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Variation in children's classroom engagement throughout a day in preschool: Relations to classroom and child factors

Virginia E. Vitiello^{a,b}, Leslie M. Booren^a, Jason T. Downer^a, and Amanda Williford

Virginia E. Vitiello: vev9m@virginia.edu; Leslie M. Booren: booren@virginia.edu; Jason T. Downer: jd2fe@virginia.edu; Amanda Williford: apw2c@virginia.edu

^aUniversity of Virginia, 350 Old Ivy Way, Charlottesville, VA 22903

^bTeachstone, 105 Monticello Ave., Charlottesville, VA 22903

Abstract

This study examined sources of variability in preschool children's positive and negative engagement with teachers, peers, and tasks, and how that variability was related to both classroom activity settings (e.g., teacher-structured time, outdoor time, transitions) and child factors (age, gender). Participants were 283 socioeconomically and linguistically diverse children drawn from 84 classrooms, 34 to 63 months old ($M = 50.8$, $SD = 6.5$). Each child's engagement was observed and rated multiple times within a single day. Results suggested that children's engagement varied significantly across the preschool day. Activity settings that provided children with a greater degree of choice (free choice and outdoor time) were associated with more positive engagement with peers and tasks, while teacher-structured activities were associated with more positive engagement with teachers. Transitions emerged as a difficult part of the day, associated with less positive engagement with teachers and tasks. Older children were rated higher on peer and task engagement. These findings, together with previous research, suggest that both characteristics of the classroom setting and child factors are associated with children's classroom engagement throughout a day in preschool.

Keywords

preschool; activity settings; teacher-child relationships; peer relationships; task engagement

Three- to five-year old children in the United States are more likely than ever to be enrolled in classroom-based preschool programs (Snyder, Dillow, & Hoffman, 2009). As preschool becomes a common context for early development, it is increasingly important to understand the nature of children's preschool experiences. While much research has focused on characterizing aspects of preschool that are external to individual children, such as the length of the school day, child-teacher ratios, and the quality of the classroom environment as a whole (e.g., Burchinal, Peisner-Feinberg, Bryant, & Clifford, 2000; Pianta et al., 2005), another important aspect of preschool is each child's individual experiences of frequent, high-quality social and task engagement within the classroom.

Preschool classrooms give children regular opportunities to interact socially with teachers and peers and to engage with tasks. However, children may not engage in high-quality experiences evenly across the preschool day. Basic elements of classroom organization, including teachers' use of different activity settings, may be associated with children's frequency and quality of engagement with tasks and social partners (Kontos & Keyes, 1999). The term *activity setting* refers to the basic way that teachers organize class time in terms of both group size and activity; common activity settings in preschool include large group, small group, individual work time, free choice, outdoor time, meals, and transitions between activities (Early et al., 2010). These activity settings may differ in the opportunities they provide for children to engage positively (or negatively) with teachers, peers, and tasks (Booren, Downer, & Vitiello, in press). Furthermore, child factors like age and gender may be related to how children engage with teachers, peers, and tasks across activity settings.

The purpose of the current study was to understand sources of variability in children's classroom engagement within a single day. Within this frame, the study first identified the extent to which levels of engagement were stable across children versus being variable across the preschool day. Next, the study examined associations between engagement and classroom activity settings, as well as associations between engagement and individual child factors. Exploration of these constructs will lead to a better understanding of how children's classroom engagement is associated both with changing elements of classroom organization (activity settings) and stable child factors.

Why is it Important to Understand Children's Engagement with Teachers, Peers, and Tasks?

Children's classroom experiences, both social and with tasks, are widely seen as a critical component of early learning and development. There is strong evidence that children's preschool experiences are associated with the development of later social and academic skills (e.g., Burchinal et al., 2000; Mashburn et al., 2008). Increasingly, researchers view children's engagement with social partners and tasks in the classroom as learning processes in and of themselves; in other words, as the processes that drive learning in early childhood (Hamre & Pianta, 2001). On an individual level, a child's ability to get the most out of his or her classroom experiences, by engaging actively and positively with teachers, peers, and tasks and limiting negative or conflictual engagement, may maximize that child's opportunities to learn and develop within the classroom.

Positive engagement with teachers

Researchers have long known that children who engage in positive, affectionate, and confident interactions with their mothers exhibit higher levels of achievement in elementary school (Pianta & Harbers, 1996). Beyond mother-child interactions, however, children's positive relationships with teachers significantly predict school success (Pianta, Nimetz, & Bennett, 1997). Children who have positive relationships with teachers tend to have higher achievement, lower levels of internalizing behavior, and higher social competence than children whose teacher relationships are characterized by conflict (O'Connor & McCartney, 2007; Palermo, Hanish, Martin, Fabes, & Reiser, 2007; Pianta & Stuhlman, 2004).

Positive engagement with peers

Children's engagement with peers is also associated with school readiness. Young children who interact positively with peers experience less rejection and more social acceptance than do peers with poorer social skills (Ladd, Birch, & Buhs, 1999). Evidence suggests that peer acceptance is positively related to children's classroom engagement and achievement (Buhs & Ladd, 2001; Buhs, Ladd, & Herald, 2006). Additionally, children who have profiles of high social skills demonstrate higher achievement than would be expected based on cognitive scores alone, while children with poor social skills have lower achievement (Bierman, Torres, Domitrovich, Welsh, & Gest, 2009; Konold & Pianta, 2005). The effects of early positive social relationships have been shown to persist into middle childhood (Buhs et al., 2006; Welsh, Parke, Widaman, & O'Neil, 2001).

Positive engagement with tasks

Engagement with tasks is another important predictor of early outcomes. Preschool children who engage positively with classroom tasks and activities, characterized by showing active engagement, motivation, persistence, and independence as learners, tend to have higher academic achievement than peers who engage less positively with tasks (Fantuzzo, Perry, & McDermott, 2004; McClelland, Morrison, & Holmes, 2000). Furthermore, evidence suggests that positive engagement with tasks may act as a protective factor for children at risk, mitigating the effects of problem behaviors on academic readiness and social adjustment (Dominguez & Greenfield, 2009; McWayne & Cheung, 2009).

Negative classroom engagement

Tense, conflictual, and dysregulated engagement with teachers, peers, and tasks also have implications for children's development. Children whose relationships with teachers are conflictual tend to show lower achievement gains in the early school years that persist throughout elementary and middle school (Hamre & Pianta, 2001). Likewise, children who exhibit aggressive or antisocial behaviors are more likely to be rejected by peers, which in turn is associated with lower classroom engagement and achievement (Buhs et al., 2006; Crick et al., 2006).

Context Effects on Children's Classroom Engagement with Teachers, Peers, and Tasks

In sum, research suggests that children's engagement with teachers, peers, and tasks in early childhood significantly predicts academic and social success. It is important, however, to understand how these patterns of engagement are expressed within the classroom context. Bronfenbrenner's ecological systems theory stresses the importance of considering context when studying human behavior and suggests that characteristics of a child's environment influence that child's behavior and development (Bronfenbrenner, 1979). The current project applied this principle at a micro-level by examining how children's classroom engagement varied across a preschool day and how classroom activity settings co-occurred with both positive and problematic forms of engagement within the single day.

Variability in children's engagement

Studies have shown that children's behavior is characterized by both stable, individual differences and variability across contexts (Ruff, Capozzoli, & Weissberg, 1998). Multiple observations of individual children can result in the identification of stable interaction patterns (Rose, Blank, & Spalter, 1975; Ruff et al., 1998). However, young children are very sensitive to environmental cues and their behavior can vary substantially across different settings (e.g., preschool vs. laboratory; Walden & Baxter, 1989). Preschool-based research has indicated that children's behavior can also vary across classroom settings from day to day and even within a single school day (Booren et al., in press; Roper & Hinde, 1978; Rose et al., 1975). A study comparing preschool children's behavior during indoor and outdoor play showed that children were consistent in their rates of talking with peers, but inconsistent in their rates of talking with adults across the two settings (Roper & Hinde, 1978). Another study showed that observers' ratings of children's behaviors were consistent when two observers rated a child on different occasions in the same situation, but were less consistent when observers rated children across different situations (Rose et al., 1975).

Activity settings

One of the key aspects of the classroom environment that may be associated with variability in children's engagement is the classroom activity setting (Booren et al., in press; Carta & Greenwood, 1985; Kontos & Keyes, 1999). Preschool children spend a large proportion of the day in structured, large-group activities (Pianta et al., 2005; Powell, Burchinal, File, & Kontos, 2008). However, children engage in more sophisticated interactions with tasks during child-choice activities such as creative arts and dramatic play (Kontos et al., 2002; Kontos & Keyes, 1999). Likewise, observational research on teacher and child behaviors suggest that teacher-child interactions occur most frequently during whole-group, teacher-structured time, suggesting that more positive teacher-child interactions may be associated with teacher-structured activity settings (Booren et al., in press; Pianta et al., 2005). Thus, this basic element of classroom organization may have important implications for how children engage with teachers, peers, and tasks.

Individual Differences

It is also important to consider how child characteristics are associated with individual differences in children's classroom engagement (Rimm-Kaufman, Curby, Grimm, Nathanson, & Brock, 2009). Evidence suggests that children in the same classroom may have very different preschool experiences, based in part on characteristics of the children themselves (Dobbs & Arnold, 2009). Child age and gender, in particular, are related to children's classroom-based behaviors. For example, boys tend to receive lower ratings of task behaviors and higher ratings of aggression than girls (Walker, 2005; Walker, Berthelson, & Irving, 2001); teachers rate older children as having better engagement with tasks than younger children; and teachers report closer relationships with older children (Saft & Pianta, 2001; Xue & Meisels, 2004). Despite evidence of age and gender differences in children's classroom engagement, prior studies have largely not focused on how individual differences are associated with engagement within specific activity settings.

The Current Study

The purpose of the current study was to understand sources of variation in children's positive and negative engagement with teachers, peers, and tasks, and to examine associations between this variability and two potentially salient factors: classroom activity settings and child factors. To capture these associations, a socioeconomically and linguistically diverse group of preschool children was observed and rated using a child-focused observational system that allowed researchers to observe child behaviors in multiple, ten-minute periods across a single school day (Downer, Booren, Lima, Luckner, & Pianta, 2010). The current study extends previous work by Booren and colleagues (in press) by utilizing multi-level models for a larger, more diverse sample in order to further examine children's observed positive and negative engagement with teachers, peers and tasks between classroom activity settings.

Three aims were examined. Using multilevel modeling, the first aim was to examine how much variance in children's positive and negative engagement could be explained by differences from observation period to observation period, differences between children, and differences between classrooms. Based on previous research (Powell et al., 2008), it was hypothesized that ratings of children's positive and negative engagement would vary significantly from cycle to cycle. Because the observation cycles represented repeated measures across the day, a sub-aim was to examine patterns of change in children's interactions within a single day; in other words, whether children's positive and negative engagement increased or decreased across the preschool day.

The second aim was to determine whether classroom activity settings, controlling for child factors, would account for differences in children's positive and negative engagement across cycles. Based on findings from previous studies (Booren et al., in press; Kontos et al., 2002; Powell et al., 2008), it was hypothesized that children would engage in more positive peer and task interactions during activities that provided children with a higher degree of choice, including free choice and outdoor time. It was further expected that children would engage in more positive teacher interactions during teacher-structured activities (Booren et al., in press; Pianta et al., 2005). Additionally, this study examined whether activity settings were related to children's negative engagement with teachers and peers. This aim was intended to isolate the associations between activity settings and engagement. Prior studies have shown that teachers' presence is related to children's engagement with peers and tasks, particularly in child-choice activities. For this reason, teachers' participation in the child's activity during observations was controlled for in analyzing children's engagement with peers and tasks (Kontos et al., 2002; Kontos & Keyes, 1999; Kontos & Wilcox-Herzog, 1997). Teachers are active in structuring every aspect of the preschool day, so this approach was not meant to minimize the importance of teachers; however, a closer examination of teachers' behaviors with children was beyond the scope of this study.

The third aim of the study was to examine age and gender as they related to children's engagement. Based on prior research, it was expected that boys would show higher levels of conflict and lower task engagement across activity settings (Walker et al., 2001). It was also expected that older children would show more positive and less negative engagement with

teachers, peers, and tasks across settings (Xue & Meisels, 2004). As a sub-aim to this question, this study examined whether children's engagement was differentially associated with activity settings on the basis of age and gender; for example, whether girls exhibited more positive teacher interactions than boys during large-group as opposed to other activity settings. Because this was an exploratory analysis, no specific directional hypotheses were proposed.

Method

Participants

Participants in this study were drawn from 341 children enrolled in 100 preschool classes. Individual preschools (publicly and privately funded) were recruited based on being within reasonable driving distance from the research office. Seventy-eight centers were initially approached. Twenty-eight declined to participate and 10 did not respond, resulting in a sample of 40 preschools. After permission was granted from the center director, preschool teachers were invited to participate in the project and consented. One hundred and ten teachers were invited to participate, and 84 consented. Teachers assisted with the parental consent process, allowed for access to their classroom for observations, and completed classroom and personal demographic questionnaires.

All parents or guardians in each participating classroom were given an informational consent letter and short family demographic survey through the preschool. Parents or guardians returned the consent form and survey to their child's preschool teacher. On average, the classroom response rate from parents was 37% (ranging of 8 to 100%), with a total of 707 children consented. Of the consented children, four were randomly selected from each classroom for participation: two girls and two boys whenever possible. In approximately 20% of classrooms, only two children were randomly selected so that children could be observed for additional observation cycles.

The classrooms were located in a large urban region in the southwestern United States and included morning and afternoon classes. Sixteen of the teachers taught in both the morning and afternoon. To avoid over-representing those teachers' classroom practices in the current study, only their morning classes were included, resulting in a sample of 283 children randomly selected from 84 classes. The randomly selected children in this study did not differ from non-selected children in terms of age but did have significantly higher income-to-needs ratios ($t(240) = -9.70, p < .001$) and included a higher proportion of Hispanic children ($X^2(1) = 14.33, p < .001$) and a lower proportion of white children ($X^2(1) = 12.01, p < .001$). The final child sample was 51% female. The majority of children, 62%, were Hispanic. The mean income-to-needs ratio, calculated by dividing family income by federal poverty level guidelines (taking into account the number of people in each household) was 1.9 ($SD = 1.6$). Additional demographic characteristics of the participants are included in Table 1.

All classes met for a half-day Monday through Friday, and 89% met in the morning. Twenty-three percent of the classes received funding through the federal Head Start preschool program. Teachers reported having an average of 19 children ($SD = 4$) in the class

at the start of the school year, with an average of 62% of children in their classes Hispanic ($SD = 40\%$) and 22% white ($SD = 34\%$). The classrooms were also linguistically diverse, with an average of 30% of children per class reported by teachers as limited English proficient ($SD = 36\%$, ranging from 0–100%).

All of the lead teachers were female (mean age was 41 years, $SD = 11$). Thirty-seven percent had a bachelor's degree or beyond as their highest level of education, and 29% had majored in early childhood education. Ninety-five percent of teachers reported that English was spoken by the teacher or teacher's aide, 57% reported that Spanish was spoken, and 6% reported that another language was spoken. Additional teacher demographic information is presented in Table 1.

Measures

Child demographic characteristics—Parents completed a brief demographic questionnaire that was included with the consent form. The questionnaire asked parents to report child date of birth, gender, and ethnicity; family size and household income; as well as languages the child spoke at home.

Child observations—The *Individualized Classroom Assessment Scoring System* (inCLASS; Downer et al., 2010) is a child-focused observational assessment of children's positive and negative engagement with teachers, peers, and tasks in preschool. The inCLASS is comprised of ten dimensions: *positive engagement with the teacher* (attunement to the teacher, proximity seeking, and shared positive affect), *teacher communication* (initiations of and sustained conversations with the teacher, as well as use of speech for varied purposes), *peer sociability* (proximity seeking, shared positive affect, popularity, perspective taking, and cooperation with peers), *peer assertiveness* (positive initiations with peers, leadership, and self-advocacy), *peer communication* (initiations of and sustained conversations with peers, as well as use of speech for varied purposes), *engagement with tasks* (sustained attention, active engagement), *self reliance* (personal initiative, independence, persistence, self-directed learning), *conflict with the teacher* (aggression, noncompliance, negative affect, attention-seeking directed toward the teacher), *conflict with peers* (the same behaviors directed toward peers), and *behavior control* (patience, activity level, physical awareness).

The target child is rated on all ten dimensions after each ten-minute observation period. Each dimension is rated on a seven-point scale guided by detailed descriptors of low, medium, and high behaviors, with higher ratings indicating more positive engagement (except in the cases of Conflict with Teachers and Conflict with Peers, for which higher ratings indicate more negative engagement). Ratings incorporate both the quality and the frequency of observed behaviors. Scores are not mutually exclusive; for example, a child may exhibit high positive engagement with teachers, peers, and tasks during a single ten-minute period.

Factor analysis of the data using principal axis factoring and oblimin rotation indicated the presence of four overall domains: Positive Engagement with Teachers (*positive engagement with the teacher, teacher communication*), Positive Engagement with Peers (*peer sociability,*

peer assertiveness, peer communication), Positive Engagement with Tasks (*engagement with tasks, self reliance*), and Negative Classroom Engagement (*conflict with the teacher, conflict with peers, behavior control*). These results closely mirrored findings from a validation study of the inCLASS (Downer et al., 2010). That study, which used an earlier version of the inCLASS, did not include the Behavior Control dimension, which was added upon revising the measure. The factor analysis of the current data indicated that Behavior Control loaded with Conflict with the Teacher and Conflict with Peers to form a Negative Classroom Engagement domain.

Summary scores for each domain were created by averaging items within the domain to produce domain scores with a possible range of one to seven (with Behavior Control reverse scored). Cronbach's alphas for the domain scores were as follows: Positive Engagement with Teachers, .73; Positive Engagement with Peers, .86; Positive Engagement with Tasks, .65; and Negative Classroom Engagement, .67. Inter-rater reliability was calculated across 22% of all cycles during live observations, as two coders independently observed and rated the same child. Percent agreement within one point ranged from 87 to 100% across the dimensions. Intraclass correlations for the dimensions were in the excellent range at an average of .85 (range .75-.93).

A validation study of the inCLASS indicated that inCLASS scores were significantly correlated with teacher ratings of children's social and task-related skills (Downer et al., 2010). Specifically, positive engagement with teachers was positively related to ratings of teacher-child closeness and child assertiveness; positive engagement with peers was positively correlated with ratings of social communication, assertiveness, and social skills; positive engagement with tasks was positively correlated with teacher-child closeness, social communication, assertiveness, task orientation, and social skills and negatively correlated with problem behaviors; and negative engagement with teachers and peers was positively correlated with ratings of teacher-child conflict and problem behaviors and negatively correlated with task orientation, social skills, and social communication.

The inCLASS also has checklists to record setting-related factors that occur during observation cycles. For 'teacher was part of the activity,' data collectors check a box at the end of each observation period indicating whether the teacher was part of the child's activity (working with or near the child) during the majority of the ten minutes. Activity settings were recorded throughout the observation and included large group (an organized, teacher-structured activity including 6 or more children), small group (an organized, teacher-structured activity including 5 or fewer children), individual time (child has been assigned to work individually with or without teachers), free choice (child is able to select what and where he/she would like to play or learn), outdoor time (child is outside for free choice, recess, or an organized outdoor activity), meals (child is eating lunch, breakfast, or snack), and routines/transitions (child is part of a major transition from one activity to another or a routine classroom procedure). The definitions were adapted from Ritchie and colleagues' Emerging Academic Snapshot (Ritchie, Howes, Kraft-Sayre, & Weiser, 2001). These definitions have been used in other studies, specifically the NCEDL's Multistate Pre-Kindergarten Study (Pianta et al., 2005). Data collectors record activity settings throughout each observation cycle, indicating which activity setting the target child was in and when the

activity setting started and ended (see Procedures section for more details). Refer to Table 1 for the frequency of each activity setting, which generally matched the frequency of activity settings in other studies (e.g., Booren et al., in press; Pianta et al., 2005; Powell, et al., 2008).

Procedures

Training—Five data collectors attended an intensive training session about the observational measure (the inCLASS; Downer et al., 2010) and were required to reliably code video training clips before observing live in the field. Training occupied two full days and began with the trainer describing each dimension in detail. All data collectors watched five training clips (ten minutes each), which they coded using the inCLASS manual and discussed extensively. At the end of training, all data collectors were required to code five reliability clips independently (without discussion), and had to score within one point of the master code on 80% of their scores to be deemed reliable and ready for live data collection. All training and reliability video clips were master coded by a group of researchers, educators, and designers of the inCLASS observation system prior to the start of the study. Initial inter-rater reliability was calculated from these inCLASS training clips; as a team, the coders were within one point of the master code 90% of the time across all five training videos (a range of 84 to 96% across the ten dimensions).

Observation protocol—One observational visit was made to each classroom during a four-month fall period. Observations were scheduled at the teachers' discretion and lasted for approximately four hours during the preschool day, across all activity settings. During this time, data collectors watched each of the participating children in turn, in a series of alternating fifteen-minute cycles (ten minutes to observe, five minutes to record scores), for a target of four observations per child in classrooms with four selected children, and eight observations for classrooms with two children. The average number of cycles per child was 3.7 ($SD = 1.2$) with a range of one to eight; 78% of children were observed for either three or four cycles. For morning classes, the average start time of the first observation was 8:34 AM ($SD = 1:38$); for afternoon classes, the average start time of the first observation was 1:07 PM ($SD = 0:29$).

Activity settings—Data collectors used a stopwatch to ensure that each observation period lasted for ten minutes. At the start of each cycle, data collectors recorded the activity setting that the target child was participating in. Throughout the observation, data collectors recorded changes in the child's activity setting, noting the time of the change using the stopwatch. At the end of the observation period, the recorded start and stop times were used to determine which activity setting had taken up the majority of the observation period, and this setting was recorded as the primary activity setting. The average duration of the primary activity setting was 8.6 minutes ($SD = 1.9$). Primary activity settings were well represented across both children and classrooms: 205 children (72%) and 82 classrooms (98%) had at least once cycle with a teacher-directed primary activity setting; for free choice, 192 children (68%) and 76 classrooms (90%); for outdoor time, 137 children (48%) and 67 classrooms (80%); for routines/transitions, 112 children (40%) and 67 classrooms (80%); and for meals/snacks, 135 children (48%) and 76 classrooms (90%).

Analytic Approach

Four models were run to test the associations of interest. To address the nested nature of the data, multilevel models were run using SAS 9.1 Proc Mixed (SAS Institute, 2002; Singer, 1998). Level one (the cycle level) represented differences in children's engagement across observation cycles; level two (the child level) represented differences between children, and level three (the classroom level) represented differences between classrooms. Because children were observed multiple times across a single school day, analyses were treated as growth models with the effect of time (hours since the start of the school day) capturing changes in children's engagement.

Activity settings were entered as predictors at the cycle level and were dummy-coded so that the effect of each activity setting was contrasted with the most common activity setting, teacher-structured activities (e.g. for free choice, free choice = 1, teacher-structured = 0). For example, a significant, positive effect of outdoor time would indicate that children were engaged more positively during outdoor time compared to teacher-structured activities. At the child level, age represented the child's age in months at the time of the observation, centered around the grand mean age; gender was dummy-coded (1 = male, 0 = female). A set of child-level covariates (child ethnicity, income-to-needs ratio, and English spoken at home) were included in all analyses. Whether or not the teacher was a part of the activity was included as a cycle-level covariate for the peer and task models (teacher part of activity = 1, teacher not part of activity = 0).

Modeling of variance components followed the recommendations of Raudenbush and Bryk (2002). Each cycle-level variance component was initially allowed to vary across level two units. If the variance component was not significant ($p > .10$) or could not be estimated, then it was fixed to zero. All child-level variables except the intercept and the effect of time were fixed across level-three units. Cross-level interactions between activity settings and age and gender were tested only if there was significant variance at level two (the child level) in the association between the activity setting and children's engagement.

Results

Descriptive and Preliminary Analyses

Frequencies and means for the variables under study are presented in Table 1. The most common activity settings were large group and free choice. Two of the activity settings, small group and individual time, occurred infrequently. These settings were combined with large group to create a composite representing teacher-structured activity settings. Ratings of children's engagement, averaged across cycles and children, indicated low- to mid-range levels of positive engagement with teachers and peers. The average task engagement rating was in the mid-range, and ratings of negative classroom engagement were low.

Aim 1: Variability in Children's Engagement at the Cycle, Child, and Classroom Level

Variance components for the fully unconditional models (models with no predictors) are presented in Table 2. For positive engagement with teachers, peers, and tasks, as well as negative classroom engagement, the majority of variance in children's engagement was due

to differences in children's behavior from cycle to cycle (72% - 78%). A smaller portion of the variance was due to differences between classrooms: 22% for engagement with teachers, 12% for engagement with peers, and 19% for engagement with tasks; for negative classroom engagement, classroom level variance was non-significant. The remainder of the variance (7%, 10%, 7%, and 23% respectively) was due to differences between children. All variance components were significant at $p < .01$ except for level-three variance in negative classroom engagement. For each domain of engagement, children's levels of engagement were highly variable from observation to observation.

Table 3 presents the results of the final multilevel models with all predictors entered. Analyses indicated that children's positive engagement with teachers and tasks decreased slightly across the school day (for teachers, $b = -.17$, $SE = .03$, $p < .001$, indicating a decrease in positive teacher engagement of .17 points each hour; for tasks, $b = -.07$, $SE = .03$, $p < .05$, indicating a decrease in positive task engagement of .07 points each hour). Positive peer engagement decreased at a non-significant trend level, and negative engagement with teachers and peers remained stable across observation cycles.

Aim 2: Associations between Engagement and Activity Settings

Controlling for covariates, time, age, and gender, analyses indicated that activity settings were significantly related to engagement in each of the domains (see Table 3). Children exhibited less positive engagement with teachers during free choice ($b = -.44$, $SE = .12$, $p < .001$), outdoor time ($b = -.54$, $SE = .10$, $p < .001$) and routines/transitions ($b = -.37$, $SE = .11$, $p < .001$) compared to teacher-structured activities. Children showed more positive engagement with peers during free choice ($b = -.47$, $SE = .14$, $p < .01$), outdoor time ($b = .80$, $SE = .12$, $p < .001$) and meals ($b = .26$, $SE = .11$, $p < .05$) compared to teacher-structured activities. Children engaged in more positive task behaviors during free choice ($b = .55$, $SE = .10$, $p < .001$) and outdoor time ($b = .56$, $SE = .10$, $p < .001$) compared to teacher-structured activities, and less positive task behaviors during routines/transitions ($b = -.29$, $SE = .10$, $p < .01$). Children displayed less negative classroom engagement during meals compared to teacher-structured activities ($b = -.14$, $SE = .06$, $p < .01$).

Aim 3: Associations between Engagement and Individual Child Factors (Age and Gender)

Engagement with teachers—Age and gender were not significantly associated with children's positive engagement with teachers (Table 3). The effect of one activity setting, free choice, was found to vary significantly across children, so age and gender interactions were tested for this variable. The interaction between free choice and age was significant. Post-hoc probing of this interaction (Preacher, Curran, & Bauer, 2006) indicated that the difference in children's engagement with teachers between free choice and teacher-structured activities was non-significant for children 12 months younger than the mean age (i.e., 39 months old; $b = -.08$, $SE = .20$, $p = .69$) but significant for children at the mean age (51 months old; $b = -.44$, $SE = .12$, $p < .001$) and for children 12 months older than the mean (63 months old; $b = -.80$, $SE = .19$, $p < .001$); older children engaged less positively with teachers during free play compared to teacher-structured activities.

Engagement with peers—Age was positively related to engagement with peers ($b = .02$, $SE = .01$, $p < .01$), indicating that older children engaged more positively (Table 3). The effect of free choice varied significantly across children, so interactions with gender and age were tested. None of the interactions showed significant effects.

Engagement with tasks—Age was significantly related to engagement with tasks ($b = .02$, $SE = .01$, $p < .05$), indicating that older children had more positive task engagement across activity settings (Table 3). None of the activity setting effects varied significantly across children, so no interactions were tested.

Negative classroom engagement—Age and gender were not related to children's negative classroom engagement (Table 3). None of the activity settings was found to vary significantly across children, so no interactions were tested.

Variance Accounted For in Final Models

In predicting children's positive engagement with teachers, the final model accounted for 16% of the variance at the cycle level and no variance at the child level. For positive engagement with peers, the final model accounted for 23% of the cycle-level variance and 17% of the child-level variance. For positive engagement with tasks, the final model accounted for 19% of the cycle-level variance and no variance at the child level. Lastly, for negative classroom engagement, the model accounted for 7% of the cycle-level variance and no variance at the child level.

Discussion

Young children's positive and negative engagement with teachers, peers, and tasks form the basis of learning within the preschool context and serves as an important predictor of later academic and social success (Buhs et al., 2006; Hamre & Pianta, 2001). Using ecological systems theory as a framework for understanding children's behavior and extending findings by Booren and colleagues (in press), this study aimed first to identify the extent to which children's engagement with teachers, peers, and tasks was variable within a single day; and next to characterize relations between preschool activity settings, child factors, and children's engagement across the preschool day. Findings indicated that certain aspects of engagement tended to co-occur with specific activity settings, suggesting that activity settings provide an opportunity structure that affords certain types of interactions. Furthermore, child factors predicted individual differences in engagement. Together, these findings support the notion that children's engagement within a day is associated with both child factors and changing classroom circumstances.

Variability at the Cycle, Child, and Classroom Level

Past research has indicated that children's behavior can differ substantially across contexts, suggesting that children are highly sensitive to environmental cues (Booren et al., in press; Rose et al., 1975; Ruff et al., 1998). This study aimed to expand our understanding of the sources of this variability. For each domain of engagement, findings showed that children's behavior varied substantially from cycle to cycle across the day. There are two principle

implications of these findings. First, global ratings of children's behavior may miss important variations in behavior that occur within a single day. These variations may have implications for learning. For example, a child given a mid-range task engagement rating by her teacher may actually show high levels of engagement with free choice tasks but low engagement during teacher-directed tasks, leading to the child getting more out of some activities than others. Second, the findings suggest that children's classroom engagement depends to a large degree on the changing circumstances of the classroom across the morning. This further underscores the importance of examining how variable classroom characteristics relate to children's engagement.

Results also showed that children's positive engagement with teachers and tasks decreased slightly across the day, beyond the effects of activity setting. It may be that child fatigue, changes in teacher behaviors, or changes in classroom quality led to less positive engagement over time. While one recent study of preschool classroom quality found that quality was relatively stable across the first two hours of the day (Curby, Grimm, & Pianta, 2010), research in elementary classrooms suggests that aspects of classroom quality decrease across the school day, including teacher sensitivity and positive climate (Chomat-Mooney et al., 2008). More research is needed that directly examines links between classroom quality and children's engagement, as a possible explanation for decreases in positive engagement across the preschool day.

Interestingly, children's negative classroom engagement showed a higher degree of variability at the child level and did not vary significantly from classroom to classroom. The negative engagement dimension may therefore have tapped into a construct that was slightly more indicative of children's behavioral tendencies and less dependent on global classroom factors compared to other dimensions. It is important to note, though, that substantial variance in children's negative engagement was also found at the cycle level, suggesting that moment-to-moment factors apart from activity settings may be associated with negative classroom engagement. It may be that children engage negatively when they find themselves with certain peers, or when they dislike or struggle with the content of an activity.

Associations between Activity Settings and Children's Engagement

The second aim of this study was to determine whether classroom activity settings accounted for variability in engagement from cycle to cycle. The initial hypothesis, that children would engage more positively with peers and tasks in settings that provided greater autonomy, was supported: Children's engagement with both tasks and peers was higher during free choice and outdoor time. The findings for engagement with peers are not surprising, as both settings are likely to provide children with more opportunities to engage socially with peers compared to teacher-structured activities. However, it is interesting that children had higher task engagement during free choice and outdoor time than during teacher-structured activities, when children are often being provided with a specific task. It is likely that child-directed settings give children opportunities to engage in the activities that they find most motivating, leading to stronger task engagement (Booren et al., in press); research has shown that interest and motivation support students' attention and persistence with tasks (Krapp, 1999).

This finding also corresponds with Vygotskian views of learning and development in early childhood, which posit that children learn best through collaborative play with social partners and that one of the most important roles for teachers is to support and give structure to children's engagement with peers and tasks (Tzuo, 2007; Vermette, Harper, & DiMillo, 2004). Some researchers, following Vygotskian principles, have even suggested that large-group activities are not particularly appropriate for preschool children, in part because the structure limits children's opportunities to engage socially and actively in learning (Bodrova & Leong, 2005). The current findings suggest, at a minimum, that active, enthusiastic engagement is more likely to occur in child-directed settings. Similar findings have been reported in a series of eco-behavioral studies, which showed that creative free choice activities (art, dramatic play, blocks, etc.) were associated with greater engagement with tasks compared to other activities (Kontos et al., 2002; Kontos & Keyes, 1999; Kontos & Wilcox-Herzog, 1997). It is interesting to note that, in this study as in others, the largest proportion of children's time was spent in teacher-structured activities (Booren et al., in press; Pianta et al., 2005).

Another hypothesis tested in this study was that children's engagement with teachers would be more positive during teacher-structured activities. Results supported this hypothesis; engagement with teachers was significantly lower during free choice and outdoor time than during structured time. These findings may indicate that individual children have relatively low levels of positive engagement with teachers during activities that offer more child choice. It may be that teachers scaffold children's engagement during child-choice activities to encourage more positive engagement with peers and tasks, while teachers themselves remain in the background of the activities. Future studies examining both teacher and child behaviors across different activity settings may be better able to tease apart these relations.

Transitions appeared to be a slightly more challenging part of the preschool day, with children exhibiting lower engagement with tasks and teachers. Transitions have long been identified as taking up too much class time, and observational research suggests that children experience higher levels of stress during transitions (Burts, Hart, Charlesworth, & Kirk, 1990). Transitions between activities are necessary, often including clean-up time, hand washing, or lining up to go outside. Judging by the current findings, though, it appears that easing transitions and reducing transition times is an important goal for some preschool teachers. Maintaining high task engagement may be particularly challenging. Setting clear behavioral expectations at the start of the transition and providing children with engaging activities to do while waiting for the start of the next activity may be effective strategies.

Meals were associated with positive engagement with peers and lower levels of conflict. Meals may provide children with opportunities to demonstrate prosocial behaviors, including social conversation, sharing, and helping as food is passed out (Bailey, Harms, & Clifford, 1983). At the same time, children's physical activity is limited and every child has their own food to focus on, perhaps resulting in lower conflict. Although task engagement was lower for meals, this may reflect that children spent less time actively engaged: During meals, children may not consistently demonstrate high levels of enthusiasm, or may go off task if they finish eating before their peers. Overall, however, results suggested that meals provide an opportunity for children to engage positively with peers.

Associations between Age, Gender, and Children's Engagement

The last aim of this study was to examine associations between child age, gender, and children's engagement, both across activity settings and within specific settings. Contrary to expectations, boys did not exhibit higher conflict or lower task engagement across settings. It may be that prior studies have found gender differences in part because they relied on teacher reports (e.g., Walker et al., 2001); teachers may perceive differences between boys and girls that are not apparent to outside observers.

As in previous research, age was related to more positive engagement with peers and tasks (Saft & Pianta, 2001; Xue & Meisels, 2004), most likely reflecting older children's increasing social and attention capacities. A significant interaction between age and free choice on positive engagement with teachers further indicated that older children engaged more positively with teachers during teacher-structured activities compared to free choice activities. The tendency to engage more positively during teacher-structured activities likely reflects that older preschoolers' growing verbal skills increase their ability to engage with material being presented by the teacher. The tendency to engage less with teachers during free choice activities may reflect older preschoolers' increasing social competence, which allows them to engage more fully with peers (Shin et al., 2011). Furthermore, as preschoolers' self-regulatory skills develop, they exhibit better classroom behavior, including more prosocial behavior and fewer problem behaviors, potentially enabling them to be more independent during free choice activities (von Suchodoletz, Trommsdorff, Heikamp, Wieber, & Gollwitzer, 2009).

The covariates in the model were largely meant to control for factors not central to the aims of this study. However, two interesting findings warrant brief discussion. First, children whose families reported speaking English at home had significantly higher engagement with tasks compared to children whose families reported speaking no English at home. This suggests that children from language-minority homes may face a substantial barrier to full engagement in classroom activities. Second, teachers' participation in the activity (whether the teacher was working with or near the child during the majority of the observation cycle) was negatively associated with peer and task engagement. This finding is in keeping with previous findings (e.g., Kontos & Wilcox-Herzog, 1997) and may indicate that teachers spend more time interacting with children who need extra support, rather than teachers' presence directly reducing children's quality of engagement. However, more research in this area is needed to confirm or discount this possibility.

Limitations and Future Directions

Several limitations to this study are worth noting. First, the observation protocol was not designed to provide in-depth descriptions of teacher behaviors. Detailed observations of teacher behaviors collected concurrently with child observations are needed to shed greater light on the critical role of teachers in promoting positive engagement.

Second, the activity setting code assigned to each cycle was the setting that predominated during the cycle, not necessarily the only setting observed. In the course of a ten-minute observation, target children often participated in more than one activity setting. It may be

that associations with activity settings that were shorter in duration, like transitions, were somewhat obscured by this method of coding. Limiting observations to one setting would reduce this source of error in future studies.

Relatedly, data collectors in this study were not asked to record the content of children's activities or the number of children involved in each activity setting, which may have added important additional information about the classroom setting. For example, it may be that academic content is associated with the extent to which children engage with tasks, or that book reading during teacher-structured time promotes better engagement between children and teachers. Further work in this area would continue to tease apart these relations.

Third, the number of observation cycles varied across children. Since a multilevel modeling framework was used, this means that some children contributed more information to the estimation of scores on the observation. More information included in multilevel models generally leads to more stable, accurate estimations, though, so it was deemed important to retain as much data as possible.

Fourth, the significant variability in children's inCLASS scores from cycle to cycle may indicate low cycle-level reliability in the measure. Although scores show strong inter-rater reliability, more work with the inCLASS is needed to establish the stability of the measure over time. Future users of the inCLASS and other observational measures should also think carefully about how variable classroom factors affect children's behaviors in designing their studies.

Finally, the diversity of the sample can be viewed as both a strength and a weakness of this study. As preschool programs become increasingly diverse, it is critical to understand how minority children, including Hispanic children in particular, engage within the classroom context. However, the high proportion of Hispanic children and language minorities in the current study may limit generalizability to other samples. While the current study controlled for children's home language, future studies should delve more deeply into these issues by examining the match between teachers' and parents' behavioral expectations for children, or how parents' cultural identity is associated with children's classroom engagement.

Despite these limitations, findings from this study raise important questions. Additional studies could deepen our understanding of the current findings by exploring the characteristics of activity settings that lead them to be associated with more or less positive engagement. For example, how much autonomy are children typically given to choose activities during free choice and outdoor time, and does that help explain why children exhibit more positive engagement in that setting? Future work should also look closely at transition times to determine what factors are associated with a lack of positive engagement. Small changes to the content or structure of certain activity settings may ultimately promote more positive and less negative engagement for children.

The models presented here accounted for only 7% to 23% of the cycle-level variance in engagement, leaving substantial portions of the variance unexplained. Future studies should seek to identify how other changing elements of a day, such as instructional content and overall classroom quality, are associated with variance in children's engagement. Other

child characteristics, like temperament or behavior problems, may also be important predictors of children's behaviors within specific settings. While the current study focused on within- and between-child associations, future studies should also focus on connecting teachers' use of activity settings to child outcomes and to examining how children's engagement within specific settings is associated with outcomes. These questions are especially important in light of the large amount of time that children spend in teacher-structured activities (Booren et al., in press; Pianta et al., 2005; Powell et al., 2008).

Conclusions

In summary, this study provided evidence that children's behavior is highly variable within a single day, and that both activity settings and child factors are important predictors of children's positive and negative engagement with teachers, peers, and tasks. Child-choice activities, including free choice and outdoor time, were associated with more positive task and peer engagement compared to teacher-structured activities, while transition times were associated with less positive engagement with teachers and tasks. These findings suggest that different activity settings provide children with different opportunities to engage with teachers, peers, and tasks. A stronger understanding of these relations, including how individual child characteristics are associated with engagement within settings, could ultimately lead teachers to consider these factors in structuring the preschool day to maximize children's opportunities to learn.

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Table 1

Demographic Information and Descriptive Statistics for Study Variables

Child Demographics	Frequency (%)	Mean	SD	Range	
				Min	Max
Female	51%				
Age (months)		50.8	6.5	34	63
English spoken at home	67%				
Spanish spoken at home	60%				
Other language	6%				
Ethnicity					
Hispanic	62%				
White	18%				
African American	4%				
Native American	1%				
Asian	7%				
Multi-ethnic/Other	8%				
Attends morning pre-K	89%				
Teacher-child language match	84%				
Income-to-needs ratio		1.9	1.6	.1	7.8
Maternal education (years)		13.3	3.2	8	20
Teacher Demographics					
Female	100%				
Age (years)		41.2	10.8	23	65
Ethnicity					
Hispanic	57%				
White	21%				
African American	7%				
Native American	0%				
Asian	2%				
Multi-ethnic/Other	12%				

Child Demographics	Frequency (%)	Mean	SD	Range	
				Min	Max
Years experience with pre-K children		9.7	6.7	0	31
Two-year degree	36%				
Bachelor's degree or higher	37%				
Degree in education or related field	73%				
Descriptive Statistics					
Child Engagement ^a					
with Teachers		2.21	.80	1.00	5.50
with Peers		2.55	.76	1.00	4.83
with Tasks		3.69	.77	1.50	5.50
Negative		1.65	.44	1.00	4.00
Cycles per child		3.70	1.20	1	8
Activity Settings					
Teacher-structured	31%				
Large group 24%					
Small group 4%					
Individual 3%					
Free choice	26%				
Outdoor time	16%				
Meals	14%				
Routines/Transitions	13%				
Teacher part of activity	60%				

Note:

^a Averaged across cycles and then across children.

Table 2

Variance Decomposition of inCLASS Domains

Variance	Positive Engagement with Teachers			Positive Engagement with Peers			Positive Engagement with Tasks			Negative Classroom Engagement		
	Estimate	SE	%	Estimate	SE	%	Estimate	SE	%	Estimate	SE	%
Level 1: Cycle	.9872 *	.05	72%	1.1356 *	.06	78%	.9477 *	.05	75%	.3426 *	.02	74%
Level 2: Child	.0931 *	.04	7%	.1476 *	.04	10%	.0844 *	.04	7%	.1072 *	.02	23%
Level 3: Classroom	.2964 *	.06	22%	.1748 *	.05	12%	.2369 *	.06	19%	.0119	.01	3%

Note:

* $p < .05$

Table 3

Associations between Activity Settings, Child Characteristics, and Children's Classroom Engagement: Results of Multilevel Models

Coefficients	Positive Engagement with Teachers		Positive Engagement with Peers		Positive Engagement with Tasks		Negative Classroom Engagement	
	B	SE	B	SE	B	SE	B	SE
Intercept	2.88*	.14	2.28*	.17	3.78*	.15	1.40*	.09
Slope (hours)	-.17*	.03	-.07†	.04	-.07*	.03	.02	.02
<i>Covariates</i>								
Income-to-needs	-.01	.04	.05	.04	-.00	.04	.02	.03
English at home	.13	.11	.18	.11	.29*	.10	-.01	.07
Child is white ^a	.10	.16	.22	.16	.19	.15	-.14	.10
Child is multi-ethnic/other ^a	-.01	.13	-.09	.13	-.03	.12	.07	.09
Teacher part of activity	--	--	-.27*	.09	-.18*	.08	--	--
<i>Level 1: Observation Cycle^b</i>								
Free choice	-.44*	.12	.47*	.14	.55*	.10	-.01	.05
Outdoor time	-.54*	.10	.80*	.12	.56*	.10	.02	.06
Transitions/Routines	-.37*	.11	.18	.11	-.29*	.10	.03	.07
Meals	-.08	.10	.26*	.11	-.13	.10	-.14*	.06
<i>Level 2: Child</i>								
Gender ^c	.02	.09	.08	.09	.08	.08	.06	.06
Age	.01	.01	.02*	.01	.02*	.01	.00	.00
<i>Cross-Level Interactions</i>								
Free choice * Gender	.17	.17	.10	.18	--	--	--	--
Free choice * Age	-.03*	.01	-.01	.01	--	--	--	--
<i>Variance Components</i>								
Level 1 Residual	.83*	.05	.87*	.05	.76*	.04	.32*	.01
Level 2								

Coefficients	Positive Engagement with Teachers		Positive Engagement with Peers		Positive Engagement with Tasks		Negative Classroom Engagement	
	B	SE	B	SE	B	SE	B	SE
Intercept	.08*	.04	.12*	.05	.10*	.04	.19*	.06
Slope (hours)	--	--	--	--	--	--	.01*	.01
Free choice	.29*	.15	.37*	.17	--	--	--	--
Level 3								
Intercept	.32*	.07	.46*	.17	.20*	.05	.01	.01
Slope (hours)	--	--	.05*	.02	--	--	--	--

Note:

^a Referent ethnic group is Hispanic.

^b Referent activity setting is teacher-structured activities.

^c boy = 1, girl = 0.

[†] $p < .10$;

* $p < .05$