Paper 2: Middle School Mathematics Professional Development Impact Study: Intervention Overview and Implementation Results (Kirk Walters and Steven Hurlburt)

Intervention / Program / Practice:
The PD program provided to teachers who participated in both years of the study was designed to deliver 114 contact hours (68 hours in the first year and 46 hours in the second year). For teachers who entered the study in the second year, the PD provided 58 contact hours, including the 46 hours offered to all teachers and a 12-hour “makeup” institute that provided a condensed version of the summer institute from the first year of the study (See Table 3 in Appendix B). The amount of PD in mathematics offered annually by the study was more than most mathematics teachers typically receive in a single year.

The main goal of the intervention was to increase teachers’ capability to teach positive rational number topics effectively. Within the domain of rational numbers, the program design focused on fractions, decimals, ratio, rate, proportion, and percent. Across the two years of the intervention, the program was designed to provide equal coverage to fractions and decimals and ratio, rate, proportion, and percent. For each rational number topic area, the PD program was designed to address both common knowledge of mathematics and specialized knowledge of mathematics for teaching.

Two providers selected through a competitive process delivered the PD program. The study design required both PD providers to deliver the same intended dosage and to adhere to a common set of objectives, rational number topics, and PD features, described in more detail below. But because the providers built on their existing materials addressing topics in rational numbers, the providers differed in how they planned to structure teacher learning activities and present the content to teachers.

The summer institute and seminars blended activities intended to develop specialized knowledge of mathematics for teaching and strengthen common knowledge of mathematics. To address the common knowledge goals, the program design emphasized using precise definitions and explicated the properties and rationales underlying common procedures used with rational numbers. To address the specialized knowledge goals, the PD emphasized developing teachers’ explanations of rational number concepts and procedures, identifying and addressing persistent student misconceptions, and using representations of rational number concepts in teaching. The design called for modeling and practicing relevant pedagogical techniques as a means to develop teachers’ skills in implementing specific mathematics teaching strategies.

The primary purpose of the coaching component of the PD program was to help teachers apply material covered in the institutes and seminars to their classroom instruction. The coaching component was designed to consist of 10 days of coaching provided through 5 two-day visits to each school in the first year of the study and 8 days of coaching provided through 4 two-day visits during the second year. Each two-day coaching visit was intended to immediately follow one of the seminar days and to link to the preceding seminar. Both providers used their districts’ curricular pacing guides to schedule coaching visits when teachers planned to teach rational number topics.
This paper will also discuss the implementation results of the study—i.e., the degree to which the planned PD activities (institutes, seminars and coaching) matched the PD activities that were actually delivered in the study.

**Paper 3: Middle School Mathematics Professional Development Impact Study: Summary of Findings** (Andrew Wayne, Mengli Song, Seth Brown, Susan Sepanik and Pei Zhu)

**Findings / Results:**
The Final Report is scheduled to be released in May, 2011—plenty of time to incorporate into the proposed symposium, but these results cannot be presented at this time. The main results after the first year of implementation were as follows:

**Impact Findings After One Year of Treatment**
- **During the first year of implementation, the PD program did not have a statistically significant impact on overall teacher knowledge (effect size = 0.19, p-value = 0.15).** On average, 54.7 percent of teachers in the treatment group answered test items of average difficulty correctly, compared with 50.1 percent for teachers in the control group. (See Figure ES-1.) To put these results into context, the study also administered the teacher knowledge test to the PD provider staff (i.e., the staff who delivered the institutes, seminars, and coaching). On average, 92.7 percent of the PD provider staff answered test items of average difficulty correctly.15

- **The PD program did not have a statistically significant impact on either of the teacher knowledge subscale scores.** On average, 58.4 percent of treatment group teachers answered CK test items of average difficulty correctly, compared with 57.7 percent of control group teachers (effect size = 0.02, p-value = 0.88). On average, 54.7 percent of treatment group teachers answered SK test items of average difficulty correctly, compared with 47.5 percent of control group teachers (effect size = 0.23, p-value = 0.14). (See Figure ES-1.)

- **There was a statistically significant and positive impact of the PD program on the frequency with which teachers engaged in activities that elicited student thinking (effect size = 0.48).** Treatment teachers on average engaged in 1.03 more activities per hour that elicited student thinking. On average, teachers in the treatment group engaged in such activities 3.45 times per hour, compared with 2.42 times per hour for teachers in the control group. (See Figure ES-2.)

- **The PD program did not have a statistically significant impact on teachers’ use of representations (effect size = 0.30; p-value = 0.0539).** Treatment teachers on average used representations 1.76 times per hour, compared with 1.21 times per hour for the control group. (See Figure ES-2.)

- **The PD program did not have a statistically significant impact on the frequency with which teachers engaged in activities that focused on mathematical reasoning (effect size = 0.19, p-value = 0.32).** Treatment teachers on average engaged in activities that focused on mathematical reasoning 1.03 times per hour, compared with 0.94 for the control group. (See Figure ES-2.)