Using Data to Inform Decisions:
How Teachers Use Data to Inform Practice and Improve Student Performance in Mathematics

Year 1 Results from a Randomized Experiment of Program Efficacy and Effectiveness

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Introduction: Data Use in Education

• Recent expansion in use of education data to improve instruction, student achievement, graduation rates.

• Using a wide variety of data about students
  – state accountability test scores;
  – interim progress test results;
  – classroom tests,
  – assignments, and homework;
  – attendance, mobility, and grade-level progression rates;
  – dropout and graduation rates (Allensworth & Easton, 2007; Marsh et al., 2006; Hamilton et al., 2009).
Recent findings

• Significant gains in student achievement are possible, if data are used effectively
  – Carlson et al. (2011): multi-state randomized study (500 schools, 59 districts)
  – Faria et al. (2012): formative assessment → student achievement gains

• Challenge
  – Data literacy: the ability of instructional leaders and teachers to work individually and collectively to examine different types of data, and develop strategies for improvement based on those data
Using Data

• Designed to improve effectiveness of data use in schools
• Developed by TERC with support from NSF and the Eisenhower Regional Alliance for Mathematics and Science Education
• Data teams are trained in continuous, collaborative improvement
  – Collect data
  – Formulate hypotheses about sources of learning problems
  – Draw conclusions from data and research
  – Make action plans, and implement them
  – Monitor results
  – Repeat
• Goal of UD: Improve teaching and learning through collaborative development of action plans that address systemic learning problems.
The UD program we evaluate

• Each participating school forms a data team
  – Two grade-4 and two grade 5 teachers
  – Designated data coach

• Teams participate in
  – Three 2-day professional development events, and two TA sessions in year 1
  – One 2-day refresher prior to start of SY 2, plus two TA sessions
  – 1-day capstone at the end of SY 2
  – Coaches and principals participate in an extra ½ day session/PD event

• Teams are expected to collect and analyze data about their own school

• Principals are expected to be supportive, provide space and time for teams to meet
Teacher Behavior: Research Questions

Compared to study teachers in control schools, at the end of year 1, do study teachers in treatment schools,

1. report *more frequent use of data*?

2. have *greater* data use *knowledge and skills*?

3. report *more positive attitudes and beliefs* about the value of data to inform instruction and improve student learning?
Student Achievement: Exploratory Questions

After the first year of program implementation,

1. do grade 4 and 5 students in study schools have higher levels of mathematics achievement than their counterparts in control schools?

2. do grade 4 and 5 students of Using Data-trained teachers have higher levels of mathematics achievement than their counterparts in control schools?
Experimental Design

• Block-randomized experiment
  – Two-levels of treatment: Using Data vs business-as-usual
  – Randomization at the school level
    ▪ Participating teachers form a team – need same assignment as school
    ▪ Intervention designed to alter school outcomes
  – Blocked because of diversity of district

• Randomization procedure
  – 60 schools recruited in a single district
  – Applicants identify their data team
  – Each school given a random number and assigned to one of 4 blocks
    based on an index of extent of school needs at baseline:
      ▪ Title I status, percentage of students African-American, percentage of
        students eligible for FRL, school-wide math score on state assessment
  – Half the schools in each block assigned “treatment” or “control”
    ▪ Lowest numbers go to treatment group
Sample and year 1 attrition

**Teachers**
- Began with 60 schools and 233 teachers at randomization
  - One treatment school lost in Year 1 – all originally assigned teachers replaced before PD began.
  - Treatment schools replace 30 teachers prior to program start.
    - 73% remain in ITT sample (88/120)
- Control schools replace 18 teachers prior to start
  - 84% remain in ITT sample (94/113)

**Students**
- Began with 11,516 students
- 8 pct attrition after 1 year (7 pct T, 9 pct C)
  - Missing outcome variable (621 students); parents opted out (292 students)
- No school losses
**Teacher Behavior Results**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Coefficient</th>
<th>P-value</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Use</td>
<td>4.38</td>
<td>0.01</td>
<td>0.38</td>
</tr>
<tr>
<td>Knowledge and Skills</td>
<td>0.68</td>
<td>0.07</td>
<td>0.24</td>
</tr>
<tr>
<td>Attitudes and Beliefs</td>
<td>4.53</td>
<td>0.09</td>
<td>0.25</td>
</tr>
</tbody>
</table>

- Positive and statistically significant effect on Data Use
- Positive effect on Knowledge and Skills, Attitudes and Beliefs
## Student Achievement Results

<table>
<thead>
<tr>
<th>Baseline model</th>
<th>Coefficient</th>
<th>P-value</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall treatment effect</td>
<td>-0.56</td>
<td>0.46</td>
<td>0.03</td>
</tr>
</tbody>
</table>

- No overall treatment effect

<table>
<thead>
<tr>
<th>Dosage model</th>
<th>Coefficient</th>
<th>P-value</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student in treatment school</td>
<td>-1.47</td>
<td>0.13</td>
<td>0.07</td>
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<tr>
<td>Student in treatment school who is taught by Using Data participant (incremental effect)</td>
<td>1.76</td>
<td>0.05</td>
<td>0.08</td>
</tr>
<tr>
<td>Student in treatment school who is taught by Using Data participant (overall effect)</td>
<td>0.29</td>
<td>0.75</td>
<td>0.01</td>
</tr>
</tbody>
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- Negative effect on treatment school students without UD-trained teacher
- No effect on treatment school students with UD-trained teacher