Identifying Aspects of Pre-K Classrooms that Benefit Achievement through Grade 1

Kimberly T. Nesbitt & Dale C. Farran
Vanderbilt University

PEABODY research institute

Introduction

With calls for "universal pre-k" and arguments that pre-k experiences are essential for children from low-income families[1], it is critical to identify specific, and potentially malleable, aspects of pre-k classrooms that are associated with greater immediate and sustained gains for at-risk children.

Prior evidence suggests associations between pre-k quality and children's concurrent and future achievement[2], including environments with:

- richness in spoken and written language experiences
- contingent and focused attention on the child
- abundant child exploration
- constructive models of adult language, reading, and learning

However, much of the work examining the impacts of pre-k quality has involved global ratings of the classroom rather than counts of specific and observable aspects of the classroom's practices and behaviors[3].

Moreover, little is known about the process by which greater pre-k quality contributes to children's classroom experiences and their subsequent outcomes.

Current Study

The goal of current study was to:

- Identify specific aspects about the pre-k classroom that predict children's immediate (pre-k) and sustained achievement gains (kindergarten and grade 1).
- Examine the relations between specific aspects of pre-k quality and pre-k achievement gains as mediators for individual children's engagement with the environment.

Method

Participants

- 849 children. 40% Caucasian, 26% African American, and 24% Hispanic. 46% female, 29% ELL, and 87% FRPL. Average age at pretest was 54.4 months (*SD* = 3.7).
- 60 pre-k classrooms taught by teachers with an average of 12.0 years (*SD* = 8.2) teaching experience. All licensed teachers.

Woodcock-JohnsonAssessments[4]

- Literacy: Letter-Word Identification and Spelling
- Language: Picture Vocabulary, Academic Knowledge, and Oral Comprehension
- Mathematics: Applied Problems and Quantitative Concepts

Classroom Observations

Three pre-k observations using a snapshot system for capturing teacher's and children's behaviors in the classroom across a day-long visit[5].

Teacher Behaviors:

- Emotional Climate: approving/ disapproving, emotional tone
- Child-Directed Learning: centers and small group centers
- Quantity of Instruction: instruction or assessment
- Quality of Instruction: inferential questioning, sustained topic focus

Children's Behaviors

- Academic Focus: attending to a learning-related activity
- Involvement: intense focus on learning-related activities

Analytic Approach

Direct and indirect effects were estimates using multilevel regression models in Mplus 7.11

- Residualized change models with child-level covariates conducted to reduce potential baseline bias.
- Tests of direct effects conducted by content area (literacy, language, and mathematics) and time point (end of pre-k, kindergarten, and grade 1).
- Tests of indirect effect though child behaviors examined for pre-k gains.

$$Posttest_{ij} = \gamma_{00} + \gamma_{01}(EmoTone_j) + \gamma_{02}(CDirect_j) + \gamma_{03}(QuantInst_j) + \gamma_{04}(QualInst_j) + \gamma_{10}(Focus_{ij}) + \gamma_{20}(Involve_{ij}) + \gamma_{30}(Covar_{ij}) + \mu_{0j} + \varepsilon_{ij}$$

Results

Direct Effects

End of Pre-K. As seen in top panel of Table 1, positive emotional climate, more child-directed learning, and greater instructional quality were related to children making greater pre-k gains, in particular gains in literacy.

Effect sizes reported are the independent contribution of each classroom predictor; therefore, the benefit of being in a high or low classroom on the various aspects can be estimated by summing across predictors. For example, as reflected in Figure 1, being in pre-k class that was high (+1 *SD*) on all predictors was equivalent to an effect size of 0.62 *SD* or a 39% improvement over the annual gains made by children in a class that was low (-1 SD) on all predictors.

End of Kindergarten. While the positive effects of emotional climate did not maintain into kindergarten, more child-directed learning and the quality of instruction in the pre-k continued to benefit children.

End of Grade 1. Pre-k classroom quality still had a sustained positive effect on children's literacy gains though end of grade 1. In particular more child-directed learning and greater instructional quality predicted greater gains.

Indirect Effects

As illustrated by Figure 2, higher quality instruction was associated with children spending a larger proportion of the day in an academic focus, which in turn contributed to greater pre-k gains in literacy and math (indirect effect *p*s < .019). More child-directed learning was positively related to higher levels of involvement, which in turn was related to literacy gains (*p*s < .028).

Table 1. Standardized mean difference effect sizes reflecting magnitude of a 2 SD improvement for each pre-k classroom predictor.

Parameter	Literacy	Language	Mathematic
End of Pre-K Outcomes			
Pre-k emotional climate, γ_{01}	0.18*	0.10**	0.03
Pre-k child-directed, γ_{02}	0.22**	0.04	0.01
Pre-k quantity instruction, γ_{03}	0.01	-0.07*	0.04
Pre-k quality instruction, γ_{04}	0.21**	0.01	0.09*
End of Kindergarten Outcomes			
Pre-k emotional climate, γ_{01}	-0.02	0.06	0.02
Pre-k child-directed, γ_{02}	0.32**	-0.02	0.12**
Pre-k quantity instruction, γ_{03}	-0.01	-0.10	-0.10
Pre-k quality instruction, γ_{04}	0.16**	0.06**	-0.01
End of Grade 1 Outcomes			
Pre-k emotional climate,, γ_{01}	-0.05	0.03	0.01
Pre-k child-directed, γ_{02}	0.21**	-0.08	-0.03
Pre-k quantity instruction, γ_{03}	-0.08	-0.09*	-0.05
Pre-k quality instruction, γ_{04}	0.12**	0.05	0.05

Note. Estimates presented for outcomes at the end of pre-k (top panel), kindergarten (middle), and grade 1 (bottom). Estimates indicate impact of being in a classroom with high (+1 SD) verses low (-1 SD) occurrences of each predictor. $^{**}p < .01$. $^{*}p < .05$.

Figure 1. Achievement Gains from Pre-K to Grade 1 by Pre-K Classroom Quality and Content Area

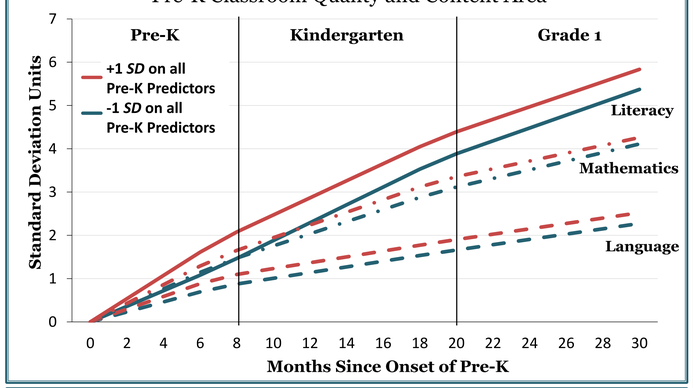
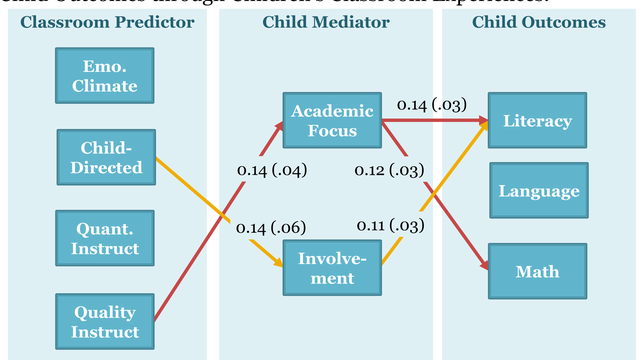


Figure 2. Significant Indirect Effects of Classroom Predictors on Child Outcomes through Children's Classroom Experiences.



Discussion

Although correlational, these results suggest that aspects of pre-k classrooms have lasting effects on academic gains, especially in literacy. These results also suggest a mechanism through which classroom quality facilitates future achievement gains.

Policy and Practice Implications

If the benefits of pre-k for at risk children are to be realized, it is essential that we not only provide pre-k, but ensure that pre-k is high-quality and effective at optimizing children's outcomes and success.

Identification of specific aspects of the pre-k classroom that are observable, potentially malleable, and related to outcomes is just the first step in an iterative process. Future work also needs to:

- develop and evaluate interventions and practices guided by insights from empirical data.
- design evidenced-based professional development that can help make classrooms more effective learning environments.
- consider what practices work for whom and under what conditions in terms of both children and teachers.

References

[1] Heckman, J. J., (2006). Skill formation and the economics of investing in disadvantaged children. Science, 312, 1900-1902.; Heckman, J. J., & Kautz, T. (2012). Hard evidence on soft skills. *Labour Economics*, *19*, 451-464.

[2] Early, D. M., et al. (2007). Teachers' education, classroom quality, and young children's academic skills: Results from seven studies of preschool programs. *Child Development, 78*, 558-580.; NICHD-ECCRN, & Duncan, G. J. (2003). Modeling the impacts of child care quality on children's preschool cognitive development. *Child Development*, 74, 1454-1475.; Peisner-Feinberg et al. (2001). The relation of preschool child care quality to children's cognitive and social developmental trajectories through second grade. *Child Development, 72*, 1534-1553.

[3] Curby, T. W., Rimm-Kaufman, S. E., & Ponitz, C. C. (2009). Teacher–child interactions and children's achievement trajectories across kindergarten and first grade. *Journal of Educational Psychology, 101* 912-925.; Pianta, R. C., et al. (2008). Classroom effects on children's achievement trajectories in elementary school. American Educational Research Journal, 45, 365-397.; NICHD-ECCRN (2000). The relation of child care to cognitive and language development. *Child Development, 71*, 960-980.

[4] Woodcock, R. W., McGrew, K. S., & Mather, N. (2001). *Woodcock-Johnson III Tests of Achievement*. Itasca, IL: Riverside Publishing.

[5] Bilbrey, C., Vorhaus, E., Farran, D. C., & Shufelt, S. (2010). *Teacher observation in preschool: Tools of the Mind Adaptation*. Nashville, TN: Peabody Research Institute.; Farran, D. C., Son-Yarbrough, W., Silveri, B., & Culp, A. (1993). Measuring the environment in public school preschools for disadvantaged children: What is developmentally appropriate? In S. Reifel (Ed.), *Advances in early education and day care* (pp. 75–93). Greenwich CN: JAI Press, Inc.

[6] Muthén, L.K., & Muthén, B.O. (2011). *Mplus user's guide* (7th ed). Los Angeles, CA: Muthén & Muthén.

Acknowledgements

The project from which these data are drawn is funded by the Institute of Education Sciences (R305A090533; PIs: Dale C. Farran & Mark W. Lipsey).

ies