Elementary Math Programs in the Pittsburgh Public Schools

A Comparison of Everyday Math and Harcourt Math

Mathematica Policy Research
Brian Gill, Catherine Nelson, Julia Kaufman, Kevin Booker
December 2007
Context for the evaluation

- Everyday Math (EM) in use in PPS elementary schools since 1990s
- Harcourt Math (HM) pilot initiated in fall 2005
  - Eight schools completed two years of HM as of spring 2007
- PPS is considering possibility of district-wide math program adoption
Evaluation questions

• Have students using EM or HM shown greater achievement gains?
• How do EM and HM differ in terms of program design, content, and implementation in PPS?
What do we know about achievement with EM and HM in other places?

<table>
<thead>
<tr>
<th>Evidence of impact</th>
<th>Everyday Math</th>
<th>Harcourt Math</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rigorous studies show positive achievement effects</td>
<td></td>
<td>No rigorous studies exist</td>
</tr>
<tr>
<td>Only elementary math program showing “potentially positive” effects according to US Dept of Ed’s “What Works” Clearinghouse</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Notable districts using it successfully</th>
<th>Everyday Math</th>
<th>Harcourt Math</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York City (2007 Broad Prize)</td>
<td></td>
<td>Garden Grove CA (2004 Broad Prize)</td>
</tr>
<tr>
<td>Norfolk VA (2005 Broad Prize)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Philadelphia (large achievement gains since 2002 EM adoption)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Achievement analysis in PPS focuses on PSSA scores in grades 3-5

- Grades 3-5 PSSA scores are key outcomes for state accountability
- Two years of treatment examined
  - Harcourt pilot initiated fall 2005
  - Results examined in spring 2006 and spring 2007
- Full technical report of methods and results to be available by the end of the month
Analysis includes three cohorts of students

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 5</td>
<td></td>
<td></td>
<td></td>
<td>PSSA</td>
</tr>
<tr>
<td>Grade 4</td>
<td></td>
<td></td>
<td>PSSA</td>
<td>PSSA</td>
</tr>
<tr>
<td>Grade 3</td>
<td></td>
<td>PSSA</td>
<td>PSSA</td>
<td>PSSA</td>
</tr>
<tr>
<td>Grade 2</td>
<td>Terra Nova</td>
<td>Terra Nova</td>
<td>Terra Nova</td>
<td></td>
</tr>
<tr>
<td>Grade 1</td>
<td>Terra Nova</td>
<td>Terra Nova</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Scores on Terra Nova and PSSA standardized to allow examination of changes within district-wide distribution
We compare achievement gains 2005-2007 for students using EM and HM

Matching creates EM comparison group for HM students, then gains of two groups are compared

1. Propensity match uses student and school characteristics to create sample of EM students comparable to HM students

2. “Difference-in-differences” analysis examines each student’s achievement in 2006 and 2007 compared to his/her prior achievement
“Difference-in-differences” analyses control for school characteristics

- Other school changes may affect achievement gains independently of curriculum
- Many schools had major changes in fall 2006
  - Population changes due to right-sizing
  - Conversion to Accelerated Learning Academies
- Analysis controls for school demographics, the proportion of students who changed schools, and ALA status
Achievement questions

- Which program shows greater average achievement gains?
- Which program shows greater gains for
  - Low-income students?
  - African-American students?
  - Low-achieving students?
  - High-achieving students?
- Is there any evidence of harm to students who change programs as a result of mobility?
Results: Achievement trajectories for HM and EM are virtually indistinguishable.
EM and HM show no achievement differences overall or for subgroups of interest

- No difference in average achievement trend
- No difference after one year or two
- No difference for low-income students
- No difference for African-American students
- No difference for low-achieving students
- No difference for high-achieving students
Limited evidence shows no harm to mobile students who switched programs

- We assess the effect of switching programs by examining two different groups of students who changed schools in 2006 with right-sizing
  - Students who changed schools and changed math programs
  - Students who changed schools but kept same math program
- Achievement growth for mobile students who switched math programs was not significantly different from achievement growth for mobile students who stayed with EM or HM
Long-term effects of EM vs HM cannot yet be known

- Only two years of comparison data available, since HM pilot began
- HM students in grades 3-5 in spring 2007 began with EM in earlier grades
  - HM group is not “pure” HM
- Long-term effects of changing programs on mobile students also unknown
What is role of design/implementation/perception evidence absent achievement difference?

- Existing achievement results do not help choose a program
- Perceptions of differences in strengths and weaknesses of programs for particular students are not borne out in achievement
- Implementation evidence will show that programs in action are less different than in theory
- Design and implementation evidence is relevant for considering consistency of programs with district’s aims and plans in Excellence for All
Comparing design and implementation of EM and HM

- Literature review on both programs
- Structured interviews in 4 EM/4 HM schools (randomly selected)
  - Teachers at grades 1/3/5
  - Curriculum coach
- Background interviews with district personnel
## How are the curricula designed?

<table>
<thead>
<tr>
<th></th>
<th>Everyday Math</th>
<th>Harcourt</th>
</tr>
</thead>
</table>
| **Sequencing**      | Spiral/integrated  
*Skills secured through exposure over time* | Linear/self-contained  
*Skills taught to mastery before moving on* |
| **Skills Practice** | Games/routines                                                              | Worksheets  
Computer program                                                   |
| **Source**          | Inquiry/Exploration  
Application                                                                   | Instruction  
Practice                                                        |
| **Development of Math Ideas** |                                                                                 |                                                                         |
| **Procedures**      | Multiple paths- explored and discovered by students                          | Single path- modeled by teacher and copied by students                  |
| **Mode of instruction** | Teacher supported/ Small group work                                       | Teacher led/  
Whole class instruction                                             |
Relative strengths reported by PPS staff: Developing mathematical knowledge

<table>
<thead>
<tr>
<th></th>
<th>Everyday Math</th>
<th>Harcourt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resources for skills practice</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Skills mastered before moving on</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Number sense</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Conceptual understanding</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Opportunities to apply skills</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Problem solving</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Exploration of multiple approaches</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Rigor</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
Relative strengths reported by PPS staff: Meeting the needs of all students

<table>
<thead>
<tr>
<th>Engaging and hands-on</th>
<th>Everyday Math</th>
<th>Harcourt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supports small group work and differentiated instruction</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Challenging proficient and advanced students</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Practice and pacing work well for below basic students</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Relative strengths reported by PPS staff: Using the programs

<table>
<thead>
<tr>
<th>Feature</th>
<th>Everyday Math</th>
<th>Harcourt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy to implement out of the box</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Clear where to focus</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Looks familiar to parents</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Mathematics familiar to most teachers</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Quality manipulatives, tools, and routines</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>
To what extent does new edition of EM address identified challenges?

- EM3 now being piloted in several schools, including 2 in our sample
- Teachers in EM3 schools report increased
  - Clarity
  - Ease of use
- But some teachers of EM3 still see skills practice and spiral lesson design as weaknesses
**Patterns of Supplementation:**

*Most teachers use extra materials to fill perceived gaps*

<table>
<thead>
<tr>
<th>EM</th>
<th>HM</th>
</tr>
</thead>
</table>
| ● Skills practice  
● Homework  
● Support for below basic students  
● More formal assessments for younger students | ● Classroom routines  
● Games  
● Number sense in early grades  
● Problem solving  
● Conceptual understanding and application  
● Higher level thinking  
● Challenges for advanced students  
● Quality manipulatives |
Many teachers ask: “Can’t there be a middle way?”

- Teachers of both programs feel the need to supplement to meet student needs.
- Supplementation seen as discouraged rather than supported by district.
- Patterns of supplementation seek a middle ground:
  - Combining solid skills foundation with engaging games, applications, and conceptual understanding.
  - Teaching to mastery then spiraling back to refresh and extend.
Final thoughts

- EM/HM difference does not explain variance in student achievement in PPS
- Supplementation makes programs less clearly differentiated in practice than in design
- Many school staff would like programs to be built into comprehensive curriculum
  - School staff want supplementation permitted, supported, and made strategic
  - View is consistent with other components of Excellence for All initiative
- Program decision for the future perhaps better informed by compatibility with PPS’ larger Excellence for All aims than by 2005-07 evidence on outcomes
Appendix: PPS Descriptive Trend