found no strong associations between early behavioral skills and growth in academic achievement. The conclusion of this research was that early social and emotional skills were not related to future academic achievement. However, a more recent study has called this conclusion into question. By re-analyzing the datasets used in the Duncan et al (2007) study, Grimm and colleagues (2010) determined that associations between behavior and academic skills were study and sample specific, which the authors attributed in part to the different ways that behavior was measured across these studies. Informant-based measures, such as teacher-report, are often used to measure children's behavior. However, the variables created from these measures include variability associated with the child's behavior as well as variability associated with the informant (Konold & Pianta, 2008). Many studies, including this study, have found concurrent associations between informant-based measures of behavior and academic achievement. However, it is possible that teacher-report measures of children's behavior are not sensitive enough to detect associations between behavior and achievement trajectories, due to the introduction of teacher-based variance in children's behavioral ratings. More research is needed to determine the best methods for measuring children's behavior, specifically for examining how early social behavior is associated with future academic achievement.

The findings of this study suggest that the prior conditions that produced the associations between children's peer play behaviors and their academic skills were not

present during the children's year in Head Start. One explanation is that, in these classrooms, there are no purposeful strategies to directly connect children's interactions with their peers and their learning in specific domains of academic readiness. Previous research and theory suggest that children learn domain-general skills, such as cognitive flexibility, perspective-taking skills, and problem-solving skills, which are not specific to any academic domain (Coplan & Arbeau, 2009). It may be necessary for the classroom to be structured to purposefully provide opportunities for exposure to learning skills in the specific domains of science, mathematics, and literacy during interactions with their peers. Early childhood teachers vary in their attitudes and perceptions about their role in promoting peer play in their classrooms (Hadley, 2002; Korat, Bahar, & Snapir, 2003), and teachers naturally vary in how they are involved in scaffolding learning opportunities during children's play in the classroom (Ashiabi, 2007). Therefore, future work could focus on providing teachers with specific strategies and curricula that focus on integrating academic learning into play.

Play among children is unique in that it is occurs naturally and spontaneously; however, it is possible that this unstructured time could be enriched through different strategies, such as scaffolding by the teacher. Future research should critically examine what specifically occurs during peer play in the classroom. If academic learning is occurring during play with peers, what does it look like? Are only some children engaged in this kind of interaction? This kind of research could answer questions about whether or not more focused strategies or curricula utilized by the teacher can enhance play and if this type of intervention could support academic learning during play. There has been recent attention paid to the concept of "guided play" or structured play in which an adult

scaffolds the environment and interactions that occur during play (Massey, 2012; Tsao, 2008). Most of this work has focused specifically on literacy development. For example, Massey (2012) proposed that teachers incorporate storybook reading into guided play in order to enhance children's early literacy development. The teacher guides the play of the child through conversations and language modeling as well as props and other instructional tools (Christensen & Kelly, 2003). There is limited empirical evidence to support the effectiveness of this kind of intervention, particularly for Head Start classrooms and for other academic domains such as mathematics and science. However, the results of the current study point to the need to better understand the nature of play in the Head Start classroom, the role of the teacher in play, and how or if play with peers can be enriched in order to promote specific academic learning.

Variable-Centered Analyses

To complement the child-centered analyses, variable-centered analyses were conducted to determine the associations between the three types of peer play behaviors and growth in children's academic skills. At the beginning of the school year, displaying higher play interaction was associated with better academic skills in all domains except vocabulary. In addition, displaying disconnected play behaviors was associated with lower listening comprehension. Finally, peer play behaviors were not associated with growth in academic skills. While the variable-centered analyses do not provide the nuanced detail about unique patterns of peer play behaviors that is provided in the child-centered analyses, the results generally support the conclusions of the child-centered analyses. First, engagement in behaviors that promote play with peers, or rarely engaging in behaviors that facilitate peer play, is important to consider when examining

associations between peer play behaviors and academic achievement. Second, vocabulary development appears to be unique from the other domains of literacy skills. Third, in these classrooms, engaging in high quality peer interactions does not promote the additional acquisition of academic skills during the school year.

Limitations and Future Directions

While this study had several strengths, there were some limitations that need to be acknowledged. Children's peer play behaviors were measured using a teacher-report of their behavior based on their observations of children during peer play. This measure was developed specifically for use within the Head Start population and allowed for information to be collected on a large sample of children (Fantuzzo et al., 1998). It is important to acknowledge that when teachers rate children on their behavior, characteristics of the teacher also contribute to the variance in children's scores (Konold & Pianta, 2007). As mentioned previously, Grimm and colleagues (2010) point out that using teacher-ratings of children's behavior may not be sensitive enough when examining associations between behavior and future academic achievement or achievement trajectories, due to the introduction of teacher-based variance in children's behavioral ratings. More research is needed to determine how best to measure and capture variability in children's behavior, especially for culturally and linguistically diverse low-income populations, and future research would benefit by incorporating multiple methods of measurement of children's behavior.

Children's peer play behaviors were also measured at one time point at the beginning of the school year. While studies show that more extreme forms of peer disruption and disconnection tend to be stable (Cohen & Mendez, 2009), it is likely that

children's peer play behaviors changed throughout the year as they became more comfortable with their classroom and peers and that teachers ratings of their behavior would reflect this change over time. An important goal in future research would be to examine how these profiles change throughout the year, such as can be done using a Latent Transition Analyses (LTA; Rindskopf, 2010). For example, LTA could determine stability and change in the structural composition of the profiles as well as individual stability and change in children's profile group membership from the beginning to the end of the year. This type of analysis could address the potential hypothesis that the moderate disruption displayed by children in Profile 3 was present at the beginning of the year only, and that these children ended up in the normative profile at the end of the year as they acquired self-regulatory or adaptive skills to support more consistent positive social interactions with peers. In addition, research could examine potential factors that could influence how profiles of behavior change over time, such as the classroom environment, the teacher's beliefs about and involvement in play, and the characteristics of the peers who were present in the classroom.

This study was strengthened by directly assessing children's academic skills at multiple time points throughout the year using valid and reliable assessments. However, a major limitation to this study is that children's academic skills were measured in English, particularly because approximately one third of the sample consisted of dual-language learners. In fact, a major limitation in the field of educational research exists because of the lack of reliable and valid measures of children's academic skills in other languages, such as Spanish, as well as a lack of an established procedure for determining which children are proficient enough to be assessed in English (Espinosa, 2005; Wolf et al.,

2008). Clearly, more work needs to be done to determine the best practices for assessing the academic skills of dual-language learners.

It is also important to acknowledge that this was a short-term longitudinal study; children's growth in academic skills was measured across one school year. Assessing children's growth in academic skills over a longer period of time, for example, across the transition into kindergarten may better assess potential associations between peer play behaviors and academic growth over time. Also, a few differential associations were found among the specific academic domains. Science and mathematics did not differ with regards to their associations with peer play behaviors. However, the three components of early literacy skills that were measured in this study varied across the four profile groups. The correlational nature of this study cannot provide definitive information about why these differences existed. Future research examining why peer play behaviors were differentially associated with different components of early literacy skills is needed. For example, research could focus on the possibility that deficits in listening comprehension are a contributing factor to children's inability to engage with peers, rather than a consequence of their peer play behaviors. In addition, research could examine why children who display disruptive play behavior have difficulty in their vocabulary skills and if the informal nature of learning vocabulary may play a role.

Finally, this study controlled for several demographic covariates; however, there are a multitude of factors not accounted for in these analyses that influence both peer play behaviors and academic skills. First, additional information on the classrooms (e.g., classroom quality and the overall social environment) would be important to examine as these factors may influence children's peer play behaviors (Bell et al., 2013; Rimm-

Kaufman, LaParo, Downer, & Pianta, 2005). For example, future research could examine whether the quality of instructional support can moderate the associations between peer play behavior and academic growth. Second, information on families and neighborhoods (e.g., home environment, maternal education, exposure to community violence) was not available in the present study. The differences in academic skills among the profiles were present at the beginning of the year. Therefore, it would be important to better understand children's early experiences, including important family variables, and how they might explain these differences (Garbarino, 1995; McLoyd, 1998).

Conclusions & Implications

This study has two important conclusions that have implications for current educational practice as well as future research. First, the patterns of behavior that children displayed during play with their peers were associated with their concurrent academic skills. Fortunately, most children are able to successfully engage with peers during play, and displaying interactive play behavior is associated with higher academic skills. However, some children displayed moderate levels of difficulty engaging with peers at the beginning of the year. These children had lower academic skills that were similar to the skills of children who were identified as having the most difficulties engaging in peer play. Early in the preschool year, teachers can use play as a context to observe individual differences in their students, and these individual differences can inform teachers about their potential strengths and weaknesses in science, mathematics, and literacy. Second, the associations between patterns of peer play behaviors and academic skills remained stable across the school year. These findings call for future research to critically examine the nature of free play in the Head Start classroom. This research can potentially lead to

the creation of strategic intervention efforts, such as the use of guided play, in order to individualize instruction to improve academic readiness for children in these classrooms. Head Start has a unique opportunity to intervene with children at-risk children for school failure, and this study contributes to the continued effort to provide each child with the most effective preschool experience to meet their individual needs.

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Table 1

Descriptive Statistics for Peer Play Behaviors and School Readiness

	Fall			Winter			Spring		
	n	*Mean*	*SD*	*n*	*Mean*	*SD*	*n*	*Mean*	*SD*
Play Interaction (PIPPS)	898	54.97	9.89	--	--	--	--	--	--
Play Disruption (PIPPS)	898	47.54	5.26	--	--	--	--	--	--
Play Disconnection (PIPPS)	898	40.75	8.67	--	--	--	--	--	--
Science (PSA)	905	465.31	46.18	854	494.32	48.52	824	513.95	52.05
Mathematics (LE)	893	185.92	47.52	863	207.13	45.66	837	223.64	46.25
Vocabulary (LE)	893	181.98	52.96	863	199.27	50.12	837	217.26	46.57
Alphabet Knowledge (LE)	893	198.40	50.40	863	217.31	48.15	837	230.80	45.35
Listening Comprehension (LE)	893	190.12	46.21	863	205.05	41.10	837	216.58	37.77

Note. Scores on the PIPPS represent standardized *T* scores based on the respective standardization samples ($M = 50$, $SD = 10$). Score on the PSA represent IRT ability-level scores ($M = 500$, $SD = 50$). Scores on the LE represent IRT ability-level scores ($M = 200$, $SD = 50$)

Table 2

Bivariate Correlations between Fall Play Behaviors and School Readiness across the Year

		Play Interaction	Play Disruption	Play Disconnection
Science	Fall	.36**	-.12**	-.26**
	Winter	.32**	-.14**	-.24**
	Spring	.32**	-.10**	-.22**
Mathematics	Fall	.36**	-.15**	-.25**
	Winter	.35**	-.16**	-.27**
	Spring	.35**	-.16**	-.25**
Vocabulary	Fall	.24**	-.06	-.17**
	Winter	.22**	-.09*	-.16**
	Spring	.22**	-.05	-.13**
Alphabet Knowledge	Fall	.30**	-.15**	-.21**
	Winter	.28**	-.16**	-.21**
	Spring	.26**	-.13**	-.18**
Listening Comprehension	Fall	.34**	-.14**	-.24**
	Winter	.31**	-.06	-.24**
	Spring	.25**	-.10**	-.19**

* $p < .05$, ** $p < .01$.

Table 3

Fit Criteria for Latent Profile Analyses

Number of Latent Profiles	AIC	BIC	VLMR	Entropy
1	18633.005	18661.806	n/a	1.00
2	17683.274	17731.275	$p < .05$	0.97
3	17289.973	17357.175	$p = .66$	0.96
4	16862.565	16948.968	$p < .05$	0.99
5	16629.337	16734.941	$p < .13$	0.94

Note. AIC = Akaike Information Criterion. BIC = Bayesian Information Criterion. VLMR = Vuong-Le-Mendell-Rubin All models were estimated with 1000 random starts and 100 iterations to avoid local maxima (Hipp & Bauer, 2006).

Table 4

Mean ASPI T Scores (and Standard Errors) for the Latent Profile Types

Profile type	Play Interaction	Play Disruption	Play Disconnection
1. High Engagement with Peers (n = 624, 70%)	59.00 (1.05)	45.56 (0.19)	**36.68 (0.59)**
2. Average Engagement with Peers (n = 137, 15%)	45.27 (1.44)	46.02 (0.36)	49.35 (3.01)
3. Average Engagement and Mild Disruption (n = 100, 11%)	50.17 (1.90)	*55.35 (1.47)*	47.21 (1.50)
4. Low Engagement and High Disruption (n = 37, 4%)	**39.67 (2.84)**	**66.58 (1.44)**	*56.67 (1.60)*
Total Sample (n = 898, 100%)	54.97	47.54	40.75

Note. Values are mean *T* scores (M = 50, SD = 10). Scores 1.0 standard deviation above or below the mean are in bold. Scores 0.5 standard deviations above or below the mean are italicized. Standard errors are not available means of the total sample.

Table 5

Multinomial Logistic Regression Estimates and Odds Ratios for Child Demographic Covariates

	Profile 2: Average Engagement		Profile 3: Average Engagement with Mild Disruption		Profile 4: Low Engagement and High Disruption	
Child demographic variables	*B (SE)*	*Odds ratio*	*B (SE)*	*Odds ratio*	*B (SE)*	*Odds ratio*
Age	-0.15** (0.04)	0.86	-0.04 (0.02)	0.96	-0.06 (.0.04)	0.94
Female	-0.51 (0.28)	0.60	-0.59* (0.26)	0.55	-0.68 (0.36)	0.51
Hispanic	-0.53 (0.45)	0.59	-0.20 (0.37)	0.82	-0.56 (0.80)	0.57
DLL	-0.08 (0.47)	0.92	-0.36 (0.41)	0.70	-1.81 (1.22)	0.16

Note. Parameter estimates for each profile type are relative to the reference Profile 1 (High Engagement with Peers). Odds-ratios are exponentialized parameter estimates presented in the second column. Age is in months. Sex and Ethnicity are dummy-coded with Male and Black as reference groups.
* $p < .05$, ** $p < .01$

Table 6

Fit Criteria for Latent Growth Curve Analyses

School Readiness	χ^2 (p-value)	CFI	SRMR
Science	25.74* ($p < .001$)	0.97	0.04
Mathematics	10.59* ($p < .01$)	0.99	0.02
Vocabulary	0.04 ($p = .81$)	1.00	0.01
Listening Comprehension	2.19 ($p = .14$)	1.00	0.01
Alphabet Knowledge	5.95* ($p = .02$)	0.99	0.02

Note. $\chi^2 = \chi^2$ test of model fit; CFI = Comparative Fit Index; SRMR = Standardized Root Mean Square Residual (Bentler, 1990; Hu & Bentler, 1999; Kline, 2005).

Table 7

Intercept and Slope Parameters for All Latent Profile Types

		Type 1 High Engagement	Type 2: Below Average Engagement	Type 3: Average Engagement with Mild Disruption	Type 4: Low Engagement and High Disruption
Science	*Intercept*	485.89	433.09*	460.75*	436.93*
	Slope	5.98	5.78	5.87	5.74
Mathematics	*Intercept*	205.06	149.70*	179.89*	154.27*
	Slope	4.57	5.08	4.18	4.40
Vocabulary	*Intercept*	183.18	185.54	167.71*	165.57*
	Slope	4.40	3.81	5.39	4.76
Alphabet Knowledge	*Intercept*	214.00	168.91*	194.07*	162.19*
	Slope	3.73	4.50	3.52	5.80
Listening Comprehension	*Intercept*	201.69	159.23*	187.03*	174.57*
	Slope	3.29	3.29	3.29	3.29

Note. Score represent IRT ability-level scores ($M = 500$, $SD = 50$ for science; ($M = 200$, $SD = 50$ for mathematics and literacy). Significant differences between Type 1 and Types 2-4 are represented with * for differences $p < .05$. Differences among Types 2-4 are described in text.

Table 8

Results from Variable-Centered Analyses: Peer Play Behaviors Predicting Initial Status and Growth in Academic Skills

	Science	Mathematics	Vocabulary	Listening Comprehension	Alphabet Knowledge
	B (SE)	*B (SE)*	*B (SE)*	*B (SE)*	*B (SE)*
Intercept					
Play Interaction	.15*** (.04)	.14** (.05)	.10 (.06)	.18*** (.05)	.13* (.05)
Play Disruption	-.03 (.03)	-.05 (.04)	-.02 (.03)	.01 (.04)	-.08 (.04)
Play Disconnection	-.07 (.04)	-.07 (.05)	-.06 (.05)	-.12* (.05)	-.04 (.06)
Age	.54*** (.03)	.55*** (.03)	.45*** (.04)	.50*** (.03)	.45*** (.04)
Sex	-.07** (.03)	.03 (.03)	-.05 (.03)	.02 (.03)	.04 (.03)
Hispanic	.16*** (.04)	.01 (.04)	.01 (.05)	.05 (.04)	-.04 (.05)
DLL	-.12** (.04)	-.05 (.04)	-.24*** (.05)	-.15*** (.04)	-.02 (.05)
Slope					
Play Interaction	-.04 (.08)	-.11 (.16)	-.28 (.08)	--	-.15 (.10)
Play Disruption	-.04 (.09)	-.18 (.17)	-.04 (.06)	--	.01 (.09)
Play Disconnection	.08 (.09)	.04 (.16)	.02 (.06)	--	.04 (.09)
Age	.10 (.08)	-.14 (.13)	-.28*** (.08)	--	-.11 (.08)
Sex	.12 (.06)	.02 (.12)	-.04 (.06)	--	.01 (.06)
Hispanic	.03 (.08)	.27 (.21)	.02 (.06)	--	.03 (.09)
DLL	.08 (.06)	-.06 (.14)	.20* (.09)	--	.16 (.10)

Note. Coefficients represent standardized coefficients. Age is calculated in months. Sex (1 = Female), Ethnicity (0 = Black, 1 = Hispanic), and DLL (1 = DLL).
*** $p < .001$, ** $p < .01$, * $p < .05$

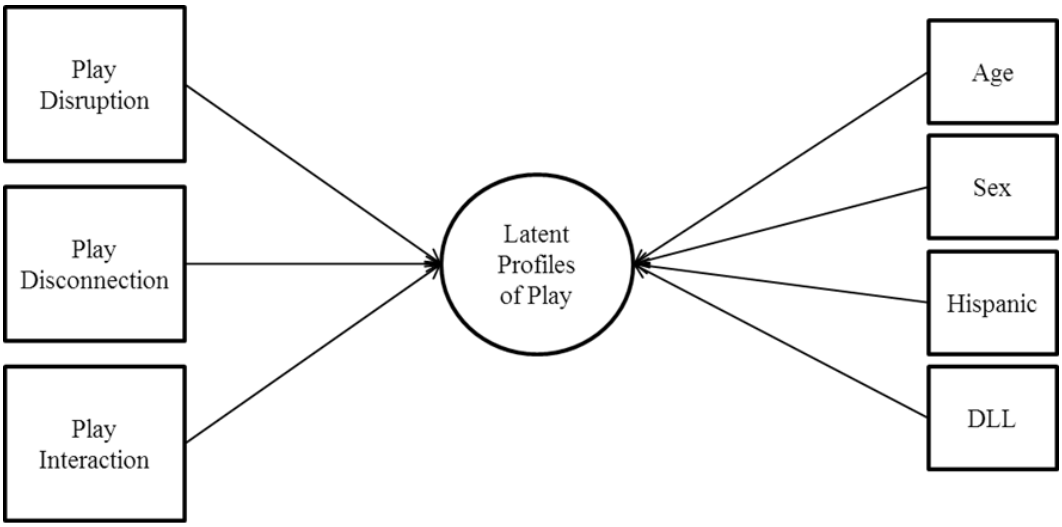

Figure 1. *LPA for Peer Play Behaviors with Demographic Covariates as Predictors*

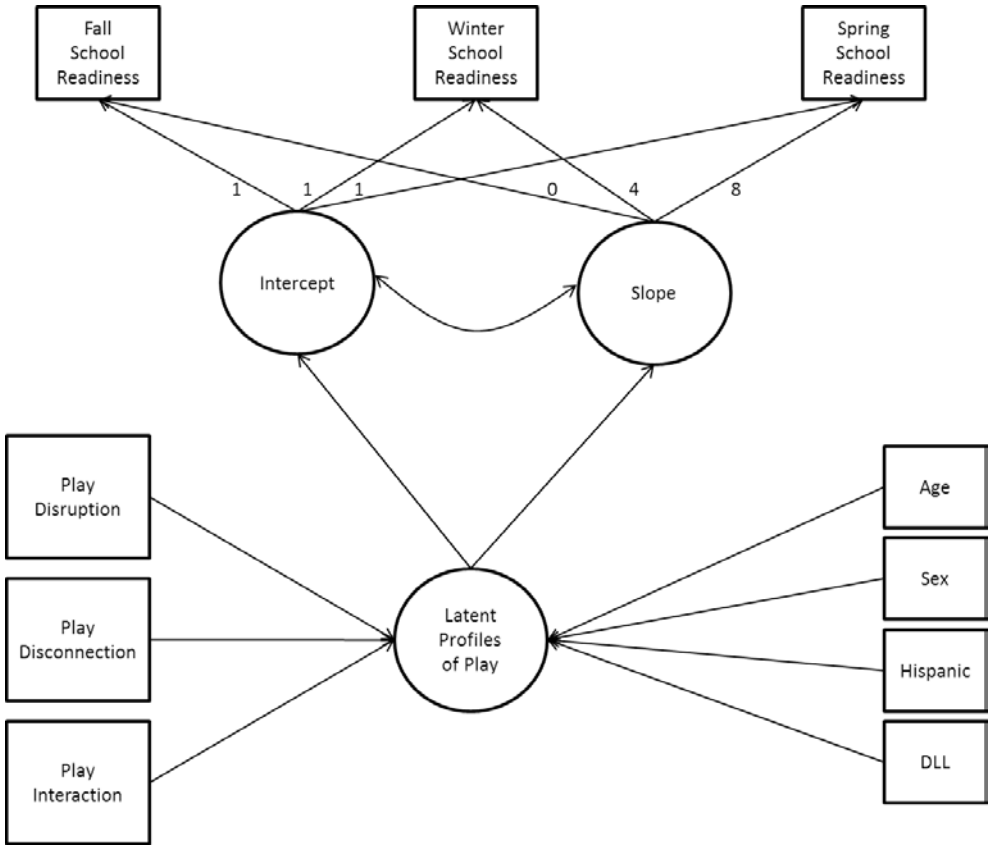

Figure 2. *Final Model: Simultaneous Estimation of LPA and LGCA.*

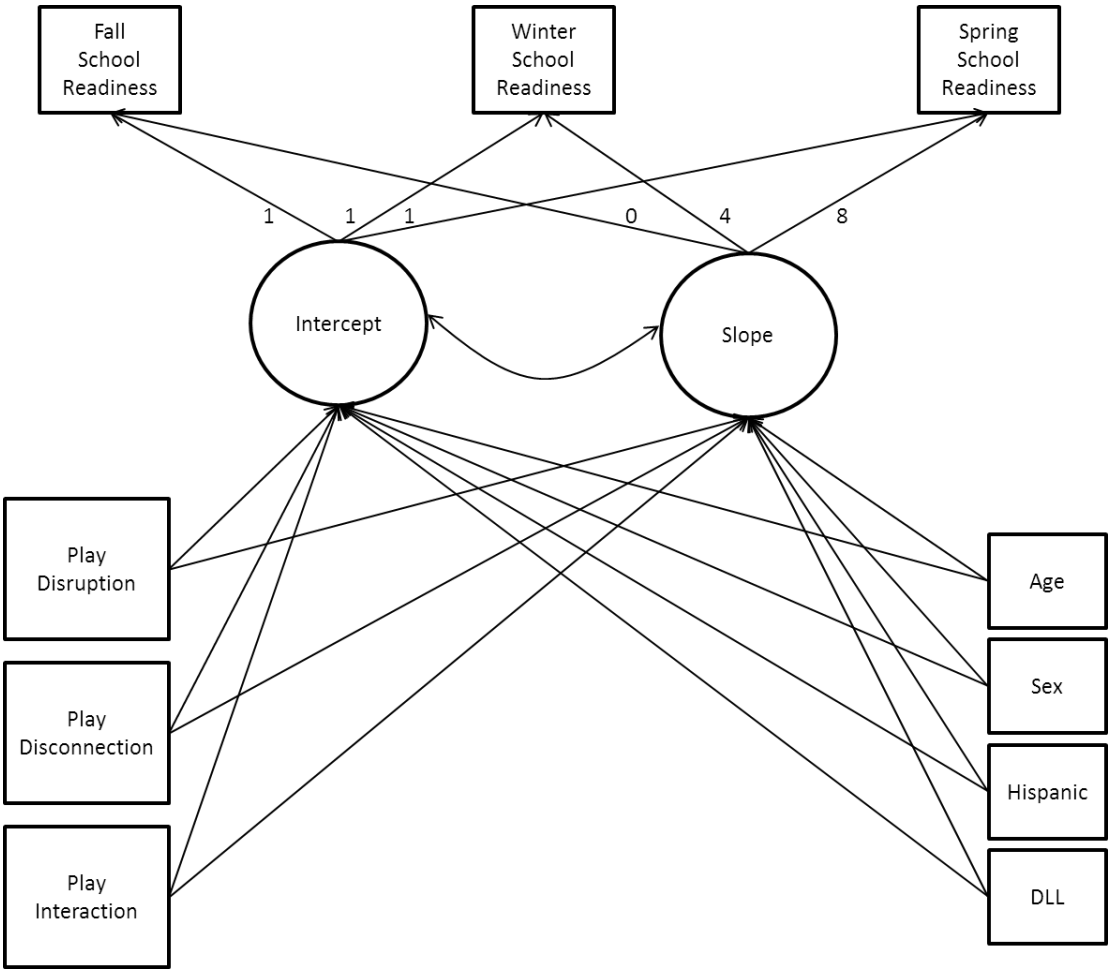

Figure 3. *Variable Centered Analyses: Peer Play Behaviors Predicting Initial Status and Growth in Academic Skills.*

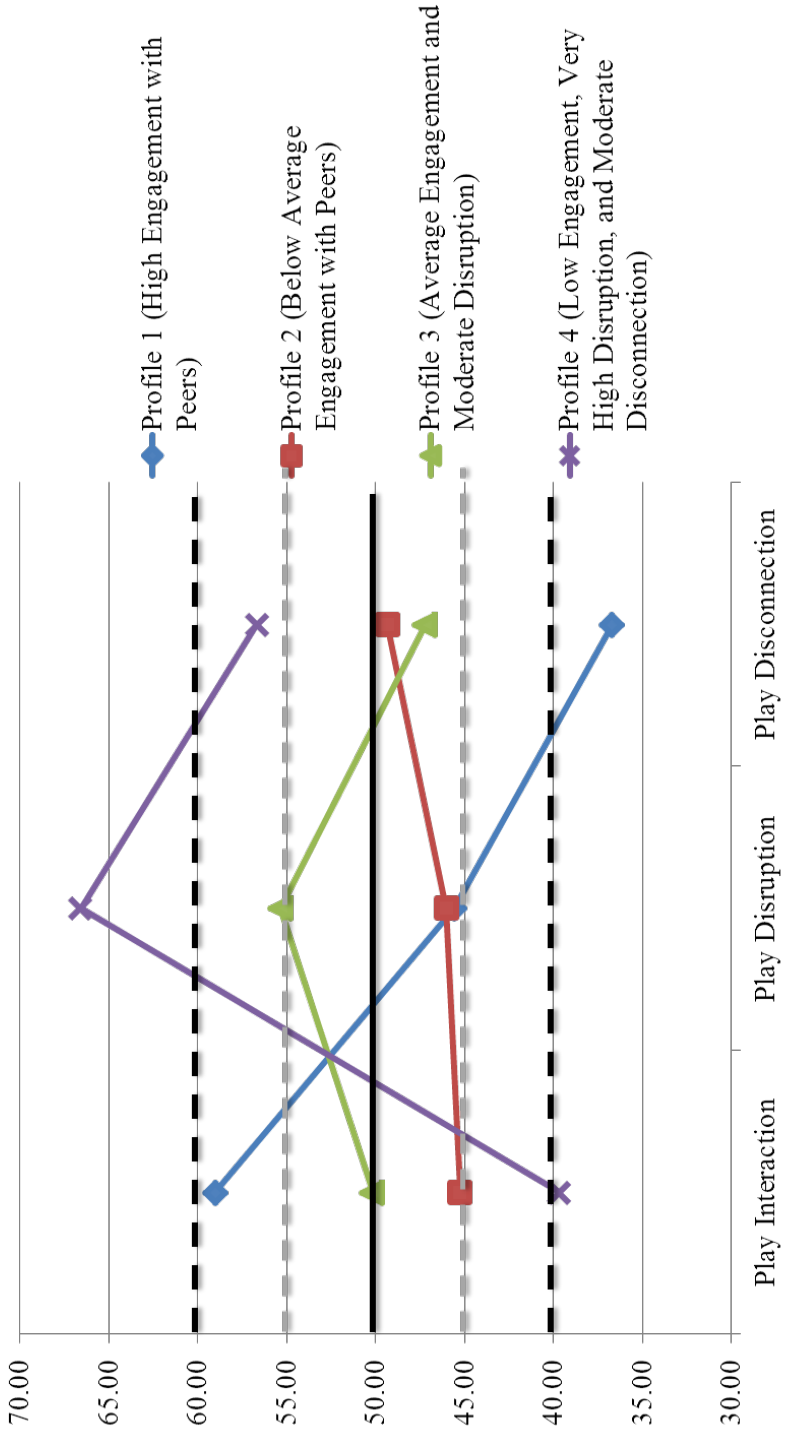

Figure 4. *Graphical display of means of peer play behaviors across profiles.*

Note. Values are mean *T* scores ($M = 50$, $SD = 10$). The solid black line represents the mean, the gray dotted lines represent 0.5 standard deviations from the mean, and the black dotted lines represent 1 standard deviation from the mean.