CCRC COMMUNITY COLLEGE RESEARCH CENTER
TEACHERS COLLEGE, COLUMBIA UNIVERSITY

Evidence of Improving Math Learning and Student Success: Findings from Two Studies

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What does the research tell us about student learning in developmental mathematics?

- Largely rely on memorization of procedures, which are easily forgotten (Stigler, Givvin & Thompson, 2010)
- Make primarily procedural learning gains, which may not prepare them for quantitative literacy demands of future coursework and careers (Quarles & Davis, 2017)

Two CCRC projects shed light on improving student learning in mathematics

- The CUNY Start program has a robust instructional model at its core, and has a track record of success
- Lesson Study is a model for professional development with evidence of improving student learning in K12 mathematics

CUNY Start Math:

An Innovative Developmental Education Program's Pedagogy, Curriculum, and Professional Development

CUNY Start Math Curriculum and Professional Developer:

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CADE 2019 Conference

June 6, 2019
San Diego, CA

The City University of New York

The City University of New York (CUNY) is the largest urban university system in the US, with over 270,000 students enrolled.

CUNY includes 25 campuses located across all five boroughs of New York City, including 7 community colleges, 4 comprehensive colleges, and 7 senior colleges.

In the 2018-19 academic year, CUNY Start/Math Start programs are running at 10 CUNY colleges.

CUNY Start/ Math Start History

- **2007** • College Transition Program (part of CUNY Adult Literacy/HSE program)
- **2009** • College Transition Initiative piloted at two community colleges
- **2011** • CUNY Start expanded to run at seven CUNY colleges
- **2014** • Summer Start piloted at one community college
- **2016** • Math Start expanded to Fall and Spring
- **2018** • CUNY Start & Math Start served over 4,000 students at 10 colleges

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Program Design and Structure

- Intensity/Hours:
  - CUNY Start FT program (Math and R/W):
    25 hours per week (11 hours of math)
  - CUNY Start PT program (Math or R/W):
    12 hours per week (10.5 hours of math)
  - Math Start:
    Up to 20 hours per week (18.5 hours of math)
- Advising & College Success Seminar
- Instructor/Advisor collaboration
- Built-in tutoring by trained alumni
- Same CUNY-wide proficiency standards
- Phase 1 and Phase 2
- $75 student fee, no financial aid used

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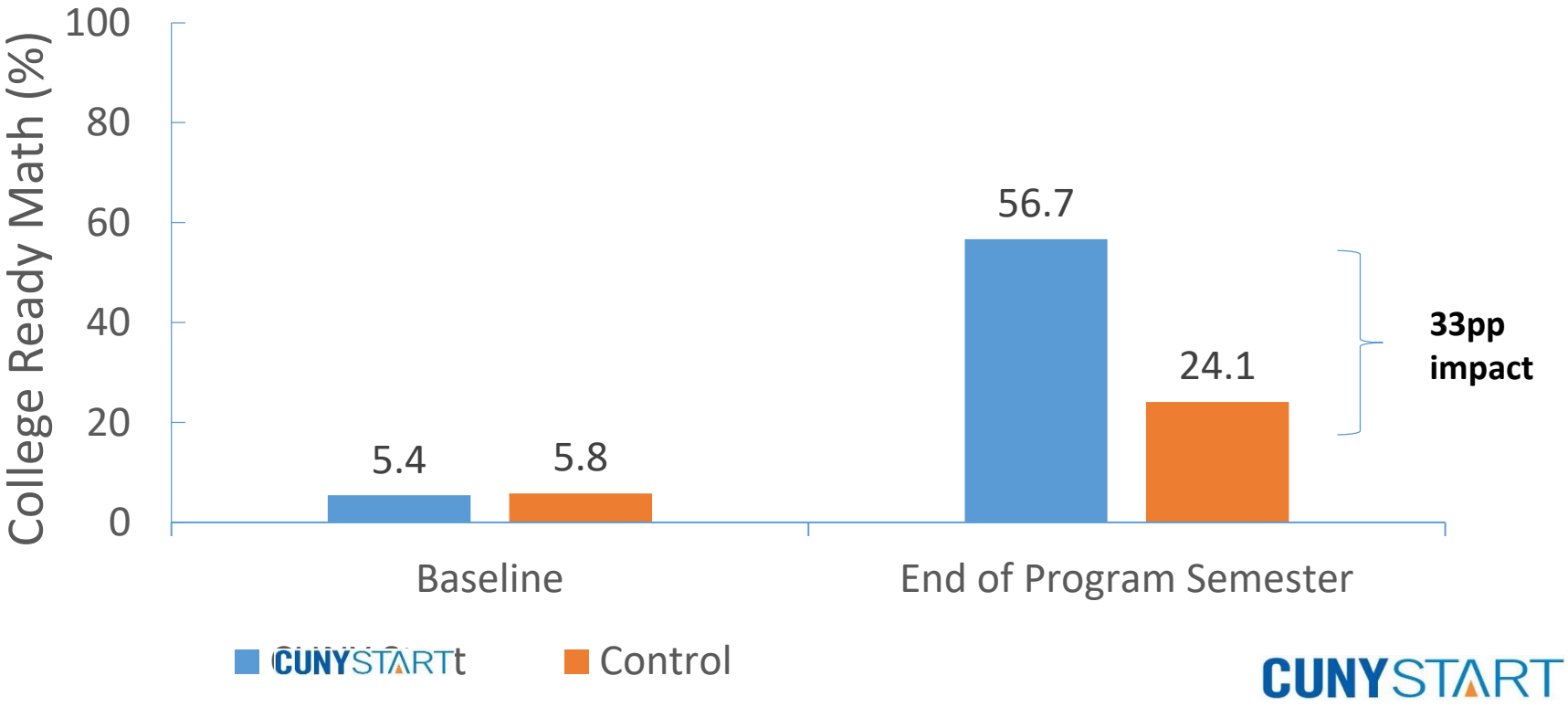
CUNY Start Boosts College Readiness in Math



Solve mentally:

10 x 3 =

10 x 13 =

20 x 13 =

30 x 13 =

31 x 13 =

29 x 13 =

22 x 13 =

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Example of student work:

10 x 3 = 30

10 x 13 = 130

20 x 13 = 86

30 x 13 = 120

31 x 13 = 123

29 x 13 = 116

22 x 13 = 92

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Student Views

- “Math is just all these steps.”
- “In math, sometimes you have to just accept that that’s the way it is and there’s no reason behind it.”
- “I don’t think [being good at math] has anything to do with reasoning. It’s all memorization.”

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Learning Goals in CUNY Start Math

- Transform students' views of math and of themselves as math learners
- Deepen students' math learning

  Conceptual understanding and procedural fluency
  Adaptive reasoning
  Cognitive autonomy
- Improve academic habits
- Reduce or eliminate developmental needs
- Prepare students to do well in classes after CUNY Start

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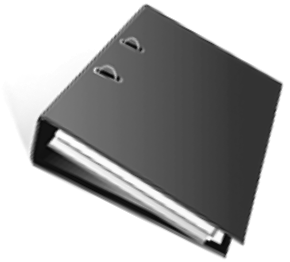
Curriculum Sample

A Moment for Mental Math

Attempt the following problem only by using mental math. That means without a pencil and paper, a calculator, or a cell phone.

A teacher buys binders for 8 students.
The binders cost $3.10 each. What is the total cost of the binders before any taxes are added?



(Remember — think about how to do this in your head!)

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Curriculum Sample

3 Scenarios and the Distributive Property

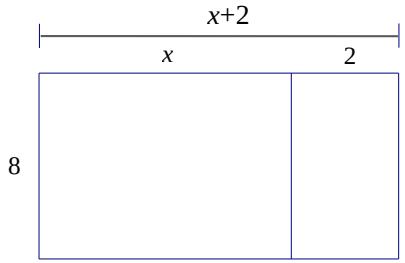
Scenario #1 — Multiplication "in parts": $15(1.03)$

$$15(1.00+.03)=15\cdot 1.00+15\cdot .03$$

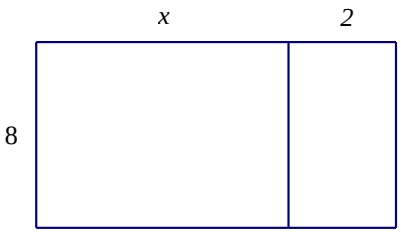
Scenario #2 — Writing out groups: $5(x+2)$

$$\begin{aligned}5(x+2)&=(x+2)+(x+2)+(x+2)+(x+2)+(x+2)\\&=x+2+x+2+x+2+x+2+x+2\\&=5x+10\end{aligned}$$

Scenario #3 — Rectangle area:



$Total\ \ Area = 8(x+2)$



$Total\ \ Area = 8x+16$

Some underlying pedagogical values

- Students learn most effectively when they are active in the classroom.
- Student talk is the most important talk.
- Rules can be the pedagogical endpoint, not the starting point.
- Number and realistic contexts can be entry points into more abstract ideas and formal representations.
- Multiple solution methods that students use can be encouraged and explored.

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More underlying pedagogical values

- Students can learn to think and communicate like scientists.
- “Relentless” questioning to develop new ideas and for assessment
- Expecting and respecting errors
- Some student struggle is important – teachers should resist being “too helpful”.

Professional Development

- Apprenticeship Semester as Cooperating Teacher
  - Observing, circulating, and tutoring
  - Participating in “preview” and “reflection” PD meetings
  - Teaching lessons and receiving feedback
- Ongoing Professional Development
  - Observations & coaching
  - Participating in regular PD meetings

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Questions

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