Erikson Institute

CollaborativeMath

SRI Education

# Building a Community of Learners to Promote Centers of Excellence in Mathematics


Erin E. Reid[1], Jennifer S. McCray[1], Erika Gaylor[2], Xime Dominguez[3], Xin Wei[2]

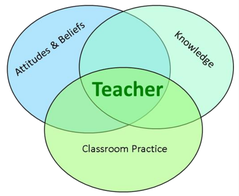
[1]Erikson Institute, [2]SRI International, [3]Digital Promise


## Rationale

- The single most important determinant of what children learn is what teachers know (Darling-Hammond & Bransford, 2005).
- To often, preschool teachers are insufficiently prepared to teach math to young children (NRC, 2009), which leas to less time devoted to math content (Chicago Program Evaluation Project, 2008), a narrow range of knowledge covered (Copley, 2010), and a low level of understanding in children's math learning (Ginsburg, Lee, & Boyd, 2008).
- Substantial and meaningful improvements in teaching practice occur and are maintained when there are school-embedded systems to provide ongoing, on-site, on-the job support (Darling-Hammond & McLaughlin, 1995; Louis & Marks, 1998).

## Whole Teacher Approach to PD

Simultaneous development of teachers' content knowledge, confidence, and classroom practice elicits and sustains the most comprehensive, meaningful, and effective teacher change (Chen & Chang, 2006; Chen & McCray, 2012). This approach has particular relevance to PD efforts in early math. Specifically, subject knowledge is crucial in mathematics.




Addressing it with thoroughness is the only way to counteract the weak understanding held by many teachers of young children (NRC, 2009). Confidence is particularly important for math PD because many preschool teachers doubt their math ability and thus avoid teaching it to children (Ginsburg, Lee, & Boyd, 2008). Direct attention to and support of practice is a powerful mechanism for making instructional shifts actually occur, as it encourages teachers to try new methods and learn from their experimentation.

## Research Design

The PD was evaluated in two, consecutive, year-long studies.

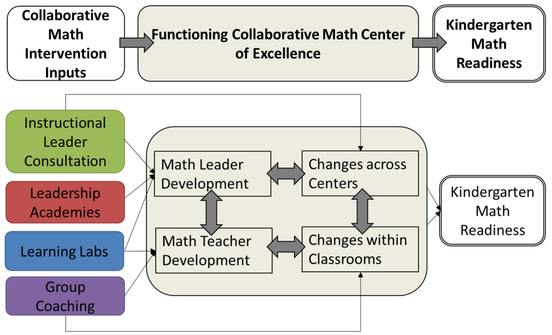
- **Study 1** utilized a cluster randomized controlled trial. A total of 28 Head Start centers were stratified based on center size and half-day vs. full-day programs. Then centers within each stratum were assigned to either the intervention condition **(Cohort A**; n=14) or the business-as-usual condition (**Cohort B**; n=14).
- **Study 2** utilized a quasi-experimental successive-cohort design. The remaining 13 comparison centers (**Cohort B**) participated in the PD participated in the intervention the following year. Year 2 teacher gains on attitudes, knowledge, and practice were compared to Year 2 gains. Children's math skill gains in the Year 2 cohort were compared to children's gains in the Year 1 cohort.

## Collaborative Math PD Program

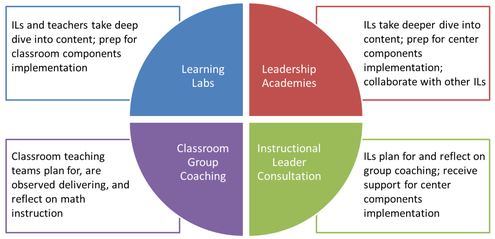
Collaborative Math is a one-year professional development (PD) initiative designed to help early childhood sites become centers of excellence in mathematics. Collaborative Math is guided by three principles:

- Attend to the Big Ideas of Early Mathematics (Early Math Collaborative, 2013)
- Promote whole teacher and leader development (Chen & McCray, 2012)
- Engage whole centers (i.e., lead teachers, assistant teachers, and paraprofessionals) in striving for math teaching excellence

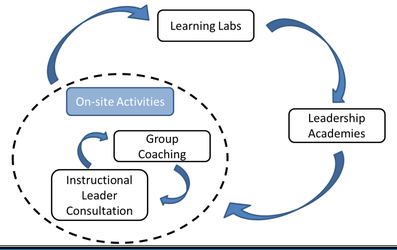
### Logic Model




### Intervention Inputs




### Four-week Intervention Cycle




## Research Methods

### Procedures

- Children's English language proficiency was screened using the Pre-LAS (Duncan & DeAvila, 2002) and results determined whether children were assessed in English or Spanish.
- Children's math skills were assessed in the fall and spring using the Woodcock-Johnson Tests of Academic Achievement Applied Problems subtest (WJ-III AP; Woodcock, McGrew & Mather, 2001) and the Research Early Math Assessment – Short Version (REMA-SV; Clements, Sarama, & Liu, 2008).
- Teacher measures were collected in the fall and spring of Year 1 and the spring of Year 2. Teacher confidence in math teaching, perceptions of center leadership around math instruction, and math practice were assessed using a researcher-developed measures in the fall and spring of Year 1 and spring of Year 2.
- The intervention consisted of six 4-week cycles covering sets and sorting, number sense, and shape.
- The same procedures were followed in Studies 1 & 2.

### Analytic Approach

- **Study 1:** We estimated Intent-To-Treat (ITT) effects of the Collaborative Math PD intervention on child and teacher outcomes. Two-level HLM was conducted to take into account participants nested in centers.

- **Study 2**: Because we found significant differences in age and pretest scores at baseline between the two groups of children in Study 2, we used propensity score weighting to make the two groups of children equivalent prior to conducting 2-level HLM to estimate impacts on student achievement. We performed 2-level HLM for the teacher impact analyses using Year 1 baseline data and Year 2 spring data.

### Research Participants

**Study 1**

- Teachers (n = 179)
  - 86 intervention and 93 comparison; 85% female; 35% Black, 17% White, 34% Hispanic; mean years of teaching experience = 11.15
- Children (n = 889)
  - 458 intervention and 431 comparison; 49% female; 40% Black, 17% White, 51% Hispanic; mean age = 48.04 months

**Study 2**

- Teachers (n = 108)
  - 82% female; 33% Black, 24% White, 33% Hispanic; mean years of teaching experience = 9.78
- Children (n = 609)
  - Business-as-usual year: n = 326; 47% female; 37% Black, 21% White, 52% Hispanic; mean age = 52.74 months
  - Intervention year: n = 326; 50% female; 42% Black, 22% White, 44% Hispanic; mean age = 47.84 months

## Study 1 Results

### Teacher Outcomes

- Collaborative Math teachers (Cohort A) reported more having more confidence than their comparison group peers, controlling for baseline scores.
- Collaborative Math had no discernible impact on teacher attitudes, quality of math instruction, or teacher perceptions of center leadership around math.

### Child Outcomes

- No discernible impact on children's WJ-III Applied Problems or REMA-SV scores were observed.

## Study 2 Results

### Teacher Outcomes

- Cohort B teachers reported significantly greater confidence in math teaching after their participation in Collaborative.
- No discernible impact was observed on teacher attitudes, quality of math instruction, or teacher perceptions of center leadership around math.

### Child Outcomes

- Students attending Cohort B centers during the intervention year outperformed their peers who attended the centers during the business-as-usual year on the REMA-SV controlling for baseline scores, age, and demographic characteristics (see Figure 4).
- No discernible impact on children's WJ-III Applied Problems scores was detected.

## Conclusion

Our center-based approach to professional development around math for Head Start centers led to shifts in teacher confidence in both studies. We also observed significantly improved math learning for the most vulnerable preschoolers on one of our outcome measures in the second study. This finding should be interpreted with caution as the two groups of children had significantly different pretest scores at baseline, even after applying propensity score weighting.

Overall, our work demonstrates the importance of collaboration within and between early childhood centers to promote the professionalism of all teaching staff and to equip leaders with the tools necessary to maintain a functioning center of excellence in math.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