



RESEARCH REPORT

Professional Development Supports and Teacher Practice in Low-Income Pre-K Programs

Strengthening the Diversity and Quality of the Early Care and Education
Workforce Paper Series

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October 2019



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Contents

Acknowledgments	iv
Executive Summary	v
Professional Development Supports and Teacher Practice in Low-Income Pre-K Programs	1
Introduction	1
Current Study	5
Data, Sample, and Methods	7
The Making Pre-K Count Study	7
Sample	9
Analytic Strategy	9
Results	10
Descriptives	10
Associations between Teacher Professional Development Supports and Teacher Practices	13
Comparing Teachers with More versus Less Experience Teaching Pre-K	14
Discussion and Recommendations	15
Key Findings	15
Implications	17
Technical Appendix	19
Methodological Details	20
Study Measure Descriptions	20
Covariates	23
Analytic Plan	23
Additional Results	24
Notes	30
References	31
About the Authors	34
Statement of Independence	35

Acknowledgments

We would like to thank the Foundation for Child Development’s Young Scholars Program for their generous support, which has made this secondary data analysis of the Making Pre-K Count study possible. We would also like to thank the Foundation for Child Development and the Urban Institute for their detailed feedback and support in the writing of this paper.

We thank the children, families, and teachers who participated in the Making Pre-K Count study and generously gave their time, commitment, and cooperation throughout the project. This research would not have been possible without them.

The current study is a secondary data analysis of Making Pre-K Count. Making Pre-K Count is the first study of the Robin Hood Early Childhood Research Initiative, a partnership between the Robin Hood Foundation and MDRC, a nonprofit, nonpartisan education and social policy research organization. Making Pre-K Count, conducted in collaboration with Bank Street College of Education and RTI International, is also supported with lead funding from the Heising-Simons Foundation, the Overdeck Family Foundation, and the Richard W. Goldman Family Foundation.

Executive Summary

With bipartisan support, public funding for pre-K programs across the United States has steadily expanded over the past two decades. This is in part because of evidence that enrolling children in high-quality early childhood education programs leads to positive academic and postschooling outcomes, such as employment and less contact with the criminal justice system. State resources and investment in early childhood have primarily been used to increase access to pre-K programs, especially for low-income children and children of color; however, program quality across states varies widely. A key question posed by policymakers and practitioners is how to create early childhood educational environments that promote successful outcomes for preschool-aged children.

Central to this discussion is the complex and challenging task of teaching and, in particular, how professional development can help teachers promote children’s learning and development. But questions remain about what forms professional development should take in early childhood centers serving preschool-aged children. Although evaluation research demonstrates that training and coaching can improve teacher practices, less work has examined which types of professional development are linked to different aspects of teacher practice in pre-K classrooms.

This report examines three types of professional development supports often provided by early childhood programs: (1) teacher training, (2) teacher coaching, and (3) common planning or “prep” time. Moreover, it examines whether these supports predict various aspects of observed teacher practice. These aspects include (1) process quality, or the extent to which teacher-child interactions are responsive and sensitive and classrooms are well-organized and well-managed; (2) instructional quality, or the extent to which teachers promote children’s high-order thinking skills and provide rich language environments; and (3) the amount of time classes spend on language and literacy activities, on math activities, and in different activity groupings such as small group, whole group, and transitions. This report also explores whether the associations between professional development supports and teacher practice vary based on teachers’ levels of experience. Data for this study come from Making Pre-K Count (MPC), a project that evaluated the effects of an evidence-based mathematics curriculum combined with teacher professional development on outcomes for 4-year-olds enrolled in center- and school-based pre-K programs in low-income neighborhoods in New York City.

Current analyses showed that the three types of professional development supports had varying associations with different teacher practices in pre-K classrooms. Those associations included the following:

- **Receiving more coaching in math was associated with better process quality and instructional quality.** Teachers who reported receiving more coaching in math tended to have higher scores on measures of process quality and instructional quality. More math coaching was also associated with more time spent in transition: that is, periods of unproductive time when children typically wait for another activity to start.
- **Receiving more in-service training was associated with better process quality, but not instructional quality.** Teachers whose administrators reported they received more training tended to have higher scores on a measure of process quality. This association was not as strong as the association found between coaching and process quality.
- **Teachers in sites with more common planning time spent less time in whole-group activities.** Amount of common planning time was not associated with any of the other aspects of teacher practice observed in this study.

The associations we found between professional development supports and teacher practice were generally similar regardless of whether teachers were more experienced or less experienced, with two exceptions. First, for less experienced teachers, more in-service training from their site or district was associated with lower instructional quality. Second, for more experienced teachers, more common planning time was associated with less time in whole-group activities. However, coaching was associated with better process and instructional quality regardless of teachers' experience.

This study's findings support the following implications for policymakers and practitioners to consider when working to improve the quality of pre-K programs:

Ongoing coaching is a key form of professional development—potentially more so than teacher training—for supporting classroom quality. More coaching in math was shown to be more strongly associated with better instructional quality and process quality than teacher training. Because research and theory suggest that coaching teachers to apply the knowledge and practices they learn in training may support quality, in-service training and coaching that are intentionally paired may be the most effective forms of professional development.

Common planning time may be a promising professional development support. Classrooms whose teachers had more common planning time spent less time in whole-group activities and more time in small

groups. This suggests that when teachers have time dedicated to planning in their schedule, they may be better able to create lesson plans while keeping activity settings in mind.

A “one size fits all” mentality for teacher professional development may not meet the needs of the early childhood workforce. Although this study found minimal evidence that the links between the three professional development supports examined in this report and aspects of teacher practice differed based on teacher experience, two findings suggested experience should be considered when planning professional development resources. First, if more in-service training is indeed related to lower instructional quality for less experienced teachers, then it may be necessary to carefully consider how much training to provide (along with that training’s content and objectives). Second, because we found that common planning time was associated with less time in whole-group activities for experienced teachers but not for inexperienced teachers, this form of support may be less effective for newer teachers who could need more support for lesson planning.

Whether the amount of training, coaching, and common planning time teachers receive is related to their observed practice, as well as whether these professional development supports matter more for teachers with more or less experience, are important questions for policy and practice, especially given the field’s emphasis on high-quality professional development in early childhood education. This is because early childhood centers must choose how to use their resources to provide professional development in cost-effective ways. This report examines three professional development supports that appear to be associated with teacher practices in school- and center-based pre-K classrooms. The findings suggest that coaching may be a promising method for supporting process quality and instructional quality, and that common planning time may help teachers address activity settings. Such research is critical for helping the field build a competent workforce that can effectively meet the needs of diverse groups of young children.

Professional Development Supports and Teacher Practice in Low-Income Pre-K Programs

Introduction

With bipartisan support, public funding for pre-K programs across the United States has steadily expanded over the past two decades (Friedman-Krauss et al. 2017). This has been partly because of evidence that early childhood is a foundational period for lifelong success (Berrueta-Clement et al. 1984; Campbell et al. 2002). State resources have primarily been invested in increasing access to pre-K programs, but the quality of such programming is currently at the forefront of continuing debates in early childhood education policy. High-quality learning experiences in early childhood education classrooms have been shown to be important for promoting children’s learning and development (Auger et al. 2014; Burchinal, Kainz, and Cai 2011; Martinez-Beck and Zaslow 2006; NICHD 2006). These experiences can be particularly beneficial for low-income, minority, and dual-language-learner children (Gormley et al. 2005; HHS 2010). However, our understanding of what makes a pre-K classroom “high-quality” and how best to promote such quality remains incomplete. One promising method for promoting classroom quality is the provision of teacher professional development, but more knowledge is needed about what professional development supports most effectively promote different aspects of quality.

This report addresses these gaps in knowledge by examining how three types of teacher professional development supports—in-service training from teachers’ centers and/or districts, coaching in math, and planning time—are related to different aspects of classroom quality and teacher practice in center- and school-based pre-K classrooms serving 4-year-old children.

Existing research on classroom quality and on which teaching practices best support children’s skill development sheds light not only on what is important for children’s development but on unanswered questions. Thinking about classroom environments in binary terms of low-quality versus high-quality can mask which elements of quality may be more critical than others. For instance, researchers and practitioners have typically focused on two aspects of quality: (1) structural quality, which focuses on structural aspects of the classroom such as group size, child-teacher ratio, and teacher education level, and (2) process quality, or the extent to which teacher-child interactions are responsive, sensitive, and

instructionally supportive and the classroom is organized and managed well. Structural aspects of quality can be regulated or changed by policies that, for example, limit class size or set education requirements for lead teachers. Process quality, however, cannot be easily regulated and is harder to manipulate because it requires changing teacher behaviors and practices.

The literature suggests that structural quality is a necessary focus but likely insufficient for promoting child outcomes. Structural features can enable teacher-child interactions that are positive, rich in content, and cognitively stimulating, but they do not guarantee such interactions will occur. Unsurprisingly, structural features are inconsistently linked with children's gains (Cassidy et al. 2005; NICHD 2002; Zaslow et al. 2010). Aspects of process quality are thought to be more closely linked with children's outcomes, but these links are modest (Burchinal, Kainz, and Cai 2011; Burchinal, Zaslow, and Tarullo 2016; Weiland et al. 2013). Teachers' emotionally responsive interactions have been shown to be related to children's teacher-reported social skills, and instructional interactions like promoting children's high-order thinking skills and providing a rich language environment have been shown to be linked with better academic and language skills among children (Mashburn et al. 2008). This suggests it may be important to distinguish between the instructional and emotional aspects of quality when considering what classroom practices matter for which child outcomes. Comparatively little research has focused on whether the amount of time allocated to teaching specific content, instructional strategies involving different group sizes (e.g., small group or whole group), or settings (e.g., transition) are associated with child gains (Fuhs, Farran, and Nesbitt 2013). Research suggests that small group settings (which may allow teachers to tailor their instruction to children's individual needs) is associated with larger impacts on children's cognitive development (Camilli et al. 2010). This study extends the existing work on classroom quality by examining multiple aspects of quality and teacher practice: process quality, instructional quality, amount of time spent on language and literacy activities, amount of time spent on math activities, and amount of time spent in different activity groupings (small and whole group) and settings (transitions).

Another key question involves how to help teachers deliver high-quality practices in the classroom. Many demands are made of pre-K teachers. They are expected to manage classrooms that create fun and rich learning experiences for diverse groups of young children, understand how children develop, lay the groundwork for young learners in multiple domains of knowledge, and tailor instruction to children with different abilities and needs. Moreover, pre-K teachers are often required to meet such demands with few resources and low compensation. This creates the challenge of helping teachers not only to create and provide high-quality learning environments but to do so while meeting the above expectations. One promising strategy for meeting this challenge is teacher professional development,

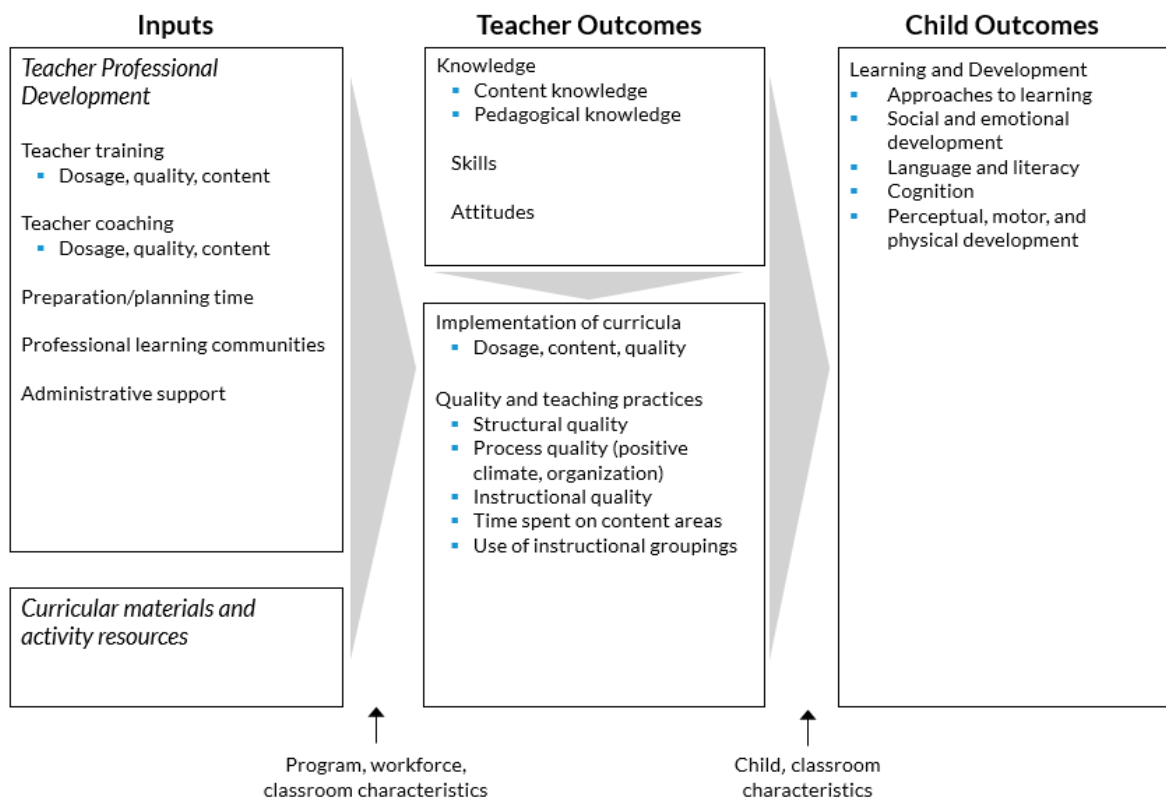
which involves continuing learning and support activities to promote teachers' professional competency and instructional capacity (Sheridan et al. 2009). Investing in quality professional development could build a teacher workforce equipped with the competencies to create high-quality learning experiences that meet the developmental needs of young children from all backgrounds.

Underlying professional development is the assumption that providing teachers professional development supports will help them expand and refine their instructional toolkits and, in turn, improve children's outcomes (Kraft, Blazar, and Hogan 2018; Sheridan et al. 2009). As shown in figure 1, the theory is that professional development can improve teachers' knowledge, skills, and attitudes toward different content areas, which is thought to change and improve their teaching practices in the classroom. These improvements in knowledge, skills, attitudes, and teaching practices, moreover, are expected to help children learn.

Factors outside the classroom may also influence learning, factors including accreditation and licensing standards; public pre-K early learning standards; the structure, type, and size of early childhood programs; program funding and resources, organizational culture, and administrator supportiveness; and the characteristics of staff, children, and families. Such program inputs may shape the form, content, quality, and duration of the professional development activities that are provided in an early childhood center. Curricular materials and other educational resources also influence the learning experiences teachers provide to children, but these may or may not be well-integrated with teachers' professional development opportunities.

FIGURE 1

Conceptual Model Underlying Teacher Professional Development



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Several forms of teacher professional development can be offered once teachers are on the job, including: (1) in-service teacher training, where teachers attend single-day or multiday training workshops, (2) teacher coaching, where coaches (typically from outside the pre-K program) provide ongoing, individualized feedback after observing teachers in the classroom, (3) common planning or “prep” time for teachers to prepare their lesson plans, and (4) professional learning communities, where groups of teachers share and learn from the group’s experiences (Hughes and Kritsonis 2006). A large body of research has found that specialized teacher training and coaching are linked to improvements in teachers’ skills and practices and, although less consistently and strongly, children’s learning outcomes (Fukkink and Lont 2007; Kraft, Blazar, and Hogan 2018). Teacher training and coaching are typically offered together, based on the idea that coaching can help teachers translate the knowledge and skills they learn in training into a real-world context (Joyce and Showers 2002). Furthermore, some evidence suggests training alone may not be the most effective form of professional development for improving teacher quality and practice (Koh and Neuman 2009; Landry et al. 2009; Markussen-Brown et al. 2017). Less research has been conducted on the effects of planning time on classroom practices, and the

research that has been conducted has been less rigorous and focused on later grades. For example, research on common planning time in middle schools shows moderate to strong positive correlations between practices that would likely be part of common planning time (e.g., curriculum coordination, coordination of student assignments, parent contact and involvement) and various classroom practices, including small-group active instruction, interdisciplinary practices, and domain-specific enhancement practices (Mertens et al. 2010). Correlational and qualitative research—again, with teachers of older grades—suggests that professional learning communities may have an effect on classroom practice and student achievement (Lieberman and Miller 2011; Saunders, Goldenberg, and Gallimore 2009; Vescio, Ross, and Adams 2008).

In summary, there is theory regarding the positive effects of professional development on teacher practice (and subsequently on children’s outcomes) and some empirical evidence to support it. But much of the existing research on teacher professional development comes from intervention and evaluation research, meaning relatively few studies have been situated in real-world contexts or have focused on which forms of professional development are related to different aspects of teacher practice. In addition, research has paid less attention to questions about professional development supports like common planning time, especially for pre-K teachers. For example, teachers with more common planning time may be more likely to devote time to specific kinds of activity settings (such as small group) or spend less time in transition because they are able to prepare their materials and schedule for specific activities ahead of time. This report addresses these gaps by examining the associations between multiple aspects of observed teacher practice and three types of professional development supports often provided by pre-K programs: (1) in-service teacher training, (2) teacher coaching in math, and (3) common planning or “prep” time.

The rest of this report outlines the data, sample, and methods used in the analysis, followed by the results and a discussion of key findings and implications for the field. The appendix provides more detailed information on the method, data sources, analysis plan, and results.

Current Study

The current study is a secondary data analysis that addresses the following research question: how are teacher professional development supports related to teacher practice in center- and school-based pre-K classrooms? It examines the following professional development supports: in-service training teachers receive from their center and/or district, math coaching, and planning time. It also examines multiple aspects of classroom quality and teacher practice, specifically classroom process quality

(defined as a classroom's emotional climate and management/organization), instructional quality, and amount of time spent on language and literacy activities, on math activities, and in different activity settings (small group, whole group, and transitions).

We hypothesized that coaching would be more strongly associated with teacher practice than teacher training, given prior experimental research showing the positive effects of coaching on teacher practice (Boller et al. 2010; Bryant et al. 2009) but mixed findings on the effects of training (Koh and Neuman 2009). Although research on common planning time is limited, especially for pre-K teachers, we expected that teachers with more common planning time may be more likely to spend time in small groups or spend less time in transition because they are able to organize their plans for specific activities ahead of time. Moreover, evidence from past studies suggests that experienced teachers who receive coaching may make more gains in classroom quality than less experienced teachers, perhaps because experienced teachers have a greater range of skills and experiences with which to incorporate new strategies (Bryant et al. 2009); therefore, we also explore whether the associations between professional development and teacher practice differ for teachers with less versus more experience.

Data, Sample, and Methods

The Making Pre-K Count Study

The current study is a secondary analysis of the pre-K data from Making Pre-K Count (MPC), the first study of the Robin Hood Early Childhood Research Initiative, an initiative designed to identify and rigorously test promising early childhood interventions. The initiative is a partnership between the Robin Hood Foundation and MDRC, a nonprofit, nonpartisan education and social-policy research organization. Conducted in collaboration with Bank Street College of Education and RTI International, MPC is supported with lead funding from the Heising-Simons Foundation, the Overdeck Family Foundation, and the Richard W. Goldman Family Foundation. Making Pre-K Count is a cluster-randomized control trial evaluating the effects of an evidence-based math curriculum (Clements and Sarama 2013) combined with extensive teacher training and in-classroom coaching on children’s educational outcomes (Morris, Mattera, and Maier 2016). The sample includes 69 pre-K sites—public schools and community-based centers, including Head Start—funded by New York City’s Department of Education and Administration for Children’s Services that serve the city’s low-income population of 4-year-olds. Half of the sites were randomly assigned to the control group, which proceeded with their usual pre-K programming, and the other half to the program group, which received Building Blocks and associated professional development over the 2013–14 and 2014–15 school years. The professional development included 11 days of training on the Building Blocks curriculum (provided by the curriculum developers) and ongoing in-classroom coaching on the curriculum and math instruction (delivered by Bank Street College of Education) over two school years. The current study uses data that include information about lead teachers (background, experience, receipt of professional development) and classrooms (observed quality and teacher practices, collected in the spring of the second school year) across the treatment and control groups. Prior research examined the effectiveness of the Building Blocks curriculum in combination with professional development (Mattera, Jacob, and Morris 2018; Morris, Mattera, and Maier 2016). The current study leverages the MPC data to examine links between teacher practices and an array of professional development supports offered in the NYC pre-K context, supports not provided by the math intervention. See table 1 for the measures used in the current study and the appendix for more detailed descriptions of MPC and study measures.

TABLE 1

List of Study Measures

Construct	Source	Measure
<i>Teacher professional development</i>		
In-service training led by district ^a	Site administrator survey	Survey item: "How many hours in total did lead teachers participate in workshops, in-services, institutes, or conferences organized by the district for teachers from multiple centers/schools in NYC?"
In-service training led by site	Site administrator survey	Survey item: "How many hours in total did lead teachers participate in workshops or in-services presented by staff from your center/school?"
Common planning or prep time	Site administrator survey	Survey item: "How many hours in total did lead teachers participate in common planning or 'prep' meetings?"
Coaching	Teacher self-survey	Survey item: "From August 2014 through February 2015, how often did you participate in any coaching on mathematics instruction, as part of a formal school arrangement? By formal school arrangement, we mean coaching or mentoring provided at your school or center."
<i>Observed classroom practice</i>		
Process quality	Classroom Assessment Scoring System – Pre-K (CLASS – Pre-K)	Average scores of Emotional Support domain and Classroom Organization domain (1–7 scale).
Instructional quality	CLASS – Pre-K	Average score of dimensions of Instructional Support domain (1–7 scale).
Proportion of time spent on language/literacy instruction	Narrative Record	Proportion of the classroom observation (i.e., 3 hours) spent on language/literacy activities.
Proportion of time spent on math instruction	Narrative Record	Proportion of the observation spent on math activities.
Proportion of time spent in transition	Narrative Record	Proportion of the observation spent in transition, typically when children are waiting for another activity to begin.
Proportion of time spent in whole group	Narrative Record	Proportion of the observation spent in activities led by a teacher and conducted with the majority of children in a class.
Proportion of time spent in small group	Narrative Record	Proportion of the observation spent in activities conducted with a small group of children.

^a In-service training hours did not include curriculum training provided to the program group.

Sample

This study is based on the 173 pre-K lead teachers participating in the second year of MPC intervention implementation. Table 2 offers information about teachers' background characteristics. Lead teachers were mostly female (94 percent) and racially and ethnically diverse. Most teachers (86 percent) had a master's degree.¹ Teachers' years of experience in pre-K education ranged from 0 to 37 years, with a mean of approximately 7 years. Teachers were serving primarily low-income minority student populations. More than half of the students were Hispanic and roughly one-third were Black. Roughly 90 percent of students in every site qualified for free or reduced-price lunch.

TABLE 2

Teacher Background Characteristics for the Full Sample in MPC's Second Year

	Mean
Characteristic	
<i>Female (%)</i>	94.5
<i>Race/Ethnicity (%)</i>	
Hispanic	32.1
Non-Hispanic White	34.2
Non-Hispanic Black	26.1
Other	8.1
<i>Experience (years)</i>	15.2
<i>Master's degree or higher (%)</i>	85.9

Note: N=173; for all variables, data were available for at least 90.2 percent of the sample.

Analytic Strategy

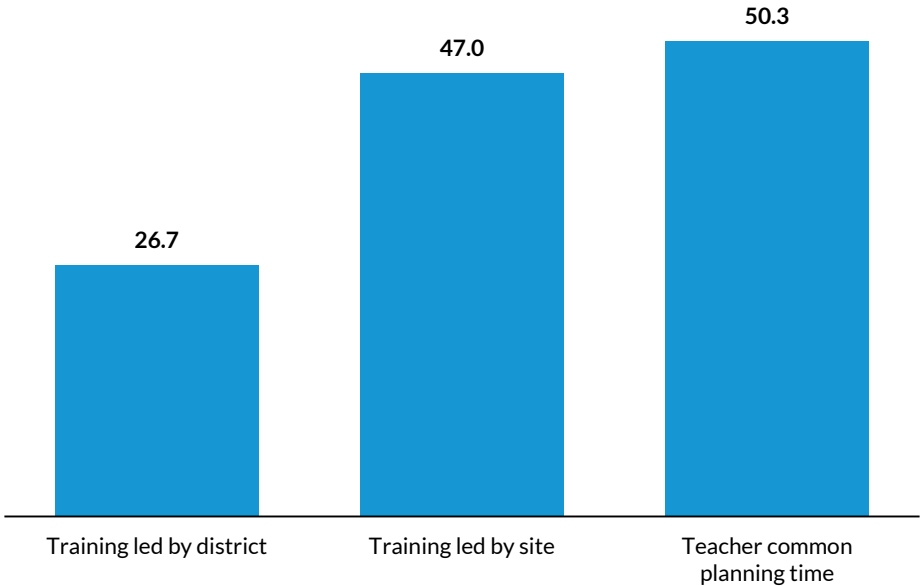
We used structural equation modeling first to estimate the strength of the links between professional development supports and observed teacher practice, controlling for teacher experience and educational attainment, as well as racial-ethnic background, random assignment status, and select center characteristics. Next, we conducted a sensitivity analysis using the sample of teachers from the control group (that is, teachers who did not receive professional development as part of the math intervention). Finally, we investigated whether the links between professional development supports and teacher practice varied among teachers who had more (defined as teaching pre-K for the median 5.7 years or more) or less experience by using multiple group analysis. For more details about the methodology, see the appendix.

Results

Descriptives

Figure 2 shows the total number of hours teachers spent in in-service training and common planning time during the second year of intervention implementation (not including the Building Blocks training MPC provided to teachers in the program group). During this year, teachers spent 47 hours in professional development trainings led by their site and roughly 27 hours in trainings led by their district. Together, this amounted to approximately 2 hours of in-service training a week. On average, teachers had a total of 50 hours of common planning time. That amounted to around 1 hour and 20 minutes of planning a week. The average number of professional development support hours was similar regardless of whether the pre-K site was a public school or community-based organization (CBO) or whether it was in the program or control group. The exception is total common planning time during the year, which appears to be slightly higher in CBOs (54.5 hours) than in public schools (47.3 hours).

FIGURE 2
Annual Hours of In-Service Teacher Training and Common Planning Time
As reported by site administrators

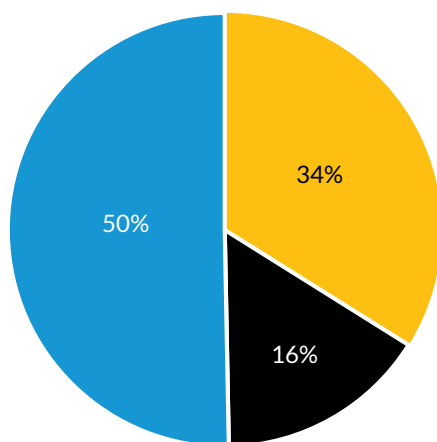


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Figure 3 shows how much math coaching teachers in the sample reported receiving, including Building Blocks and other program coaching. Because MPC was a randomized trial testing a math intervention, all teachers in the program group received coaching. Therefore, the control group drove most of the variation in the coaching variable. Roughly one-third of control teachers reported receiving some math coaching, and one control teacher reported receiving a lot of math coaching from August through February of that school year.

FIGURE 3
Amount of Math Coaching Received
As reported by teachers

■ None ■ Some ■ A lot

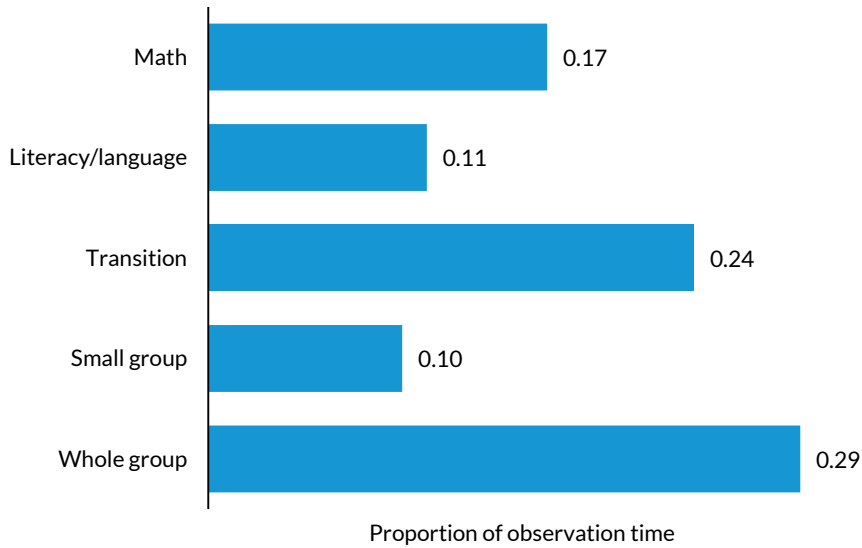


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During three-hour classroom observations in the spring, children spent (on average) more time in whole group (29 percent) and transitions between activities (24 percent) than in small groups (10 percent; see figure 4). In other words, just under 20 minutes of the morning was dedicated to teacher-led small group work. Children spent, on average, a greater proportion of these observations in math activities (17 percent of observation time) than in language/literacy activities (11 percent). The standard deviations and range for each of these averages are large, suggesting children's experiences varied widely across classrooms. It is important to note that time spent in activity settings (small group, whole group, transitions) and time spent in language/literacy or math are not mutually exclusive. Also, part of the Building Blocks curriculum includes small-group math activities, which may account for some of the variation (that is, because this aspect of the curriculum was used in half of classrooms).

FIGURE 4

Use of Classroom Time during a Three-Hour Observation

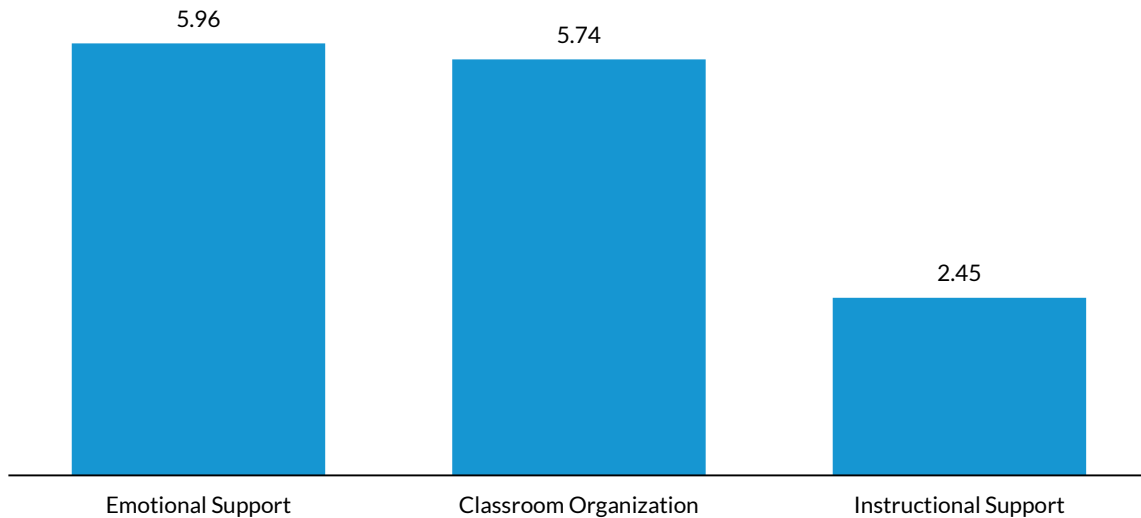


Note: Time spent in activity settings (small group, whole group, transitions) is not mutually exclusive of time spent in literacy/language or math.

Figure 5 shows average classroom scores for each of the three Classroom Assessment Scoring System – Pre-K (CLASS Pre-K) domains. Average ratings of classroom quality were similar to national averages observed among Head Start grantees, where stronger average ratings (moderate to high quality) were found for emotional support and classroom organization and a low average quality rating was found for Instructional Support.²

FIGURE 5

CLASS – Pre-K Average Quality Ratings, by Domain



Note: CLASS ratings are on a 7-point scale with ratings of 1 to 2 representing low quality, ratings of 3 to 5 representing moderate quality, and ratings of 6 to 7 representing high quality.

Associations between Teacher Professional Development Supports and Teacher Practices

Figure 6 offers a visual of the structural equation model, including standardized estimates for each predicted link between a professional

development support and teacher practice that ended up being statistically significant. Findings suggest small to moderate links between professional development and some aspects of classroom practice. Specifically, more in-service training ($B = 0.19, p < 0.05$) and more coaching in math ($B = 0.42, p < 0.05$) are associated with better process quality (the latter association was stronger than the former). More coaching in math is associated both with higher Instructional Support scores ($B = 0.45, p < 0.05$) and more time spent in transition ($B = 0.59, p < 0.001$). More common planning time is associated with less time spent in whole group, although this association was small ($B = -0.12, p < 0.05$).

Because this analysis used the full MPC sample, which included teachers who received the math professional development intervention, we conducted a sensitivity analysis where the structural equation model was run only on teachers in the control group to see if the pattern of associations remained the same. The pattern of associations was similar with few exceptions. More teacher training

was no longer associated with better process quality ($B = 0.10$, *not significant*), but more common planning time was found to be associated with spending more time in small group ($B = 0.30$, $p < 0.05$). More common planning time was still associated with less time in whole-group instruction, and this association was stronger than that found in the full sample ($B = -0.27$, $p < 0.01$).

Comparing Teachers with More versus Less Experience Teaching Pre-K

We used multiple-group analysis to explore whether the associations between professional development and teacher practice differed for teachers with more versus less experience. The two associations we found to be statistically different for teachers with less experience were (1) associations between in-service training and instructional quality, and (2) associations between common planning time and time spent in whole group. For less experienced teachers, more in-service training was associated with lower instructional quality, whereas this association was nonsignificant (yet positive) for more experienced teachers. For more experienced teachers, more common planning time was associated with less time spent in whole group, whereas this association was nonsignificant for teachers with less experience.

Discussion and Recommendations

Whether the amount of in-service training, coaching, and common planning time teachers receive is related to their observed practice, as well as whether these professional development supports matter more for teachers with more versus less experience, are important questions for policy and practice, especially given the field's emphasis on high-quality professional development in early childhood education. This study is unique in that it adds one professional development support, common planning or "prep" time, that has not been examined much in the literature, especially in pre-K classrooms. Findings suggest that two typical professional development supports—teacher coaching and common planning time—were related to teacher practice, in terms of the quality of the classroom environments and the activity settings they used; this aligns with theory about why teacher professional development matters. Moreover, the strength and robustness of the links between supports and teacher practice have implications for the form and foci of the professional development supports that early-childhood teachers receive.

Key Findings

More math coaching was moderately associated with better process quality and instructional quality (both measured by the CLASS - Pre-K, a well-known and widely used measure of global classroom quality), whereas more in-service teacher training was associated with better process quality but not instructional quality. In the full sample, teacher training was associated with process quality, but that association was weaker than that between coaching and process quality and was not found in the sensitivity analysis. This supports our hypothesis that coaching is more strongly associated with teacher practice than in-service training.

These findings are aligned with the extant literature on these forms of professional development. Prior research (e.g., Koh and Neuman 2009) provides mixed evidence for the effectiveness of in-service teacher training, suggesting training may not be sufficient for improving quality. There is more consistent evidence that coaching teachers on specific teaching behaviors can be a key strategy for improving teacher practice (Boller et al. 2010; Bryant et al. 2009).

The moderate associations between math coaching and both process quality and instructional quality persisted in the sensitivity analysis that only examined the control group. It is interesting that this measure of coaching—which captures coaching in math and not coaching in general—is positively

related to both dimensions of classroom quality. This finding seems particularly notable given that the amount of training teachers received was not associated with instructional quality, and that the amount of coaching teachers received in math was not associated with the amount of time they spent on math activities. This suggests that coaching that is focused on a particular content area may be one promising method for promoting classroom quality.

More math coaching was associated with more time spent in transition. Generally, young children in early childhood classrooms spend a substantial amount of time in transitions or routines, which typically involve waiting for the next activity to start, for behavioral problems to be addressed, or to move to a new location, rather than real learning activities (Early et al. 2010; Fuligni et al. 2012). This finding suggests that more math coaching was associated with less productive use of classroom time. It is unclear why more coaching would be associated with more transitions. It could be that teachers who receive coaching may be trying out different kinds of activities or activity settings, which could lead them to spend more time gathering materials, moving groups of children around, or addressing behavioral problems.

Teachers in sites with more common planning time spent less time in whole group activities. This study is novel in that it examined common planning time and its relation to how time is spent in pre-K classrooms. Both the main analysis and the sensitivity analysis found this association, and the association was stronger in the sensitivity analysis than in the main analysis. In addition, the sensitivity analysis found that more common planning time was associated with more time spent in teacher-led small groups focused on specific lessons or activities.

Although more research is needed to understand these findings, they suggest that when teachers have time in their schedules dedicated to planning, they are better able to create lesson plans involving a range of activity settings. Specifically, they may be more likely to provide instruction in small-group settings, where they can individualize instruction better than in whole-group settings.

We found relatively minimal evidence that links between professional development supports and teacher practice differed among teachers of different experience levels. Math coaching benefited all teachers regardless of experience. Although more common planning time was associated with less time in whole group activities overall, the association was stronger for more experienced teachers. This finding suggests that more experienced teachers may be better able to use their planning time to design activities with different activity settings in mind. For less experienced teachers, more in-service training hours were associated with lower instructional quality, suggesting that the format and content of these trainings are not meeting new teachers' needs.

Implications

This study's findings have the following three key implications:

- **Ongoing coaching is a key form of professional development—potentially more so than in-service teacher training—for supporting classroom quality.** More coaching in math was shown to be more strongly associated with better instructional quality and better process quality than time spent in in-service teacher training sessions. Instructional quality tends to be low in pre-K classrooms (Burchinal et al. 2010). It is promising to find a positive association between instructional quality and coaching in pre-K classrooms (especially in the sensitivity analyses using only the control group) because any coaching they reported receiving is outside of an intervention context.
- **Common planning time may be a promising professional development support.** Teachers with more prep time had classrooms that spent less time in whole-group activities and more time in small groups. This suggests that when teachers have time in their schedules dedicated to planning, they may be better able to create lesson plans while keeping activity settings in mind. This is an important new finding given research suggesting that small-group instruction, which may be more likely to be individualized based on children's needs, is associated with larger impacts on children's cognitive development (Camilli et al. 2010). In MPC, anecdotal evidence from teachers in the program group suggested that providing small-group instruction is challenging for teachers, so discovering that a particular professional development support may promote its use is an important and practical finding.
- **A “one size fits all” mentality for teacher professional development may not meet the needs of the early childhood teaching workforce.** Although this study found relatively minimal evidence that the associations between the three professional development supports examined in this report and different aspects of teacher practice differed based on teacher experience, two findings suggested experience should be a factor when considering how to use professional development resources. First, if time spent in in-service training is related to lower instructional quality among less experienced teachers, then it may be necessary to carefully consider training content and objectives. Second, because common planning time was found to be associated with less time in whole group for experienced teachers and not for less experienced teachers, newer teachers may need more support for lesson planning.

Several limitations of this study are important to note. First, this is a secondary data analysis, and the study is therefore constrained by the data collected in the original study. Most notably, although

MPC gathered information on the professional development teachers were receiving, professional development was not the main focus of the study, and data were limited to the math domain. Because MPC focused on a math intervention, it asked teachers to report how much math coaching they received rather than coaching more generally. Without knowing the goal and focus of the coaching other than that a math coach likely conducted it, we can only speculate about the reasons behind the associations we found. The math coach may have talked to teachers more generally about the quality of their interactions and instruction, and perhaps teachers who are able to speak with a coach may be more intentional in their approach to teaching.

Second, it may be that the way information on “coaching” was captured in this study makes it representative of the overall resources and support an early childhood center can devote to teacher professional development. There are similar limitations with the in-service training hours collected: details on the purpose, content, and quality of the teacher trainings are unknown. We also do not have specific information about common planning time (other than how often it happened), such as whether teachers planned together, whether children were in the room during planning, or how teachers actually used that time. Research that aims to gather more details about the subject content, structure, and quality of forms of professional development would provide additional insights into the foci of the different supports teachers receive and their association with teacher practices.

This study highlights that two forms of professional development supports—teacher coaching and common planning time—are related to different teacher practices in the classroom. It suggests that coaching may be a promising method for addressing process and instructional quality, whereas common planning time may be a promising method for addressing the activity settings teachers employ. These findings have implications for early childhood practitioners and researchers who want to understand which forms of professional development are most likely to influence what happens in the classroom and what to expect about a teacher’s practice given the supports they receive and the experience they have. Such research is critical for helping the field build a workforce that can meet the needs of diverse groups of young children.

Technical Appendix

This study is a secondary analysis of the data from the pre-K year of the Making Pre-K Count study. Making Pre-K Count is a cluster-randomized control trial evaluating the effects of an evidence-based math curriculum (Clements and Sarama 2013) combined with extensive teacher training and in-classroom coaching on children’s outcomes. It was conducted in 69 pre-K sites in low-income neighborhoods in New York City. Before random assignment, sites were “blocked” into groups of four or five based on borough, auspice (community-based organizations versus public schools), and the racial/ethnic compositions of the children (i.e., whether the sites served a majority of Hispanic/Latino children).³ After blocking, sites were randomly assigned to the control group, which proceeded with their usual pre-K programming, or the program group, which received Building Blocks and professional development during the 2013–14 and 2014–15 school years. The professional development that lead and assistant teachers in the program group received included 11 days of training from the curriculum developers and ongoing in-classroom coaching during the two years.

The Making Pre-K Count findings showed that teachers in program classrooms spent significantly more time on math instruction and had slightly higher-quality math instruction in pre-K than teachers in control classrooms (as measured by the Adapted COEMET, which was not used in the current study), but there were no differences between the two groups in terms of a global measure of instructional quality (as measured by the CLASS Instructional Support domain). Contrary to expectations, the observed impacts on math instruction did not result in stronger math, language, or executive-function competencies for children at the end of their pre-K year. (See Morris, Mattera, and Maier [2016] for more information about the pre-K findings in MPC.) By the kindergarten year, there were positive effects on children’s attitudes toward math and their working memory and a positive trend for children’s math skills. See Mattera and colleagues (2018) for the kindergarten findings.

The current study is a correlational study of the associations between different forms of teacher professional development and teacher practice, and therefore is not focused on the impacts of the MPC intervention. To account for the fact that the data are from an intervention, the current analysis controls for random assignment status and select center characteristics associated with how the centers were blocked before random assignment. We conducted a sensitivity analysis using only teachers from the control group to see if the associations remained. We present the full sample as the main analysis here because the control group sample is small and less generalizable and, furthermore, the associations tended to remain the same between the two analyses.

Methodological Details

Data were collected throughout the course of the MPC study. Teachers were asked to complete paper-and-pencil surveys twice, at baseline (i.e., when they consented to be part of the study) and at follow-up (at the end of the second year of implementation). At baseline, surveys asked for demographic information, educational background, and teaching experience. At follow-up, surveys asked questions about the coaching teachers received. Site administrators were surveyed in the fall, winter, and spring, and were asked to answer questions about professional development and planning hours for pre-K teachers in their sites.

Classroom data were collected in the spring of the second year of implementation. Each classroom was observed twice by trained observers blind to classrooms' random assignment status. The CLASS – Pre-K (Pianta, La Paro, and Hamre 2008) was administered during one observation day. The Narrative Record (Farran and Bilbrey 2004) and the Adapted COEMET, an observational measure adapted from the COEMET (Clements and Sarama 2009) that captures the quantity and quality of math instruction, were administered during the other observation day. Slightly more than half of each classroom's two observations were conducted on the same day. The CLASS – Pre-K observers viewed and scored five videos from the developers of the measure as a test of their reliability. The Narrative Record observers were deemed certified using a combination of videotapes and live observations.

The observations lasted an average of three hours, and most were conducted between the beginning of the day and lunchtime. Observers, who were there to see “preschool as usual,” instructed the pre-K teachers to go about their day normally. Quality assurance visits (which involved sending two field observers into a classroom to conduct independent observations) were conducted to examine interrater reliability for both the CLASS – Pre-K and the Narrative Record. About one in five observations were checked for reliability during fielding. Overall, CLASS – Pre-K observers achieved an interrater reliability average of 93 percent. On the Narrative Record, 87 percent of observations were within five minutes for all activity codes.

Study Measure Descriptions

Teacher professional development. Four aspects of teacher professional development were captured in MPC: (1) training hours led by the district, (2) training hours led by their site (that is, the early childhood center the teacher worked in), (3) hours of common planning or prep time, and (4) frequency of coaching on math. To measure how much training teachers received from their district and from their site, as well

as how much common planning time they received, site administrators were surveyed in the fall, winter, and spring. At each point they were asked, “How many hours in total did lead teachers participate in workshops, in-services, institutes, or conferences organized by the district for teachers from multiple centers/schools in NYC?”; “How many hours in total did lead teachers participate in workshops or in-services presented by staff from your center/school?”; and “How many hours in total did lead teachers participate in common planning or “prep” meetings?” To reduce recall bias, administrators were asked to consider discrete time periods so that the time in question did not overlap with the time period asked in any other survey (i.e., fall: August to October; winter: November to January; spring: February to May). Yearly outcomes were created by summing administrators’ responses to each question across all time points. Missing survey data were imputed using the mean of the time period (fall, winter, or spring) for a particular auspice (CBO or public school) and random assignment group. One site was missing administrator surveys at all time points, so data for this site was left as missing.

To obtain a proxy of how often teachers in the control group received coaching, teachers were surveyed in the spring. Because MPC was focused on math, teachers were asked, “From August 2014 through February 2015, how often did you participate in any coaching on mathematics instruction, as part of a formal school arrangement? By formal school arrangement, we mean coaching or mentoring provided at your school or center.” Response options included “on a weekly basis or every other week,” “on a monthly or quarterly basis,” “on an as-needed basis,” and “I have not been coached on mathematics this year.” Based on the distribution of responses, the categories were collapsed into three categories: “none,” “some,” and “a lot.” If teachers declined to answer the question or responded, “I have not been coached,” the measure was coded “none.” If teachers chose, “on an as-needed basis” or “on a monthly or quarterly basis,” the measure was coded “some.” And if teachers responded, “on a weekly basis or every other week,” the measure was coded “a lot.” For teachers in the program group who received coaching every other week in the intervention, the measure was coded “a lot.”

Observed classroom practice. Four aspects of teacher practice were captured in MPC: (1) process quality, (2) instructional quality, (3) time spent on language/literacy and math instruction, and (4) time spent in different activity settings.

Process quality and instructional quality were captured by the CLASS – Pre-K (Pianta, La Paro, and Hamre 2008). The CLASS – Pre-K is an observational assessment of teacher-child interactions comprising three main domains: Emotional Support, Classroom Organization, and Instructional Support. The Emotional Support domain captures Positive Climate (the emotional connection between the teacher and children), Negative Climate (expressions of negativity in the classroom), Teacher Sensitivity (teachers’ sensitivity to children’s academic and emotional needs), and Regard for Student

Perspectives (teachers' acknowledgement of students' interests and perspectives). The Classroom Organization domain captures Behavior Management (which assesses how clearly teachers set expectations and manage misbehavior), Productivity (which captures teachers' time management with regard to instructional activities), and Instructional Learning Formats (which reflects teachers' tailoring of instruction to students' interests and needs). The Instructional Support domain includes Concept Development (which captures how teachers support students' higher-order thinking skills), Quality of Feedback (which assesses teachers' provision of feedback to students), and Language Modeling (which measures teachers' use of language facilitation). The rating scale for each dimension ranges from 1 (low quality) to 7 (high quality). Emotional Support, Classroom Organization, and Instructional Support domain scores were created by averaging its constituent dimensions. Observers were trained and certified based on the typical reliability criteria for this instrument (i.e., 80 percent agreement within one). Observers conducted 20-minute cycles across the 3 hours for an average of 5.6 cycles per classroom.

The proportion of time spent on language/literacy and math instruction, as well as time spent in different activity settings, was captured via the Narrative Record (Farran and Bilbrey 2004). The Narrative Record is an open-ended instrument for logging the content and grouping of classroom instructional activities in episodes of time. The Narrative Record was used to measure the proportion of the three-hour observation that the classroom (that is, the majority of children in the class) spent on language/literacy activities, math activities, in transition, in whole group (activities led by a teacher and conducted with the majority of children in a class), and in small group (activities with small groups of children).

Observers' interrater reliability on the Narrative Record was calculated by comparing the difference within five minutes between the coding by two observers on each visit. Then, the average difference was calculated and subtracted from 100 to ascertain the percent agreement. Thirty percent of visits met exact agreement, and fifty-seven percent of visits were reliable within five minutes for all activity codes. These differences could be attributed to incorrectly employing the general rule of continuity, distinguishing between different but similar activity types (e.g., small group centers, centers) and knowing when children were or were not in transition.

Covariates

The following covariates were included in the analysis:

- **Teacher racial-ethnic background.** Teachers' racial-ethnic backgrounds were categorized as Hispanic/Latino, non-Hispanic Black, non-Hispanic White, or Other, which included teachers who identified as Asian/Pacific Islander, Native American, multiracial, or other.
- **Teacher education and experience.** Teachers reported their educational attainment and the number of years and months that they had been teaching pre-K. Based on the distribution of responses received, a binary variable was created that indicated whether or not a teacher had received at least a master's degree. Experience teaching preschool was rounded to the nearest year.
- **Random assignment status.** A binary variable indicating random assignment status was created that indicated "1" for those assigned to the program group and "0" for those assigned to the control group.
- **Center characteristics.** As mentioned earlier, in the MPC study, groups of four to five sites were "blocked" together before random assignment based on what NYC borough they resided in (Brooklyn, the Bronx, Manhattan, and Queens), their auspice (CBO or public school), and whether they served a majority of Hispanic/Latino children. Dummy variables representing each of these characteristics were created.

Analytic Plan

Multilevel structural equation modeling in *Mplus* Version 8⁴ was used to estimate the pathways (associations) between professional development received by teachers and observed teacher practice, controlling for teacher experience, education, racial-ethnic background, random assignment status, and select center characteristics. Latent factors were estimated for constructs with multiple data sources, specifically teacher training and process quality. The teacher training factor was created with two indicators: teacher training hours led by the district and teacher training hours led by the site. The process quality factor was created with two indicators from the CLASS – Pre-K (Emotional Support and Classroom Organization). Constructs assessed with a single measure were included in the model as an observed variable. Error terms for teacher practice variables were allowed to covary.

Multiple group analysis was used to explore whether the associations between professional development supports and teacher practice varied based on teachers' experience teaching pre-K. First, a model that constrained all pathways to be the same across the two groups (high and low experience) was run. Then a set of models was run, each allowing a different association between a professional development support and a specific teacher practice to vary across the two groups. The Wald Test was used to estimate whether the coefficients for the association for each group were significantly different from one another and, therefore, should be allowed to vary in the model. High experience was defined as teaching pre-K for the median number of years (5.7) or more rather than the mean ($M = 15.2$, $SD = 8.9$, ranging from .08 years to 40 years) because the mean number of years teaching pre-K was inflated, as several teachers had decades of experience.

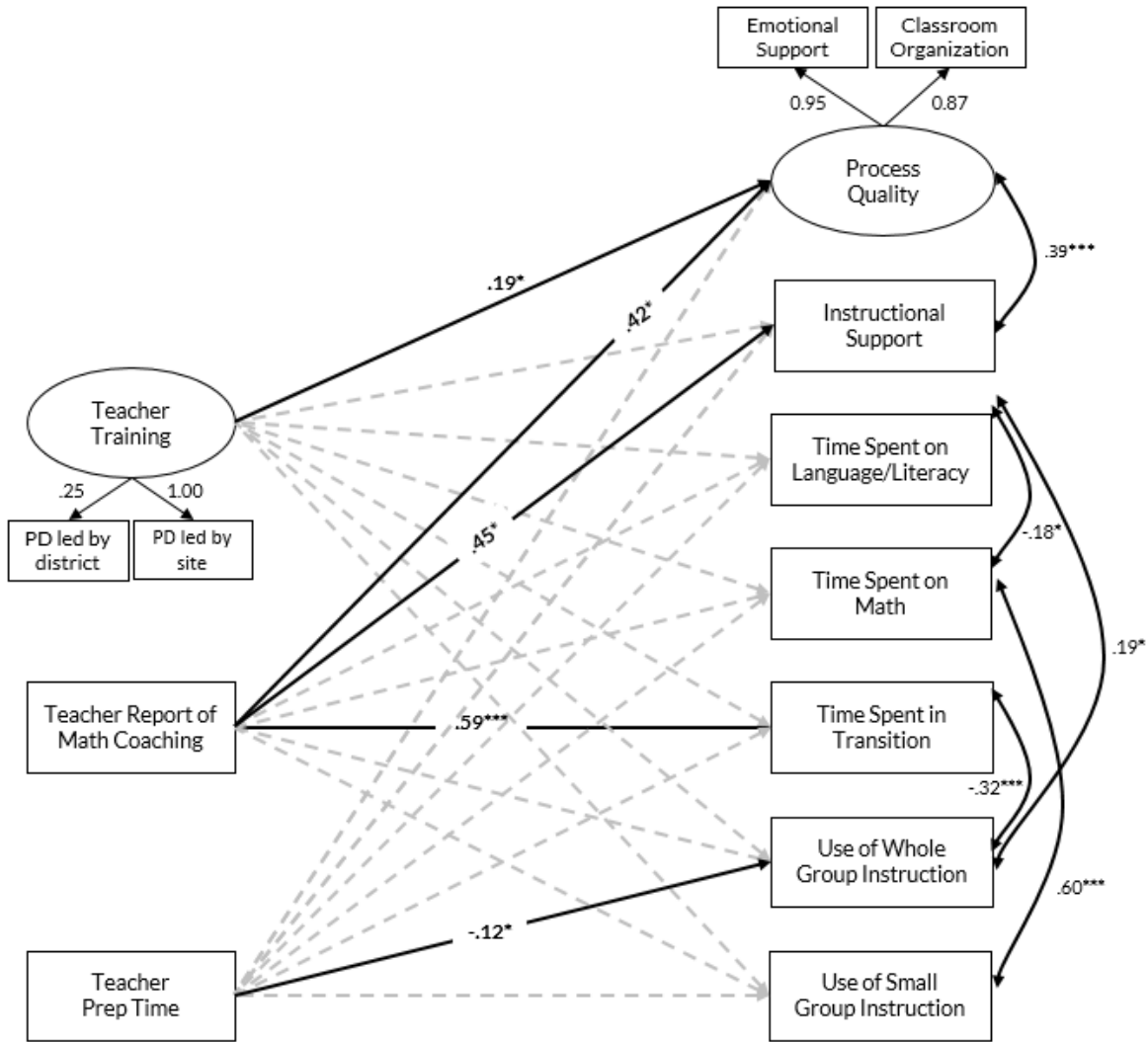
The models accounted for the multilevel nature of the data (classrooms nested within sites) by adjusting the standard errors. This feature provides maximum likelihood parameter estimates with robust standard errors, accounting for non-normality and nonindependence of observations. However, one limitation is that this does not address the problem of unobserved heterogeneity. The models' appropriateness for the data was evaluated using standard fit indices: comparative fit index (CFI), standardized root mean square residual (SRMR), and root mean square error of approximation (RMSEA). Comparative Fit Index values over 0.90 or 0.95, as well as SRMR and RMSEA values of 0.08 or lower, reflect better model fit (Hu and Bentler 1999; Kline 2005). Before data analysis, missing data for the teacher demographic information were multiply imputed. Missing data ranged from 0 to 10 percent missing values.

Additional Results

As previously mentioned, a structural equation model was used to estimate the associations between three professional development supports and observed teacher practice, controlling for teacher experience, educational attainment, and racial-ethnic background, random assignment status, and select center characteristics. Model results suggest good model fit (CFI = .99, RMSEA = .006, SRMR = .04). Figure 6 depicts the structural equation model we ran, along with the standardized estimates for statistically significant associations between professional development supports and teacher practices. Table A.1 shows the standardized estimates for all the associations between professional development supports and teacher practice. Table A.2 shows the standardized estimates for associations between the covariates and teacher practices. Few covariates were significantly associated with teacher practices in any consistent way. The exception was random assignment status, which was significantly

associated with Instructional Support, time spent in language/literacy instruction, time spent in math instruction, and time spent in transition.

FIGURE 6
Structural Equation Model of Teacher Professional Development



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Note: This figure depicts the model predicting aspects of teacher practice, controlling for select teacher and site covariates. Dotted gray lines denote predicted links that were not statistically significant; “PD” denotes “professional development.”

Figure 6 shows correlations among the teacher-practice outcomes. They show that how time was spent in the classroom (in terms of content area focus or instructional groupings) was not correlated with process quality or instructional quality. Process quality and instructional quality, both of which come from the CLASS – Pre-K, are moderately and positively correlated ($r = .39$). More time spent in

language and literacy instruction is correlated with less time spent in math instruction ($r = -.23$) but more use of whole group instruction ($r = .23$). More time spent in math instruction is strongly correlated with greater use of small group instruction ($r = .58$). Finally, more time spent in transition is correlated with less use of whole group instruction ($r = -.31$). Other key findings are reported in this report's results section.

We ran a sensitivity analysis where the structural equation model was run only on teachers in sites assigned to the control group to see if the pattern of associations remained the same. The pattern of associations was similar with a few exceptions (findings are reported in the "Results" section above). Model fit for the control group-only model was not as strong as it was for the full sample (likely because of the small sample size) but was generally still adequate (CFI = .84, RMSEA = .04, SRMR = .07). See table A.3 for the results from the sensitivity analysis.

Multiple group analysis was used to explore whether the associations between professional development and teacher practice differed for teachers with more versus less experience. First, a model holding each of the associations between the professional development supports and teacher practice to be the same across the two groups was conducted, showing good model fit ($\chi^2(197) = 250.48$; CFI = .90; RMSEA = .02, SRMR = .07). Next, individual models were run for each association, allowing that association to vary across the two groups; the coefficients for each of those associations were tested using the Wald Test to see if they were significantly different from one another. Two associations were found to be statistically and significantly different for teachers with less experience: (1) teacher training and instructional quality, and (2) common planning time and time spent in whole group. For less experienced teachers, more training was associated with lower instructional quality, whereas this association was nonsignificant for more experienced teachers. For more experienced teachers, more common planning time was associated with less time spent in whole group, whereas this association was nonsignificant for teachers with less experience.

TABLE A.1

Standardized Estimates for the Pathways from Professional Development Support to Different Aspects of Teacher Practice

	Estimate	(SE)	p-value
Estimated Pathway			
<i>Training</i> →			
Process quality	.19	(.08)	0.020
Instructional quality	-.07	(.07)	0.318
Proportion literacy	.02	(.06)	0.759
Proportion math	.01	(.06)	0.810
Proportion transition	.05	(.07)	0.528
Proportion whole group	-.09	(.08)	0.284
Proportion small group	-.02	(.07)	0.820
<i>Coaching</i> →			
Process quality	.42	(.19)	0.026
Instructional quality	.45	(.19)	0.017
Proportion literacy	.15	(.15)	0.337
Proportion math	-.11	(.17)	0.519
Proportion transition	.59	(.15)	0.000
Proportion whole group	-.27	(.22)	0.213
Proportion small group	.33	(.20)	0.102
<i>Common planning time</i> →			
Process quality	.10	(.08)	0.248
Instructional quality	.09	(.07)	0.194
Proportion literacy	.00	(.07)	0.981
Proportion math	.01	(.11)	0.899
Proportion transition	.02	(.07)	0.734
Proportion whole group	-.12	(.05)	0.021
Proportion small group	.10	(.09)	0.249

Note: Table shows standardized estimates for the hypothesized pathways from each of the three tested professional development supports (independent variables) to different aspects of teacher practice (dependent variables) for the full study sample.

TABLE A.2

Standardized Estimates and (Standard Errors) for Covariates

	Process quality	Instructional quality	Proportion literacy	Proportion math	Proportion transition	Proportion whole group	Proportion small group
Covariate							
<i>Teacher covariates</i>							
Education	.08 (.07)	.19 (.08)*	-.04 (.08)	.14 (.12)	-.10 (.07)	.05 (.07)	.03 (.12)
Hispanic	.04 (.10)	.03 (.11)	.01 (.09)	.08 (.12)	-.27 (.13)*	-.07 (.12)	.09 (.10)
White	.09 (.12)	.04 (.09)	.21 (.10)*	-.05 (.10)	-.35 (.12)**	-.08 (.13)	.05 (.09)
Black	-.00 (.10)	-.06 (.10)	-.05 (.10)	-.12 (.10)	-.24 (.12)	-.12 (.09)	.01 (.09)
Years teaching pre-K	-.05 (.09)	-.07 (.08)	.06 (.07)	-.02 (.09)	-.04 (.09)	.06 (.08)	-.09 (.08)
<i>Random assignment</i>							
Program group	-.29 (.17)	-.52 (.17)**	-.42 (.16)*	.34 (.15)*	-.46 (.15)**	.01 (.23)	-.20 (.19)
<i>Center covariates</i>							
Public school	-.28 (.09)**	-.26 (.09)**	-.04 (.09)	-.05 (.13)	.09 (.09)	.15 (.10)	-.20 (.11)
Hispanic block	-.03 (.13)	.02 (.12)	-.05 (.10)	-.07 (.11)	.05 (.11)	-.21 (.08)**	-.07 (.12)
Boro_Bronx	-.03 (.12)	.01 (.10)	.13 (.11)	.09 (.10)	.10 (.11)	.02 (.08)	.18 (.11)
Boro_Manhattan	.10 (.09)	.08 (.07)	.07 (.08)	.08 (.07)	-.10 (.07)	-.09 (.06)	.06 (.10)
Boro_Queens	.10 (.07)	.03 (.09)	-.12 (.07)	.09 (.09)	-.02 (.09)	-.24 (.07)**	.09 (.10)

Note: *** $p < .001$; ** $p < .01$; * $p < .05$.

TABLE A.3

Sensitivity Analysis

	Estimate	(SE)	p-value
Estimated pathway			
<i>Training</i> →			
Process quality	.11	(.18)	0.546
Instructional quality	.02	(.17)	0.903
Proportion literacy	.13	(.12)	0.307
Proportion math	.09	(.12)	0.477
Proportion transition	.10	(.11)	0.362
Proportion whole group	.16	(.12)	0.195
Proportion small group	.05	(.13)	0.727
<i>Coaching</i> →			
Process quality	.23	(.12)	0.045
Instructional quality	.20	(.10)	0.033
Proportion literacy	.03	(.07)	0.702
Proportion math	-.08	(.09)	0.365
Proportion transition	.32	(.09)	0.001
Proportion whole group	-.19	(.11)	0.085
Proportion small group	.17	(.12)	0.160
<i>Common planning time</i> →			
Process quality	.20	(.16)	0.215
Instructional quality	-.07	(.12)	0.561
Proportion literacy	-.00	(.13)	0.988
Proportion math	.22	(.18)	0.205
Proportion transition	-.02	(.14)	0.889
Proportion whole group	-.27	(.11)	0.020
Proportion small group	.32	(.14)	0.021

Note: Table shows standardized estimates for the hypothesized pathways from each of the three tested professional development supports (independent variables) to different aspects of teacher practice (dependent variables) in the control group only.

Notes

- ¹ New York State requires public school teachers to obtain a master's degree, and roughly 70 percent of the pre-K centers in MPC were located in public schools.
- ² “A National Overview of Grantee CLASS Scores in 2018,” Early Childhood Learning & Knowledge Center, accessed September 11, 2019, <https://eclkc.ohs.acf.hhs.gov/sites/default/files/pdf/no-search/national-class-2018-data.pdf>.
- ³ Blocking achieves two goals: First, it reduces the risk of an accidental poor match between program and control groups given the small number of units at the level of randomization. Second, blocking in groups rather than pairs protects against the loss of sample sites between randomization and the study of program impact by allowing for the retention of all remaining sites if a single site drops out of the study.
- ⁴ L. K. Muthén and B. O. Muthén, *Mplus User's Guide*, 1998–2010, 6.

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