**Abstract Title Page**
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**Title:** The Association of Peer Behavioral Regulation with School Readiness Skills in Preschool

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**Abstract Body**

**Background / Context:**
 Recently, much national attention has focused on the necessity of all children to develop school readiness skills (Obama, 2013). School readiness gaps present at preschool entry have been found to persist, and in some cases to widen, across the transition to formal schooling (Alexander & Entwisle, 1988; Duncan & Murnane, 2013; Heckman, 2006, Reardon & Portilla, 2015). The early years of life are crucial for the development of skills that help children succeed in school, as specific skills in early math, reading, and attention at kindergarten entry, have been found to be strongly predictive of future academic success (Duncan et al., 2007; Justice, Mashburn, Hambre & Pianta 2008). However, it is important to remember that early school adaptation and success are not just a function of cognitive competencies but encompass emotional and behavioral regulatory components that could contribute to early income-based school readiness gaps.

A large and growing body of evidence suggests that children's early self-regulation could have consequences for long-term academic success (Blair, 2010; Schunk & Ertmer, 2000). Children's ability to control, plan, and manage behaviors establishes a foundation for positive behaviors in the classroom, which is a key component of school readiness (Lewit & Baker, 1995; National Scientific Council on the Developing Child, 2004). Early behavioral regulation has been found to predict long-term school success as measured by academic achievement as well as high school and college graduation rates (Blair, 2002; Cooper & Farran, 1988; McClelland, Acock, & Morrison, 2006).

While research has shown that children's own behavioral regulation is associated with their academic outcomes, not much is known about how children are affected by classmates with poor behavioral regulation. Considering that preschool teachers in low-income neighborhoods report between 15 and 30 percent of children in their classrooms exhibiting clinically high levels of disruptive and challenging behaviors (Kuperschmidt, Bryant & Willoughby, 2000; Rimm-Kaufman, Pianta & Cox, 2000), one can imagine the possible influence peer effects may have on children's academic outcomes. Especially, since research has found that classmates' academic skill level have been found to be an important predictor of individual student achievement (Skibbe, Phillips, Day, Brophy-Herb & Connor, 2012). Despite increasing numbers of low-income children participating in early childhood education and the recognition of the importance of early skill building to future development, most extant research on peer effects has focused only on traditional K-12 classrooms and schools, and on academic as compared to social-emotional skills of peers as the peer effect of interest.

**Purpose / Objective / Research Question / Focus of Study:**
The current study builds on the above literature by examining classroom-level peer behavioral regulation skills and their implications for children's school readiness outcomes. Specifically, this study will answer the following research questions:
1. Is the average level of peers' behavioral regulation skills in a classroom in the fall associated with growth in children's school readiness outcomes in preschool (motor, content knowledge, and language), across fall to spring? Is a child's skill relative to his or her peers in a classroom in the fall associated with growth in school readiness outcomes in preschool (motor, content knowledge, and language), across fall to spring?
2. Do these associations differ for children with high and low initial levels of behavioral

regulation?

**Setting:**
The current study's sample is drawn from a longitudinal randomized controlled trial (RCT) of ParentCorps, a family-focused and school-based intervention. The RCT took place in New York City public schools with preschool programs.

**Population / Participants / Subjects:**
New York City elementary schools with preschool programs in two school districts serving primarily low-income and minority populations were included (high school graduation rates in these districts were ~50% (New York City Department of Education, 2006). Schools were required to have a preschool program with at least two classrooms and a student population of greater than 80% Black and greater than 70% low-income (eligible for free lunch). Schools included in the sample were selected based on NYC DOE record data on expected class size (18 students per class, up to 4 classes per school).

**Intervention / Program / Practice:**
Universal intervention aimed to promote self-regulation and early learning by strengthening positive behavior support and effective behavior management at home and school, and increasing parent involvement in education. Intervention included after-school group sessions for families of pre-k students (13 2-hour sessions; co-led by pre-k teachers) and professional development for pre-k and kindergarten teachers.

**Research Design:**
A total of 10 schools were selected, with 5 schools randomized to the intervention condition, and 5 schools randomized to the preschool-as-usual control condition. The RCT aimed to study all preschool students in four successive annual cohorts in each school. The sample included a total of 99 preschool classrooms over the four years of the study.
Behavioral regulation was assessed using Developmental Indicators for the Assessment of Learning (DIAL) Behavioral Observations (Mardell-Czudnowski & Goldenberg, 1998). The items used for this analysis included two three-item subscales: Responsiveness and Attention. School readiness skills were evaluated with the Developmental Indicators for the Assessment of Learning–3 (Speed DIAL–3; Mardell-Czudnowski & Goldenberg, 1998). The DIAL–3 is a standardized test that assesses motor, language and content knowledge skills related to school readiness.

**Data Collection and Analysis:**
*Peer effects.* To estimate the peer effect hypothesized in the first research question, I first calculated the average level of behavioral regulation exhibited by all children within each classroom in the fall, and then used aggregate peer skills to predict children's school readiness growth. This was done separately for classroom-level engagement and classroom-level attention-impulse control.
Given the clustered nature of the sampling frame for this study, preliminary analyses were conducted to examine the portion of the variation attributable to classroom and school. Intraclass correlation for the dependent variable at baseline, while small (0.034 for classroom), were non-zero, indicating that there was enough setting-level variance to merit multilevel modeling. Intraclass correlations were run to examine assessor-level clustering both at the fall

and spring data points. The assessor-level clustering ranged from 0.03 to 0.17. Two-level models were estimated using hierarchical linear modeling (Version 6.01a; Raudenbush, 2004) to examine the effects of the child-level and classroom- level behavioral variables on children's school readiness outcomes.

**Findings / Results:**

To assess the primary research aims, two-level models were estimated using hierarchical linear modeling to examine the effects of the child-level and classroom- level behavioral variables on children's school readiness outcomes. The results of RQ1 (Table 1; Block 1) indicated that engagement was a significant predictor of children's residualized spring school readiness skills ($d = 0.48$, $p = 0.029$). Peers' engagement significantly predicted children's spring motor skills ($d = 0.71$, $p = 0.008$) and spring concept skills ($d = 0.56$, $p = 0.032$). The effect sizes of these associations were moderate. Attention-impulse control was not a significant predictor of children's school readiness skills ($d = -0.29$, $p = 0.192$). Neither peer behavioral regulation measure (engagement nor attention-impulse control) were significantly associated with language growth.

The relative status analysis (Table 1; Block 2) indicated that children's engagement, relative to their classroom mean, positively predicted children's spring school readiness scores ($d = 0.05$, $p < 0.028$); this means that children whose fall engagement skills were high, relative to their classmates had higher school readiness skills in the spring. Child's engagement relative to the classroom mean positively predicted children's motor ($d = 0.05$, $p = 0.066$), content knowledge ($d = 0.08$, $p = 0.002$), and language ($d = 0.08$, $p = 0.005$) skills. Unlike the main model, children's spring language skills were statistically predicted by peers' engagement. Child's fall attention-impulse control relative to the classroom mean did not predict children's spring school readiness scores ($d = 0.00$, $p < 0.896$), content knowledge ($d = 0.01$, $p = 0.828$) or language skills ($d = 0.02$, $p = 0.583$). However, a child's fall attention-impulse control relative to the classroom mean did marginally predict children's motor skills ($d = 0.05$, $p = 0.062$). All of the effect sizes were negligible or small.

To address the aims of research question 2, cross-level interactions were added into the model. Block 3 of Table 1 includes the estimates of interactions between child's own fall behavioral regulation with fall peer behavioral regulation predicting children's school readiness skills. There was a significant interaction between children's initial engagement and classroom-level engagement predicting spring overall school readiness skills ($d = 0.03$, $p = 0.007$), motor skills ($d = 0.04$, $p = 0.013$), content knowledge ($d = 0.05$, $p = 0.001$) and language ($d = 0.05$, $p = 0.002$). This indicated that when initial child engagement was low, the association between high classroom engagement and child school readiness growth was stronger.

**Conclusions:**

The present study examined the association between peer behavioral regulation and school readiness skills within preschool classrooms and found evidence to support peer effects do operate within the preschool classroom. Most previous studies of peer effects are based on a subsample of the other children in the classroom. This study extends previous work because it is an estimate based on all of each child's classmates. Results indicated that after adjusting for an assortment of demographic, program-related, and teacher factors as well as school readiness skills at entry to preschool, classroom-level peer engagement skills appear to make a unique contribution to children's school readiness skills during the preschool academic year. When fall

peer engagement was higher, children's total school readiness skills average was higher in the spring, adjusting for fall school readiness skills.

As suggested by the literature on primary and secondary grades, but relatively unexplored in preschool, a unique focus of this study was its attention to examining whether peer effects may operate differently for children as a function of their status within a classroom, as suggested by literature in the primary and secondary grades. Peer effects appear particularly influential for children whose initial (fall) engagement skills were low when measured in relation to their classmates. Children with low initial engagement skills in a classroom with peers with low engagement skills tend to have small growth in school readiness skills by the end of the preschool year. However, children with low engagement skills in a classroom with peers with high engagement skills tend to have large growth in school readiness skills by the end of the preschool year. This indicates that children with low engagement skills benefit greatly when stronger-skilled peers surround them in a classroom. On the contrary, highly skilled children, namely, those children who arrive at preschool with high levels of engagement, may be fairly impervious to peers' effects. These findings closely resemble results from prior research, which consistently finds that children's growth in various dimensions of achievement is affected by the skills of their peers, that these peers effects tend to be positive, and that these effects are largest among the least-skilled children (Henry & Rickman 2007; Justice et al., 2011; Mashburn et al., 2009).

A significant interaction between peer's engagement and children's engagement skills (initial status) indicated that low-initial status who are in classrooms with low-engaged peers lose ground in the development of their school readiness skills when compared to their peers who are in classrooms with average engaged peers. The magnitude of associations of peer engagement with children's growth in school readiness skills appears to be larger in this study compared to others (in the moderate range; Hill, Bloom, Black & Lipsey). Consistent with other recent reports on preschool (Justice et al., 2011; Mashburn et al., 2009) and primary grades (Hanushek et al., 2003), peer effects in language operate in a positive direction and seem to be less influential to the most highly skilled children.

There are several possible explanations for these findings. Children with low behavioral regulation skills are more likely to exhibit behavioral problems, such as aggression, interrupt the overall classroom activities and need more direct teacher intervention (McCabe et al., 2007; Rimm-Kaufman et al., 2005). Thus, the time available for instruction may be reduced in classrooms with more children who have difficulties regulating their behaviors or there are a few children with very weak behavioral regulation skills. Having peers with higher behavioral regulation skills may allow more time for the teacher to instruct. A class with low behavioral regulation (either a few children with very low scores or a large number of children with weaker scores) may put a strain on teachers' ability to organize and manage their classrooms.

Future research should work on identifying the mechanisms underlying peer effects in preschool. Perhaps studies that experimentally examine the impacts of increasing the average level of behavioral regulation on children's school readiness skill growth should be re-analyzed the answer whether peer-level behavioral regulations mediates the positive impacts of those programs would be influential. At the moment, most work on peer effects has used correlational methodologies. However, the magnitude and strength of the associations between peer behavioral regulation and children's school readiness skills make a compelling case that estimates of effects of inputs in preschool are likely to suffer from omitted variable bias unless peer abilities have been included in the model specifications.

# Appendices

## Appendix A. References

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# Appendix B. Tables and Figures
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*Multilevel Effects Summary*

| | Speed Dial (total) | | | Motor | | | Content knowledge | | | Language | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Coefficient (SE) | P-value | Cohens d | Coefficient (SE) | P-value | Cohens d | Coefficient (SE) | P-value | Cohens d | Coefficient (SE) | P-value | Cohens d |
| *Block 1* | | | | | | | | | | | | |
| Speed Dial (Total) | | | | | | | | | | | | |
| Behavioral Regulation | | | | | | | | | | | | |
| Engagement (Class-level) | 1.963 (.899) | 0.029 | 0.48 | 1.168 (.439) | 0.008 | 0.71 | 1.088 (.507) | 0.032 | 0.56 | 0.540 (.424) | 0.203 | 0.35 |
| Attention-Impulse Control (Class-Level) | -0.987 (.758) | 0.192 | -0.29 | -0.235 (.372) | 0.527 | -0.17 | -.471 (.428) | 0.272 | -0.29 | -0.103 (.359) | 0.775 | -0.08 |
| Child characteristics | | | | | | | | | | | | |
| Baseline school readiness skills | 0.631 (.020) | 0.000 | | 0.541 (.027) | 0.000 | | 0.524 (.021) | 0.000 | | 0.443 (.026) | 0.000 | |
| Age | 2.524 (.417) | 0.000 | | 0.755 (.213) | 0.000 | | 0.712 (.224) | 0.001 | | 1.924 (.188) | 0.000 | |
| Female | 0.535 (.224) | 0.017 | | 0.278 (.113) | 0.013 | | 0.279 (.124) | 0.025 | | 0.176 (.104) | 0.092 | |
| Black | -0.900 (.387) | 0.020 | | -0.329 (.196) | 0.093 | | -0.296 (.216) | 0.169 | | -0.120 (.182) | 0.510 | |
| Classroom/Teacher characteristics | | | | | | | | | | | | |
| Intervention status | 0.259 (.258) | 0.333 | | 0.321 (.190) | 0.011 | | -0.005 (.164) | 0.972 | | -0.139 (.122) | 0.255 | |
| *Block2* | | | | | | | | | | | | |
| Behavioral Regulation: Relative Status | | | | | | | | | | | | |
| Engagement (Group-mean-centered) | 0.215 (.098) | 0.028 | 0.05 | 0.089 (.049) | 0.066 | 0.05 | 0.161 (.053) | 0.002 | 0.08 | 0.126 (.045) | 0.005 | 0.08 |
| Attention-Impulse Control (Group-mean-centered) | -0.010 (.079) | 0.896 | 0.00 | 0.073 (.039) | 0.062 | 0.05 | 0.009 (.043) | 0.828 | 0.01 | 0.020 (.037) | 0.583 | 0.02 |
| *Block 3* | | | | | | | | | | | | |
| Interactions | | | | | | | | | | | | |
| Child Engagement*Class Engagement | 0.141 (.052) | 0.007 | 0.03 | 0.064 (.026) | 0.013 | 0.04 | 0.095 (.029) | 0.001 | 0.05 | 0.073 (.024) | 0.002 | 0.05 |
| Child Attention-Impulse Control*Class Attention-Impulse Control | -0.032 (.047) | 0.494 | -0.01 | 0.032 (.023) | 0.165 | 0.02 | -0.005 (.026) | 0.833 | 0.00 | 0.004 (.022) | 0.859 | 0.00 |