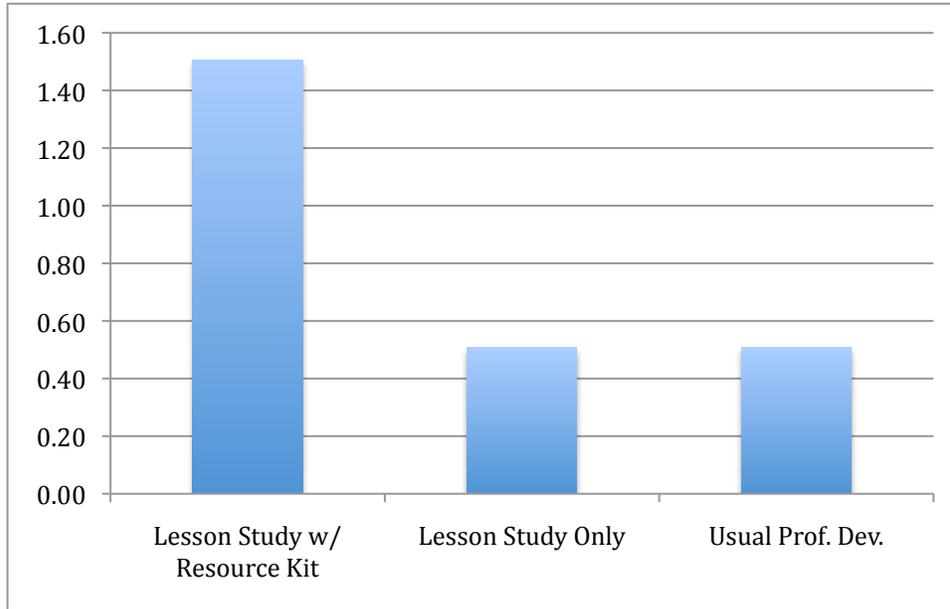


**Improving the Mathematical Content Base of Lesson Study**  
**Interim Summary of Results<sup>i</sup>**  
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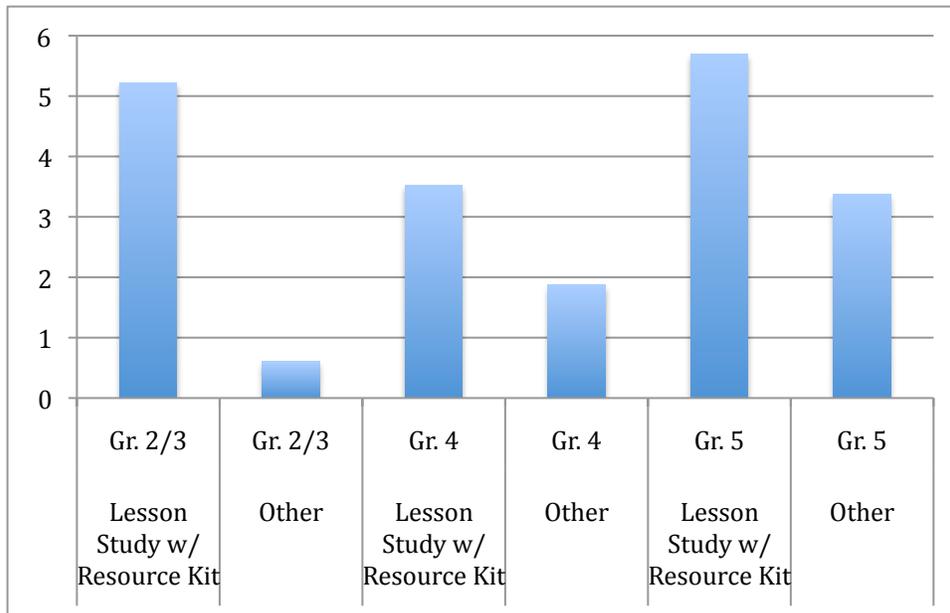
Two hundred thirteen teachers and more than 1,000 students from 27 U.S. school districts participated in a randomized controlled trial of lesson study, with or without a resource kit on fractions. Lesson study is a form of professional learning in which teachers collaborate to study the academic content of the curriculum and conduct cycles of inquiry focused on enactment, observation, and analysis of learning during actual classroom lessons. The resource kit on fractions, developed for this project, included mathematics tasks to solve and discuss (along with related student work); curriculum materials, lesson plans and video (from Japan and from U.S. research studies); research articles; and a suggested process for investigating these materials. Lesson study groups were randomly assigned to one of three research conditions – 1) lesson study with the fractions resource kit; 2) lesson study without the fractions resource kit; and 3) locally chosen “professional development as usual.” The study investigated the impact of the three conditions on teachers’ and students’ knowledge of fractions and on teachers’ attitudes toward professional learning.

Teachers’ overall knowledge of fractions was measured using a 33-item assessment drawn mainly from established assessments.<sup>ii</sup> The pre- to post- change in teachers’ fraction knowledge on this assessment is shown in Figure 1. We examined the association between the study condition and teachers’ knowledge of fractions through the use of two-level hierarchical linear modeling (HLM), which adjusts for the nesting of teacher participants (Level 1) within lesson study groups (Level 2). Controlling for other Level 1 predictors (e.g., teachers’ knowledge of fractions at pretest), HLM results show a positive statistically significant association ( $p < .05$ ) between assignment to Condition 1 (lesson study with fractions resource kit) and teachers’ knowledge of fractions at posttest.



**Figure 1. Changes in Teachers' Fractions Knowledge for Teaching**

To assess students' fraction knowledge, three different student assessment forms were developed for students in grades 2/3, grade 4, and grade 5, with the lower grade assessments containing a subset of the items included for higher grades.<sup>iii</sup>



**Figure 2. Changes in Students' Knowledge of Fractions**

We again used HLM analysis to examine the association between the random study assignment and students' fractions knowledge. A three-level model was used to investigate student outcomes, with students at Level 1, teachers/ classroom at Level 2, and study groups at Level 3. The

only Level 1 covariate was student pretest score. At Level 2, we included teacher demographic covariates (including teaching experience, lesson study experience, teaching assignment and math credential). The assignment to condition was included at Level 3.

The HLM analysis shows positive statistically significant results related to (teachers') group assignment to lesson study with resource kit (compared to teachers in the other two study conditions,  $p < .01$ ) and pretest score ( $p < .001$ ), and negative statistically significant results related to teachers having more than 15 years of experience ( $p < .001$ ). These results indicate that (teachers') assignment to lesson study supported by the resource kit is positively associated with gains in students' fractions knowledge. The  $R^2$  values indicate that the student pretest measure accounts for 65% of the variance in student achievement at posttest, teacher measures account for 18% of the variance, and assignment to lesson study with resource kit accounts for 37% of the variance.

Along with knowledge development, the study investigated whether teachers' assignment to the three professional learning conditions influenced their beliefs and dispositions related to instructional improvement. HLM results showed a positive association between assignment to lesson study with resource kit and teachers' reports of collegial learning effectiveness, their expectations for student achievement, their inquiry stance and interest in mathematics, and the perceived relevance of research for practice. Teachers in the two lesson study conditions rated the impact of their Fall 2009 professional learning experiences significantly more favorably on a variety of indicators of impact (such as intellectual rigor and application to the classroom) than did teachers assigned to professional development as usual.

Analyses are ongoing, so readers are encouraged to check back to [www.lessonresearch.net](http://www.lessonresearch.net).

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<sup>ii</sup> Including the Learning Mathematics for Teaching project (University of Michigan, Deborah Ball & Hyman Bass, PIs), the Diagnostic Teacher Assessments in Math and Science project (University of Louisville, William Bush, PI), the Numeracy Development Projects (Maths Technology Ltd., New Zealand), mathematics research literature, and the National Assessment of Educational Progress student assessments.

<sup>iii</sup> There were a total of 23 question stems on the fifth grade assessment, 17 question stems on the fourth grade assessment, and 10 question stems on the second/third grade assessment. Of the 23 fifth grade questions, four were drawn from existing student assessments (e.g., National Assessment of Educational Progress and California Standards public release items), 10 were drawn from foreign curriculum materials (teachers' manuals and student materials), and the remaining nine were drawn from or were adaptations of problems from the mathematics research literature on fractions.