

## **Abstract Title Page**

**Title:** Spillover effects in early childhood professional development

**Author(s):** Kathryn E. Gonzalez, Harvard University

## **Background/Context**

Considerable resources are currently being invested in professional development for early childhood educators to improve the quality of children's early learning environments (Fukkink & Lont., 2007; Early et al., 2007). Effective professional development programs have been shown to improve classroom quality and instructional practices (e.g., Hamre et al., 2012), and promote children's early learning outcomes (e.g., Raver et al., 2011).

However, little empirical research has examined spillover effects within teacher professional development (Garet et al., 2001). On the one hand, participating teachers may share knowledge and practices with untreated teachers. Alternatively, program effectiveness may depend on whether teachers participate with other colleagues from their school (i.e., collective participation; Douglass et al., 2015). Understanding the extent to which the impacts of professional development programs depend not only on teachers' own participation, but also on the participation of their colleagues, can inform the design and implementation of professional development programs.

## **Research questions**

We use data from a large-scale evaluation of two professional development programs, in which there was variability in the number of teachers randomly assigned to treatment across centers, to examine how the teachers' practice is affected by their colleagues' participation in professional development. First, we examine whether classroom quality, teachers' beliefs, and the language and literacy development of children in their classrooms are affected by the number of their colleagues assigned to receive professional development. Second, we examine whether these impacts vary based on teachers' own assignments to receive professional development.

## **Study participants**

The present analysis includes 226 teachers and 747 children from 89 preschool centers across nine U.S. cities. Teachers are 42 years old with 14 years of teaching experience, on average. Approximately 30% taught in public schools, and 61% taught in Head Start programs. Children in the sample are 4.2 years old. The racial/ethnic composition of children in the sample was 47% black, 9% white, and 36% Hispanic.

## **Intervention and Research Design**

The present study utilizes data from the National Center for Research on Early Care and Education Professional Development Study (NCRECE PDS), a multi-site, randomized trial of two professional development interventions designed to improve the quality of teacher-child interactions. Teachers were randomly assigned to participate in a 14-week professional development course or to a control condition in phase 1 of the study, and re-randomized to participate in an online coaching program or to a control condition in phase 2 of the study.

Random assignment in both phases involved randomizing teachers, rather than schools, within each of the participating cities. This resulted in variation in the number of teachers

assigned to the programs across centers, even among centers with the same number of teachers who participated in the study (Figures 1, 2), due to idiosyncrasies of the random assignment process.

## Measures

Classroom quality was measured using the Classroom Assessment Scoring System (CLASS, Pianta et al., 2008), and included teachers' emotional support, classroom organization, and instructional support domain scores from the end of each phase of the study. We also examine teachers' beliefs about the importance of literacy and language skills, and beliefs about intentional teaching. Finally, we examine four measures of children's early language and literacy development: the Peabody Picture Vocabulary Test (PPVT; Dunn & Dunn, 1981), Woodcock Johnson Picture Vocabulary Test (Woodcock & Johnson, 1990), and TOPEL Print Knowledge and Phonological Awareness assessments (Wilson & Longian, 2010).

## Analysis

To examine the possibility of spillover effects in the context of professional development, we leverage variation in the number of teachers assigned to receive professional development across centers. First, we estimate a series of OLS models where the number of the teachers' colleagues assigned to participate in the professional development is the predictor of interest. Teachers' own treatment assignment and the number of teachers in the school are included as additional covariates.

Second, we estimate a similar series of OLS models that include the interaction between teachers' own treatment assignment and the degree of peer participation in PD, to examine whether the impact of teachers' participation in PD varies based on the number of colleagues assigned to participate in the same program. We consider each phase of the study separately. Equations 1 and 2 provide the details of the estimated models.

## Results

Preliminary results suggest that the quality of teacher-child interactions was not affected by number of colleagues who were assigned to the course in phase 1 (Table 1). However, the assignment of an additional colleague to the coaching in a teacher's school during phase 2 led to an increase in instructional support (0.30 SD,  $p < 0.01$ ). This impact did not vary based on teachers' own treatment assignment. We also positive impacts on emotional support and classroom organization among teachers assigned to the control condition of 0.19 SD ( $p < 0.05$ ) and 0.22 SD ( $p < 0.05$ ), respectively (Table 2).

Exploring potential mechanisms, we also find teachers with more colleagues assigned to the coaching condition also reported stronger beliefs about the importance of literacy and language skills, although we observe no effect on beliefs about intentional teaching (Table 3).

However, we find little evidence that these impacts promoted children's language and literacy development. The assignment of an additional colleague to the coaching led to an 0.11

SD increase in children's print knowledge, but we find no effects on other measures of early language and literacy development (Table 4).

## **Conclusions**

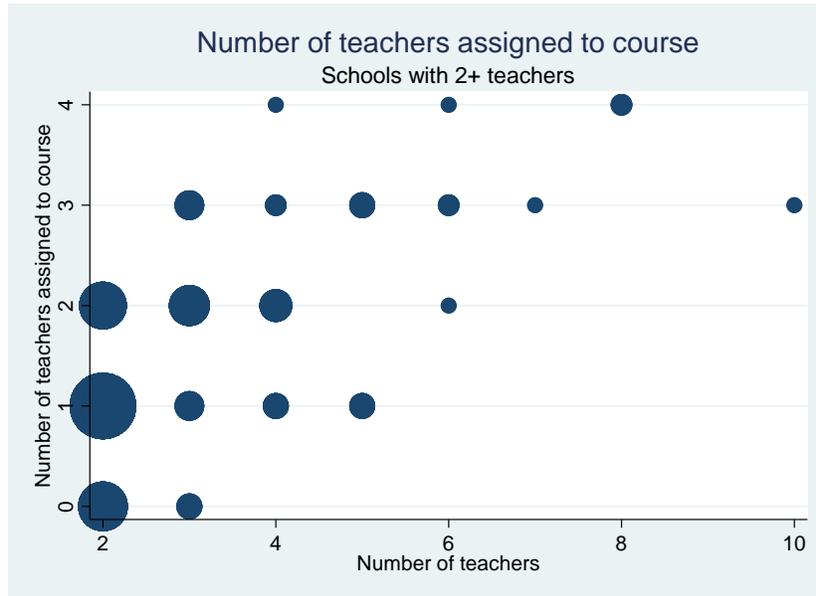
Preliminary results suggest comparisons of treated and untreated teachers within the same schools may understate the effectiveness of some professional development programs due to spillover effects. We find evidence that the participation of a teacher's colleagues in a coaching program had a positive impact on her beliefs and classroom quality, although we find only limited evidence that these impacts translated into student learning.

Additional analyses will seek to understand why these spillover effects are present in the context of coaching intervention, but not the course. We will also examine whether peer participation professional development affects teachers' participation in the program itself, including whether teachers engage in the professional development or choose to leave the study.

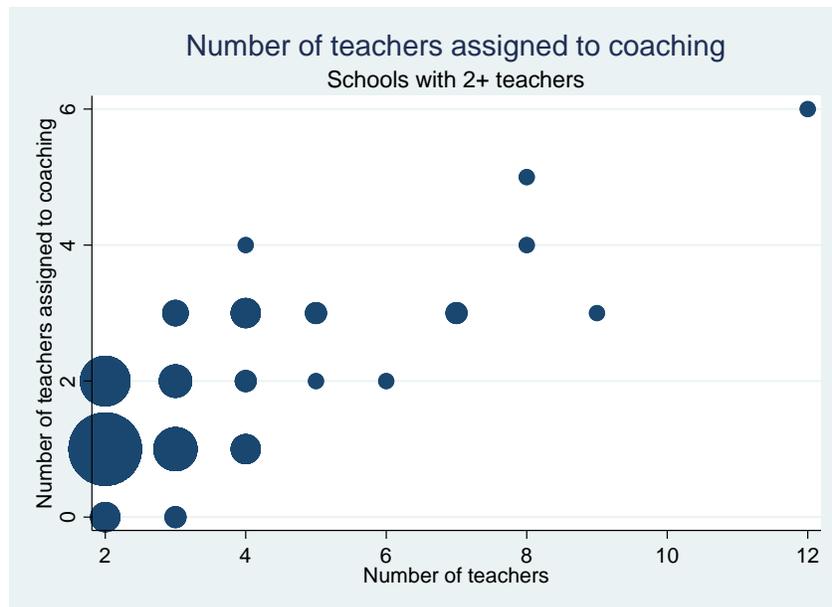
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## Tables, Figures, and Equations



**Figure 1. Number of teachers assigned to course in Phase 1, by school size.** Markers weighed by the number of schools in each category. Values on the y-axis include the number of teachers assigned to the course condition. Values on the x-axis include the number of teachers participating in phase 1 of the study.



**Figure 2. Number of teachers assigned to coaching in Phase 2, by school size.** Markers weighed by the number of schools in each category. Values on the y-axis include the number of teachers assigned to the coaching condition. Values on the x-axis include the number of teachers participating in phase 2 of the study.

**Table 1.** Impact of colleagues' assignment to course on the quality of teacher-child interactions

	CLASS: Emotional Support		CLASS: Instructional Support		CLASS: Classroom Organization	
Course	0.458** (0.155)	0.477** (0.156)	0.521** (0.156)	0.490** (0.166)	0.353 (0.180)	0.476* (0.181)
Number of colleagues assigned to course	-0.078 (0.098)	-0.059 (0.109)	0.103 (0.101)	0.072 (0.110)	0.025 (0.105)	0.150 (0.124)
Course*Num. of colleagues assigned to course		-0.044 (0.136)		0.072 (0.128)		-0.286* (0.139)
Observations	159	159	159	159	159	159

Standard errors in parentheses. Standard errors clustered at the school level. All models include site indicators, number of teachers in the school participating in the study, teacher gender, teacher race/ethnicity, teacher experience, teacher age, whether the teacher taught in a Head Start center, and whether the center was located in a public school. Number of colleagues assigned to course is grand-mean centered. Analyses include schools with at least two teachers. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

**Table 2.** Impact of colleagues' assignment to coaching on the quality of teacher-child interactions

	CLASS: Emotional Support		CLASS: Instructional Support		CLASS: Classroom Organization	
Coaching	0.150 (0.173)	0.150 (0.174)	0.725*** (0.143)	0.725*** (0.141)	-0.084 (0.163)	-0.084 (0.164)
Number of colleagues assigned to coaching	0.155 (0.081)	0.193* (0.087)	0.296*** (0.080)	0.261* (0.100)	0.174 (0.087)	0.216* (0.098)
Coaching*Num. of colleagues assigned to coaching		-0.067 (0.099)		0.063 (0.107)		-0.074 (0.091)
Observations	161	161	161	161	161	161

Standard errors in parentheses. Standard errors clustered at the school level. All models include site indicators, number of teachers in the school participating in the study, teacher gender, teacher race/ethnicity, teacher experience, teacher age, whether the teacher taught in a Head Start center, and whether the center was located in a public school. Number of colleagues assigned to coaching is grand-mean centered. Analyses include schools with at least two teachers. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

**Table 3.** Impact of colleagues' assignment to coaching on teacher beliefs and knowledge

	(1)	(2)	(3)	(4)
	Beliefs about importance of literacy and language skills Knowledge		Beliefs about intentional teaching	
Coaching	-0.282 (0.186)	-0.291 (0.187)	0.222 (0.168)	0.226 (0.167)
Number of colleagues assigned to coaching	0.247** (0.088)	0.336** (0.113)	0.215 (0.124)	0.186 (0.116)
Coaching*# colleagues assigned to coaching		-0.176 (0.117)		0.058 (0.103)
Observations	158	158	156	156

Standard errors in parentheses. Standard errors clustered at the school level. All models include site indicators, number of teachers in the school participating in the study, teacher gender, teacher race/ethnicity, teacher experience, teacher age, whether the teacher taught in a Head Start center, and whether the center was located in a public school. Number of colleagues assigned to coaching is grand-mean centered. Analyses include schools with at least two teachers. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

**Table 4.** Impact of colleagues' assignment to coaching on children's language and literacy outcomes

	(1)	(2)	(3)	(4)
	PPVT	Woodcock-Johnson Picture Vocab.	TOPEL Print Knowledge	TOPEL Phonological Awareness
Coaching	-0.001 (0.052)	-0.056 (0.052)	0.057 (0.060)	-0.014 (0.076)
Number of colleagues assigned to coaching	0.006 (0.035)	0.022 (0.031)	0.114* (0.048)	0.048 (0.069)
Observations	743	742	745	723

Standard errors in parentheses. Standard errors clustered at the school level. All models include site indicators, number of teachers in the school participating in the study, teacher gender, teacher race/ethnicity, teacher experience, teacher age, whether the teacher taught in a Head Start center, whether the center was located in a public school, child age, child race/ethnicity, child gender, whether child speaks English in the home, mother's years of education, and fall test score. Analyses include schools with at least two teachers. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

**Equation 1.** Equation used to estimate the effect of colleagues' participation in the NCRECE PD on classroom quality and teacher perception of school climate.

For teacher  $i$  in school  $s$  in site  $j$ :

$$(1) Y_{isj} = \beta_0 + \beta_1 Course_{isj} + \beta_2 NumCourse_{isj} + \beta_3 T_{isj} + \beta_4 NumTeachers_{sj} + \gamma_j + \epsilon_{isj}$$

where

$Course$  is indicator for whether teacher was assigned to treatment condition in Phase 1.

$NumCourse$  is the degree of peer participation in Phase 1, i.e., the number of a teacher's colleagues from the same school that were assigned to the treatment condition during that phase.

$NumTeachers$  is the number of teachers in the school that are participating in the study.

$T$  is a vector of teacher characteristics (including age, years of experience, gender, and race/ethnicity).

$\gamma_j$  are site fixed effects.

Analogous models will be estimated to examine the impact of colleagues' participation in the phase 2 professional development program (*Coaching*).

**Equation 2.** Equation used to estimate variation in the effect of the NCRECE PD based on the number of colleagues assigned to participate the PD.

For teacher  $i$  in school  $s$  in site  $j$ :

$$(2) Y_{isj} = \beta_0 + \beta_1 Course_{isj} + \beta_2 NumCourse_{isj} + \beta_3 Course_{isj} * NumCourse_{isj} + \beta_4 T_{isj} + \beta_5 NumTeachers_{sj} + \gamma_j + \epsilon_{isj}$$

where

$Course$  is indicator for whether teacher was assigned to treatment condition in Phase 1.

$NumCourse$  is the degree of peer participation in Phase 1, i.e., is the number of a teacher's colleagues from the same school that were assigned to the treatment condition during that phase.

$NumTeachers$  is the number of teachers in the school that are participating in the study.

$T$  is a vector of teacher characteristics (including age, years of experience, gender, and race/ethnicity).

$\gamma_j$  are site fixed effects.

Analogous models will be estimated to examine the impact of colleagues' participation in the phase 2 professional development program (*Coaching*).