

Accelerated Math Pathways and Their Impact on Student Success

Elizabeth Zachry Rutschow
Senior Research Associate, MDRC

Why Accelerated Math Pathways?



Drivers that Create Barriers for Students

Problem

Postsecondary mathematics is a **barrier** to degree completion for millions of students

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Drivers of the Problem

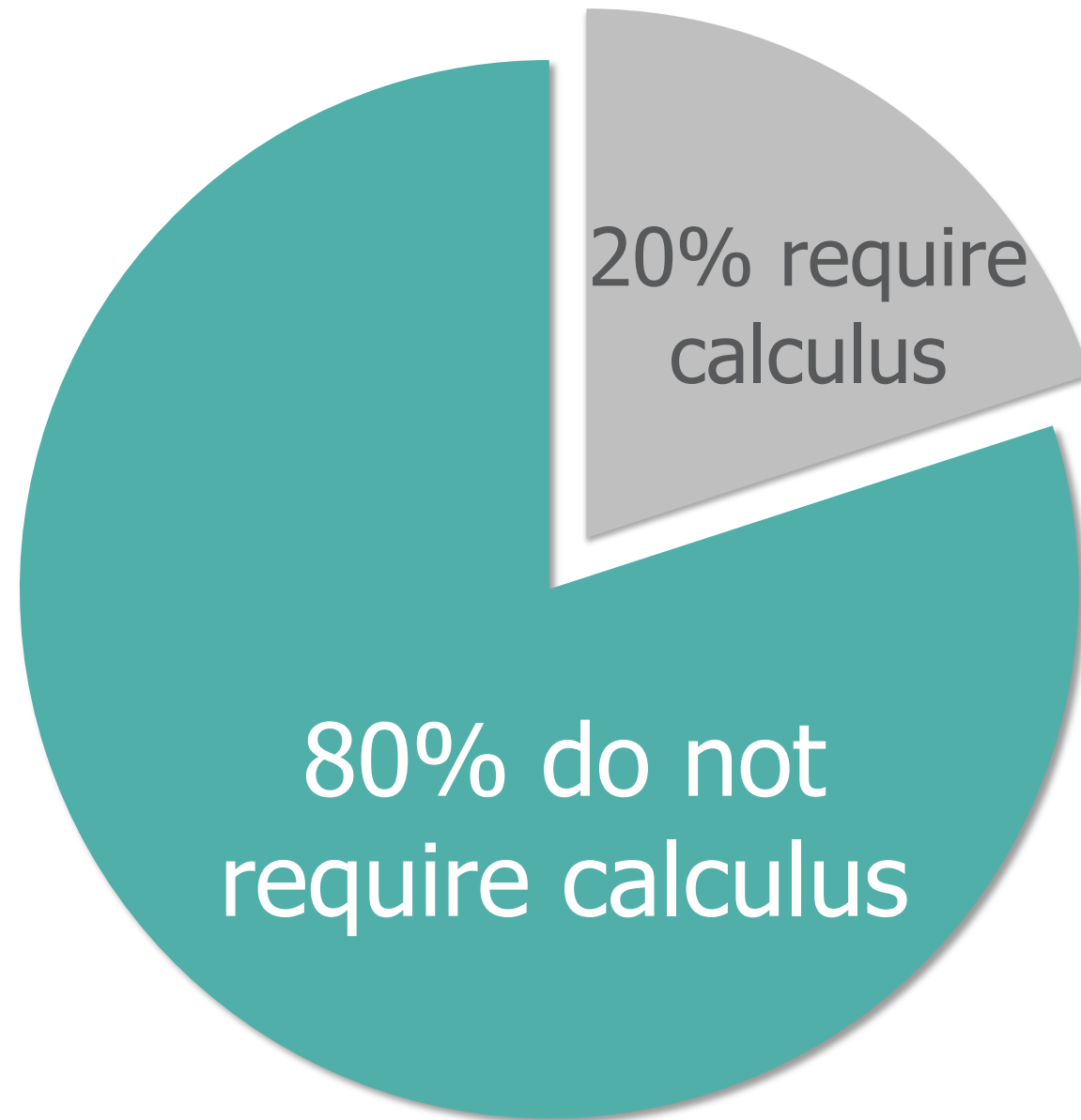
Mismatch of Content

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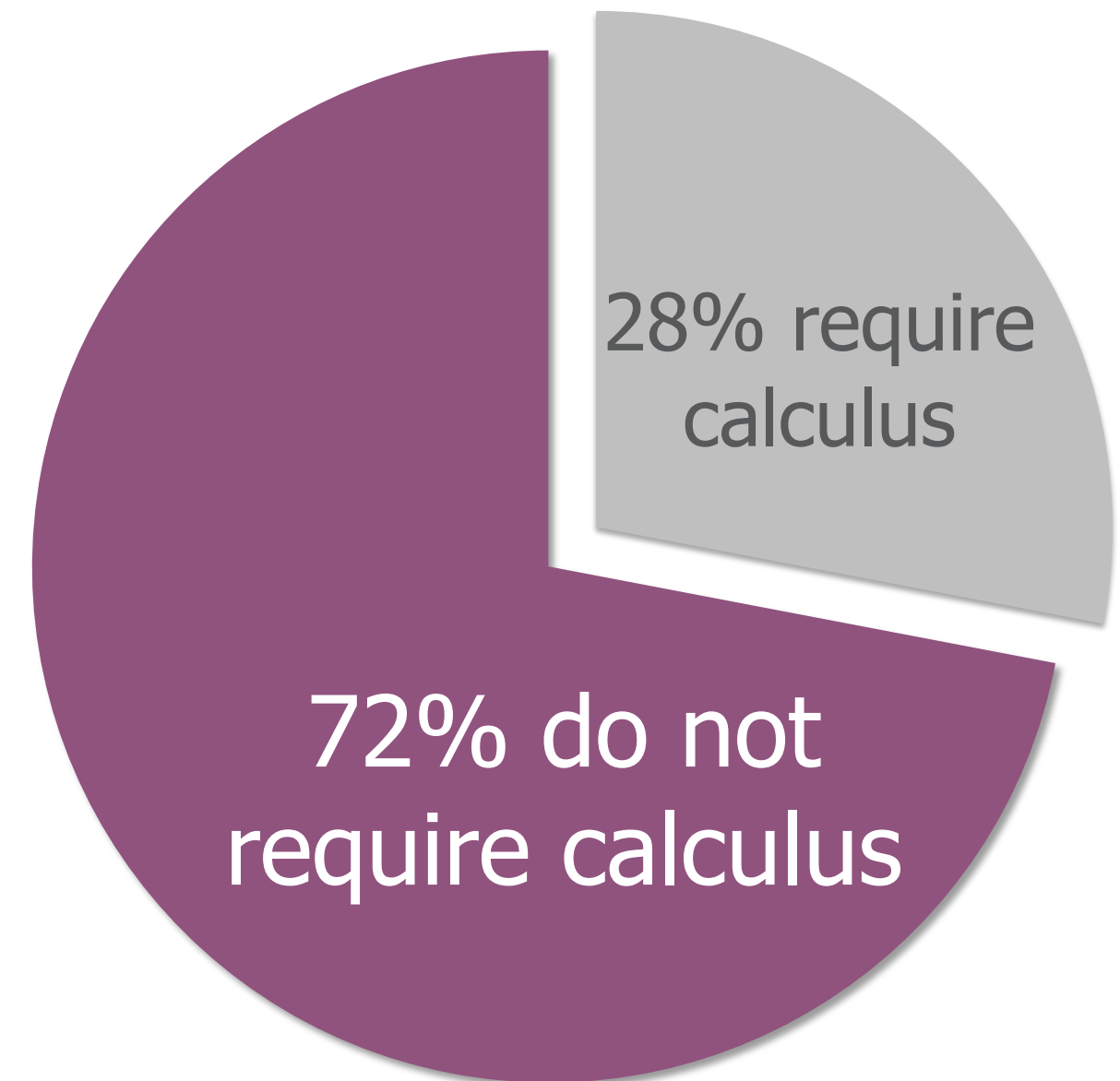
Long Course Sequences

What Math Do Students Need?

Community College Student Enrollment into Programs of Study



Four-Year College Student Enrollment into Programs of Study



Traditional Math Has Tended Towards...

1. Teacher-Directed Lecture
2. Formulas and Equations
3. Rote Memorization
4. Few Real-World Applications



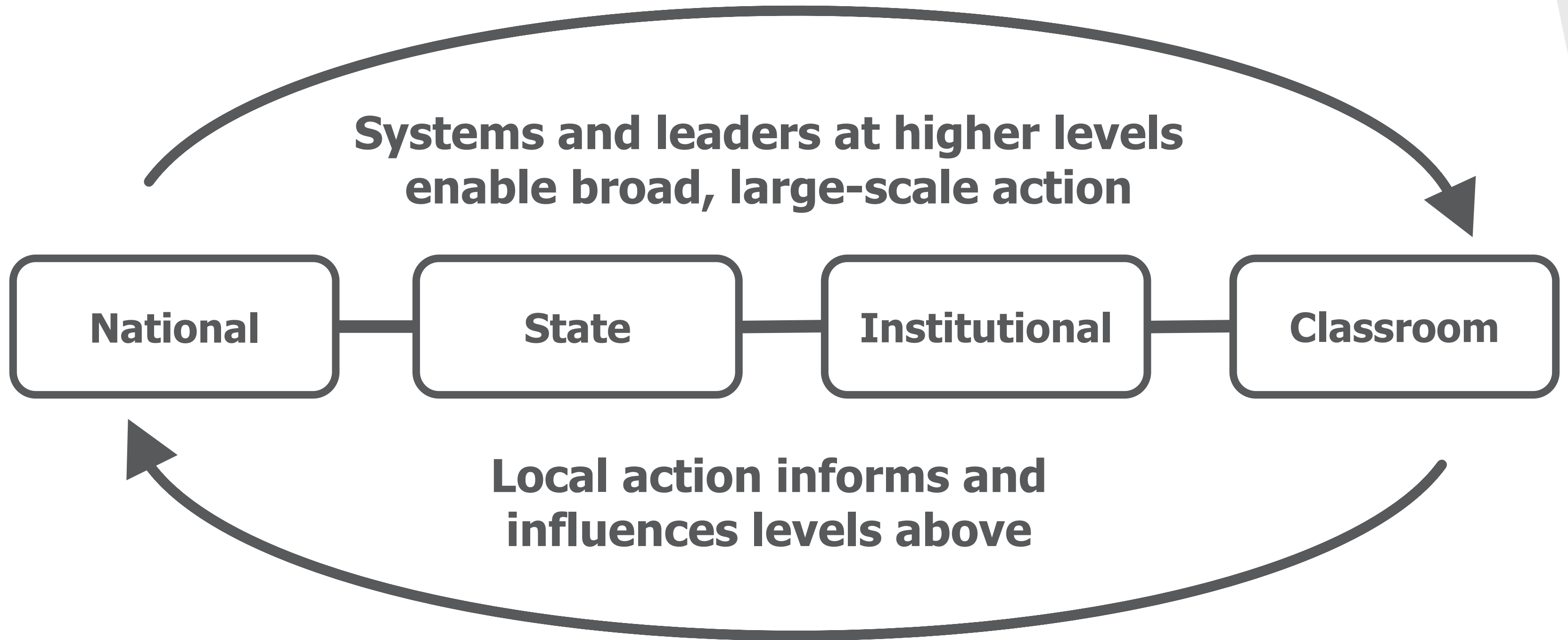
The Dana Center Mathematics Pathways

**Principles and
Curricular Course
Pathways**

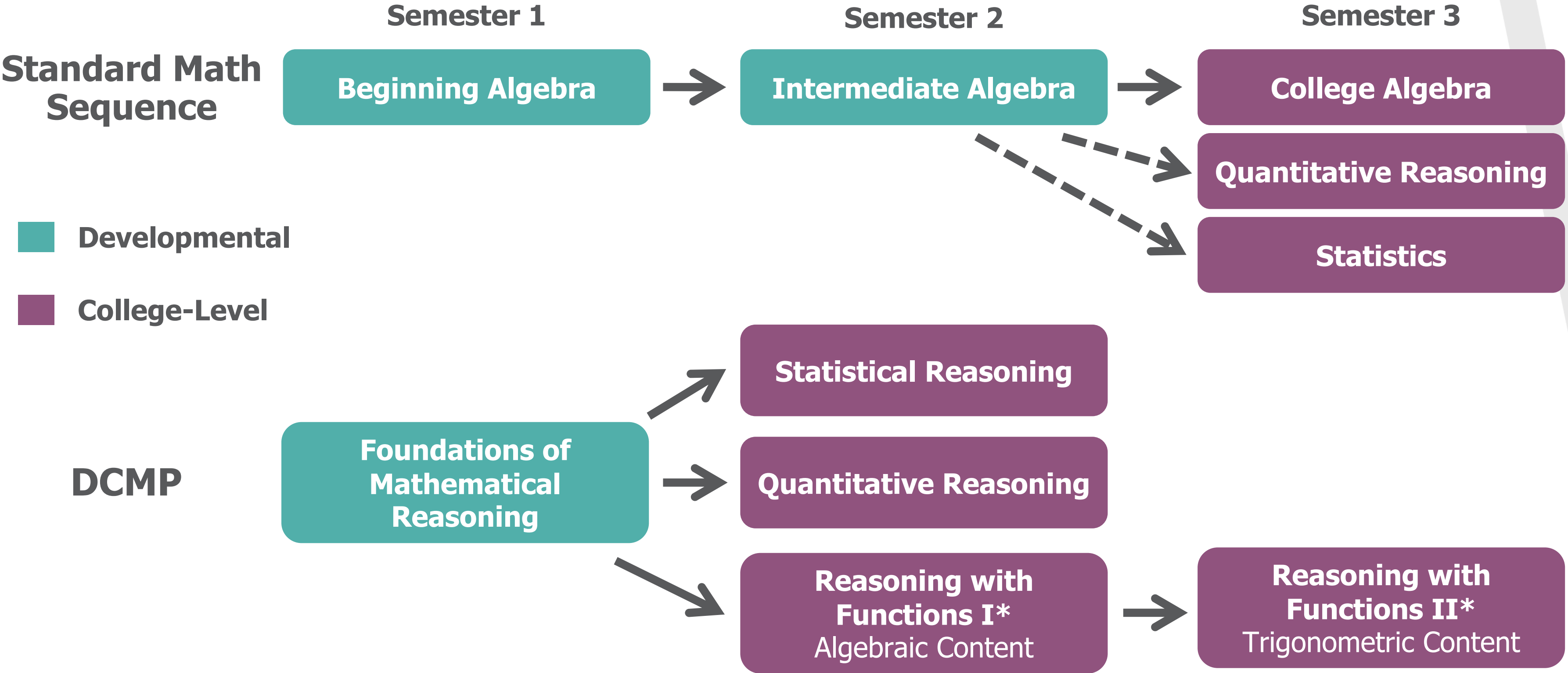
What are the Dana Center Mathematics Pathways (DCMP)?

- **Mathematics pathways are structured so that:**
 - All students, regardless of college readiness, enter directly into mathematics pathways aligned to their programs of study.
 - Students complete their first college-level math requirement in their first year of college.
- **Students engage in a high-quality learning experience so that:**
 - Strategies to support students as learners are integrated into courses and are aligned across the institution.
 - Instruction incorporates evidence-based curriculum and pedagogy.

DCMP Across the System



The DCMP Curricular Model



How Is Instruction Different?

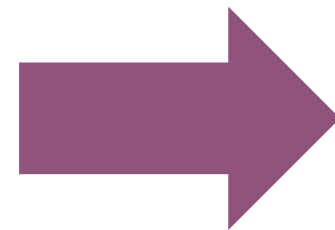
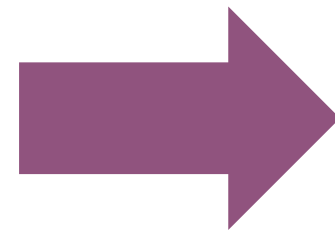
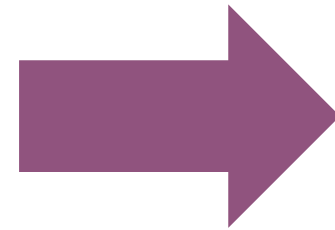
Traditional instruction

Teacher-directed
lecture

Formulas and
equations

Rote memorization

Few real-world
applications



DCMP curricula

Active Learning

Small group work, student interaction, presenting
solution methods

Reading and Writing

Problem Solving

Multistep problems building on previously learned
content or answers;
Multiple solution methods

Constructive Perseverance

Understanding the role struggle plays in learning

Contextualization

Problems contextualized in real-life situations

A Typical Developmental Algebra Problem

Solve the equation.

$$\frac{6}{y} + \frac{1}{4} = \frac{8}{4y}$$

$y =$ _____.

A Typical DCMP Developmental Math Problem

Question: A research report estimates that individuals who smoke are 15 to 30 times more likely to develop lung cancer than individuals who never smoke. If the lifetime risk of developing lung cancer for nonsmokers is about 1.9 percent, what is the lower limit of the estimated risk for smokers according to the report?

Answer: The lower limit of the estimated risk for smokers according to this report is _____ percent.

Evaluation of the DCMP Curricular Pathways

Findings

Research Questions

1. Do DCMP students have better academic outcomes than students in traditional developmental math programs?
2. To what degree is there fidelity to the DCMP curricular model across colleges?
3. How do the curriculum and pedagogy in the DCMP courses differ from the colleges' traditional developmental math courses?
4. What are the costs to colleges to implement and maintain the DCMP?



Randomized Controlled Trial (RCT) Evaluation

- 4 colleges in Texas
 - Brookhaven College
 - Eastfield College
 - El Paso Community College
 - Trinity Valley Community College
- 4 cohorts of students
(Fall 2015 – spring 2017)
- Total: 1,411 students



Mixed Methods: Impact

RQ1. Do DCMP students have better academic outcomes than students in traditional developmental math programs?

- **Data collected**
 - Student-level transcript data
 - IPEDS data
- **Key outcomes**
 - Completion of developmental math
 - Completion college-level math course
 - Overall academic progress
- **Follow up**
 - 3-4 semesters

Mixed Methods: Implementation

RQ2. To what degree is there fidelity to the DCMP model across colleges?

RQ3. How do the curriculum and pedagogy in the DCMP courses differ from the colleges' traditional developmental math courses?

- **Implementation analyzed at the**
 1. Institution-level
 2. Classroom-level
- **Data collected**
 - Site visits to colleges
 - Interviews with faculty, administrators, and staff
 - Observations of 48 DCMP and non-DCMP classes
 - Focus groups with students
 - Survey of students
 - Math instruction received
 - Perspective of classes, skills, and math

Mixed Methods: Cost

RQ4. What are the costs to colleges to implement and maintain the DCMP?

- **Cost data gathered from colleges and Dana Center**
- **Costs analyzed:**
 - **Costs to colleges**
 - Startup costs (2-year period)
 - Ongoing costs (1 year after start-up completed)
 - Costs in comparison to colleges' regular services
 - **Costs for Dana Center supports**
 - Average costs for a range of services similar to what colleges in the evaluation received

Findings







Implementation and Cost

Institution-Level Implementation

Change Needed to Implement DCMP	Strength of Implementation	Continuing Challenges?
Revision of math requirements	Strong	Some
Advising and registration	Strong	
Alignment with 4-year colleges	Strong/Mixed	Yes
Class enrollment and scaling	Strong/Mixed	Some
Professional development	Strong	
General student supports	Mixed	Yes



Fidelity to the DCMP Curricula

	DCMP Curricular Design Standard	Strength of Implementation
	Active Learning	Strong/Mixed
	Constructive Perseverance	Strong/Mixed
	Problem-Solving	Strong
	Contextualization	Strong
	Reading & Writing	Strong
	Technology	Strong







“I find myself calculating things I used to not do, like the cost and ounces in a shampoo bottle to see how to save money.”
—DCMP Student

“

I would describe the problems they work on as thought-provoking. Frustrating [laughs]. I think they require a lot of thought. I know the goal is to get students problem solving and critical thinking, and I think it does that very well.

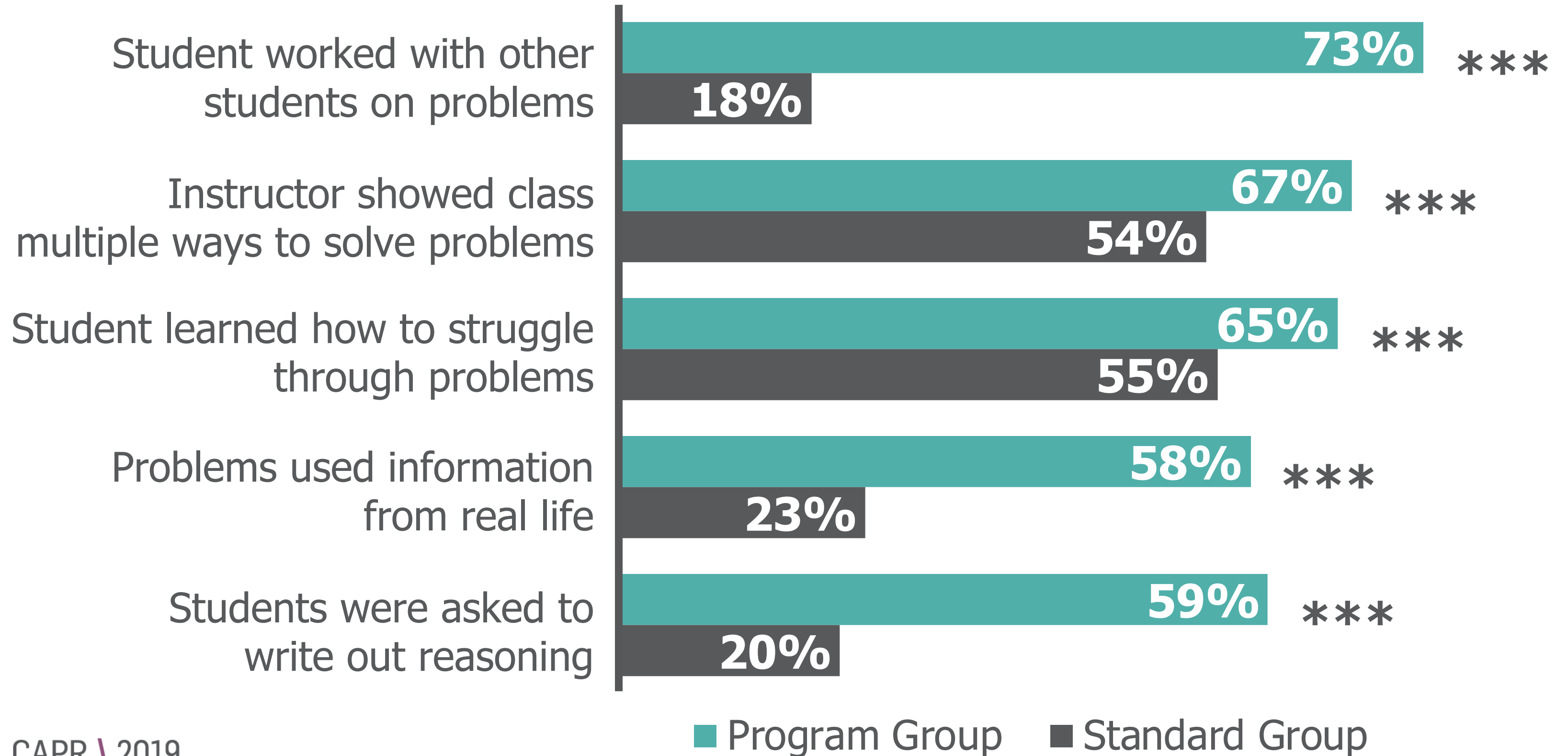
—DCMP Instructor

How Did Standard Classes Differ?

	DCMP Curricular Design Standard	Contrast with Standard Algebra Classes
	Active Learning	Lecture-based
	Constructive Perseverance	Answers are given upon request
	Problem-Solving	Instructors demonstrate, and then students practice
	Contextualization	Problems presented as equations or formulas
	Reading & Writing	Very little reading & writing. Notetaking may be encouraged.
	Technology	Calculators & MyMathLab

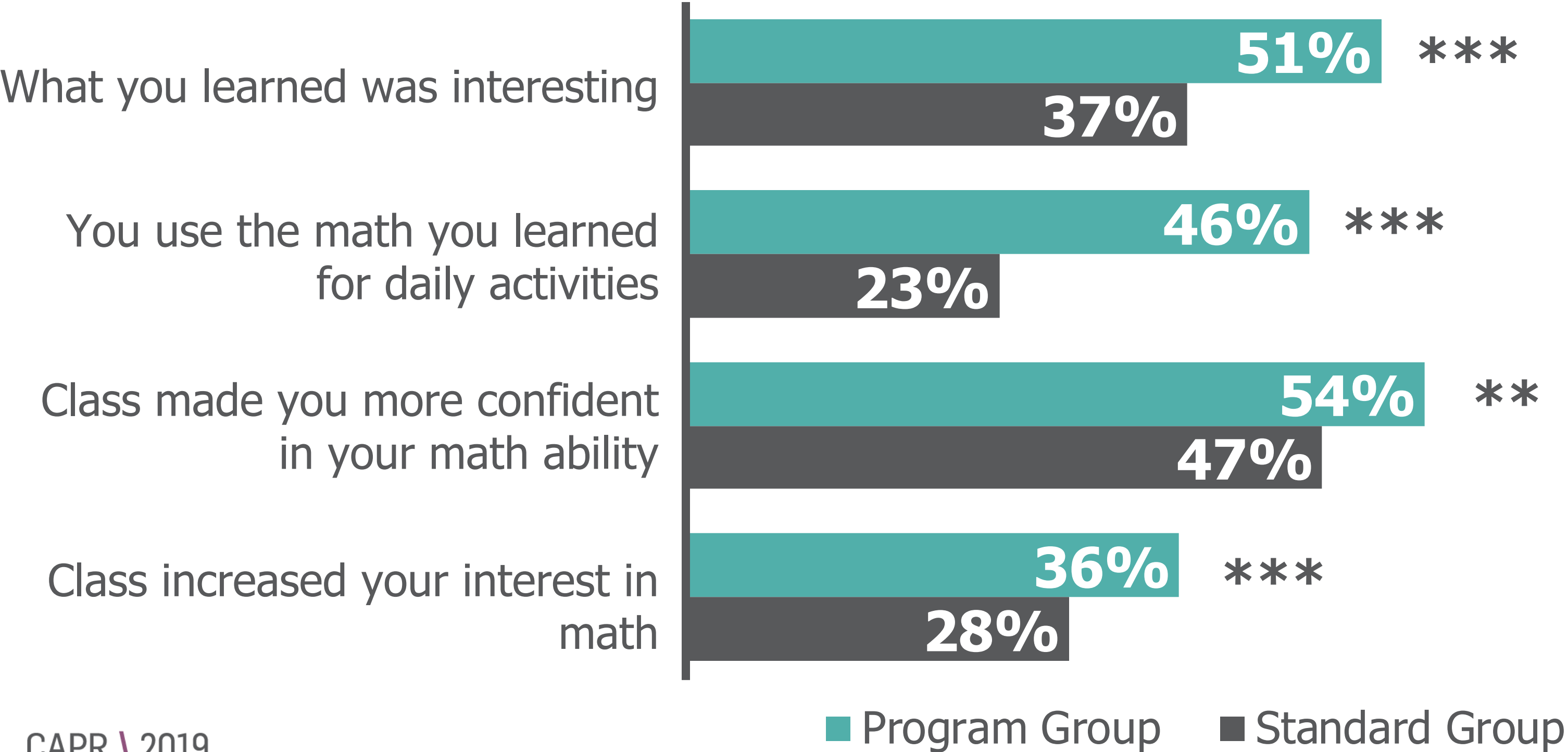
“There isn't a lot of working in groups. That's actually something I'm going to experiment with next semester. [...] That takes a lot of prep time, and I didn't have a lot of prep.”
—Standard Developmental Math Instructor

What Did Students Say? Math Instruction



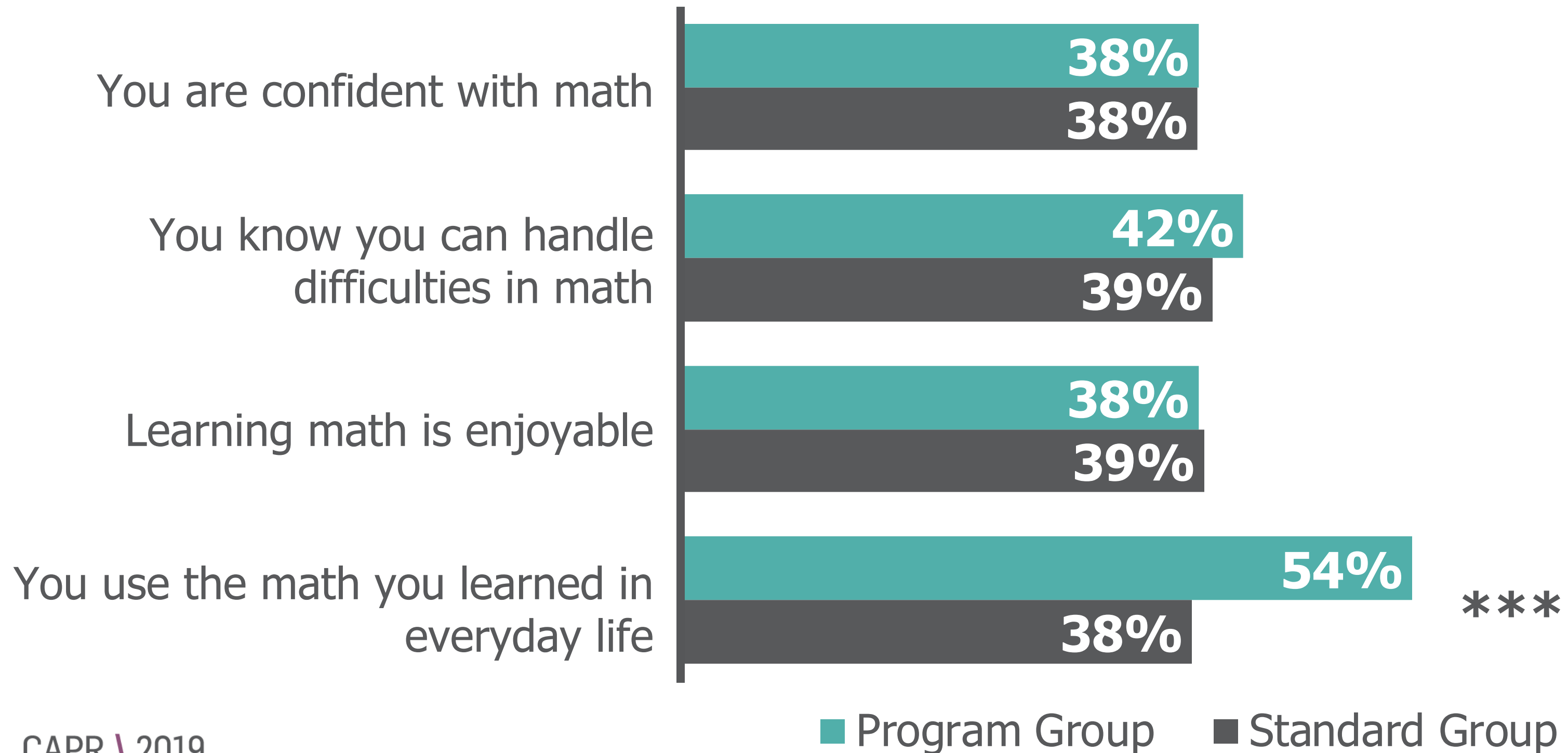
What Did Students Say? Perspectives of Math Class

Percentage of students who thought the following statements were always or mostly true



What Did Students Say? Attitudes Toward Math

Percentage of students who agreed or strongly agreed with the following statements



How much did DCMP cost?

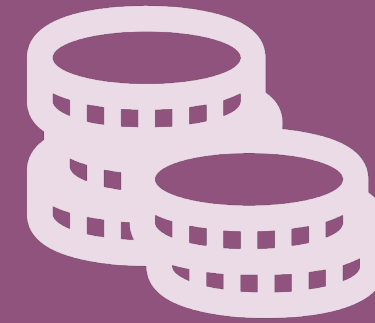
< 1% colleges' annual operating budget

**Average Start-Up
Cost Per College in
Study**



\$140,450

**Average Net Ongoing
Cost Per College in
Study**

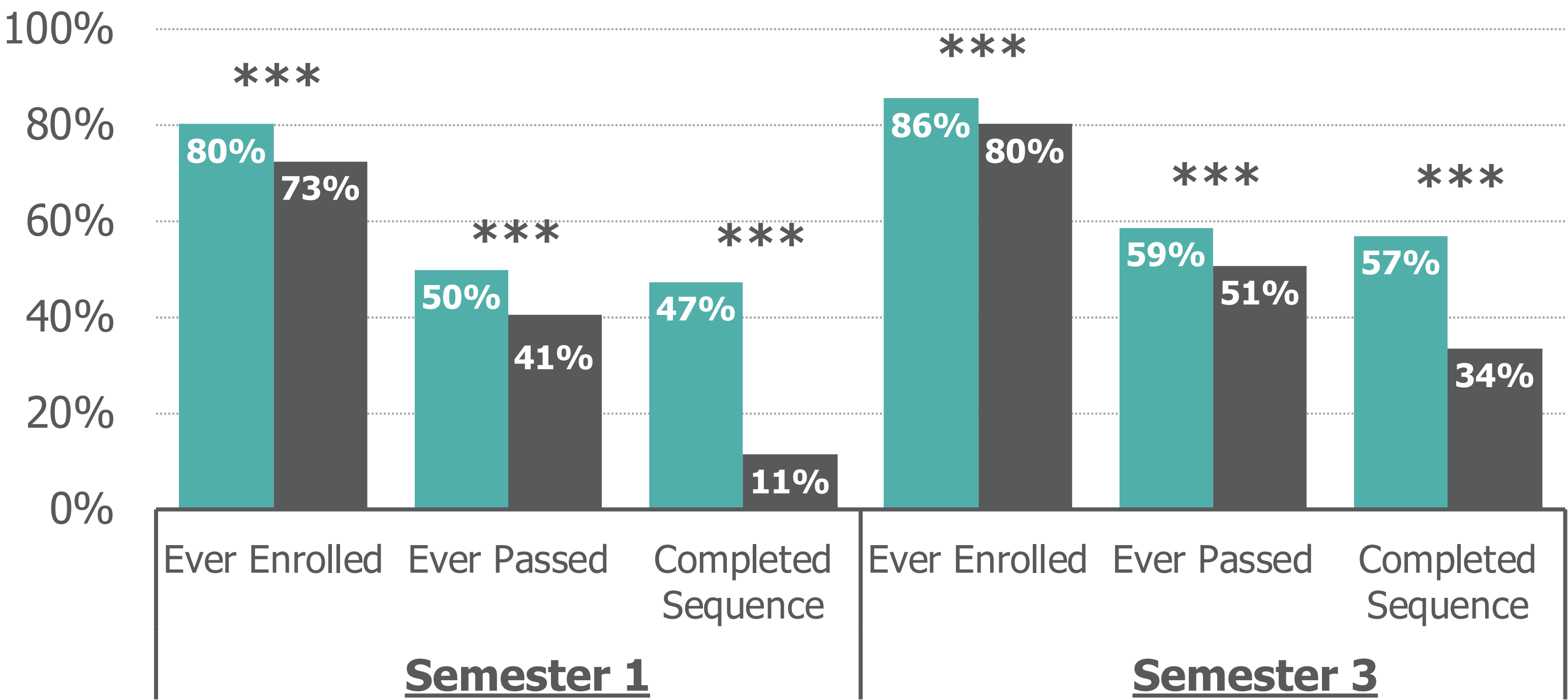


\$19,340

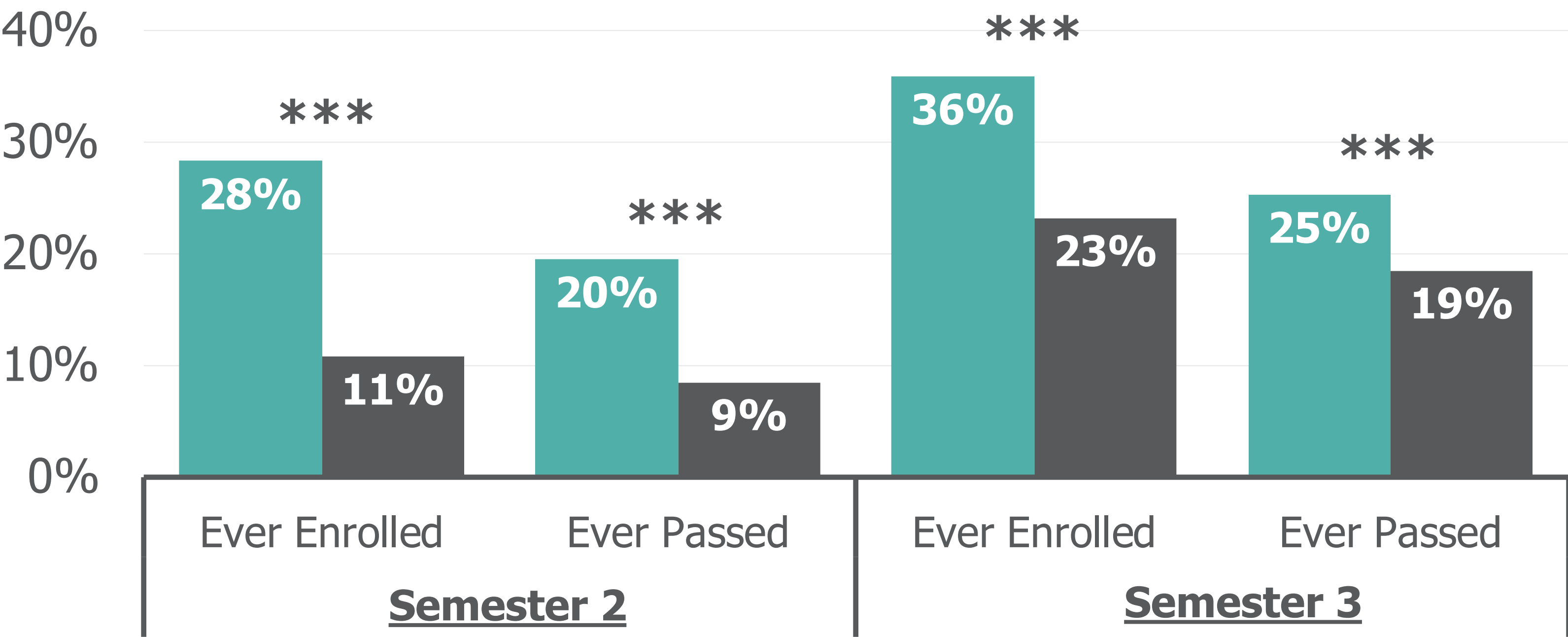
Findings

Impacts on Student Achievement

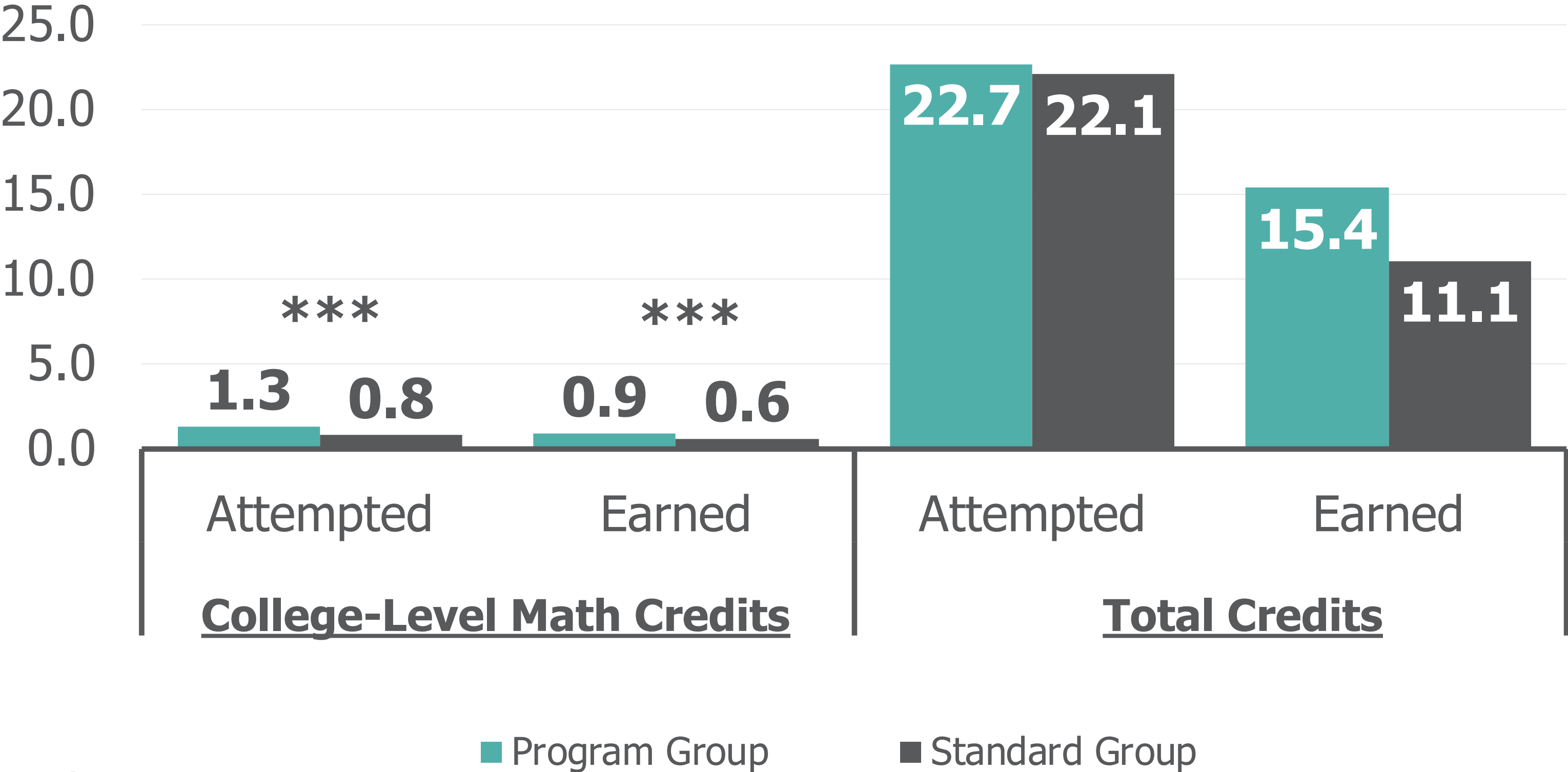
Impact on Developmental Math



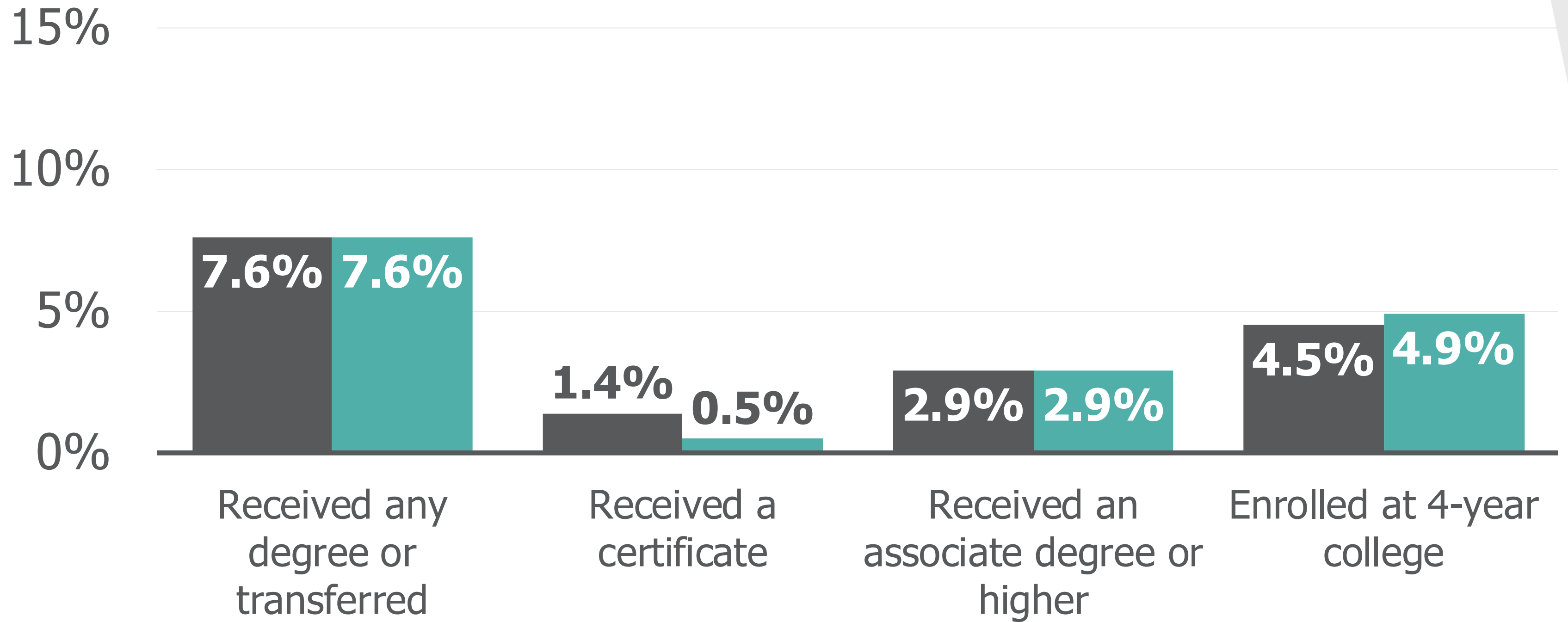
Impact on College-Level Math



Impact on Credit Accumulation

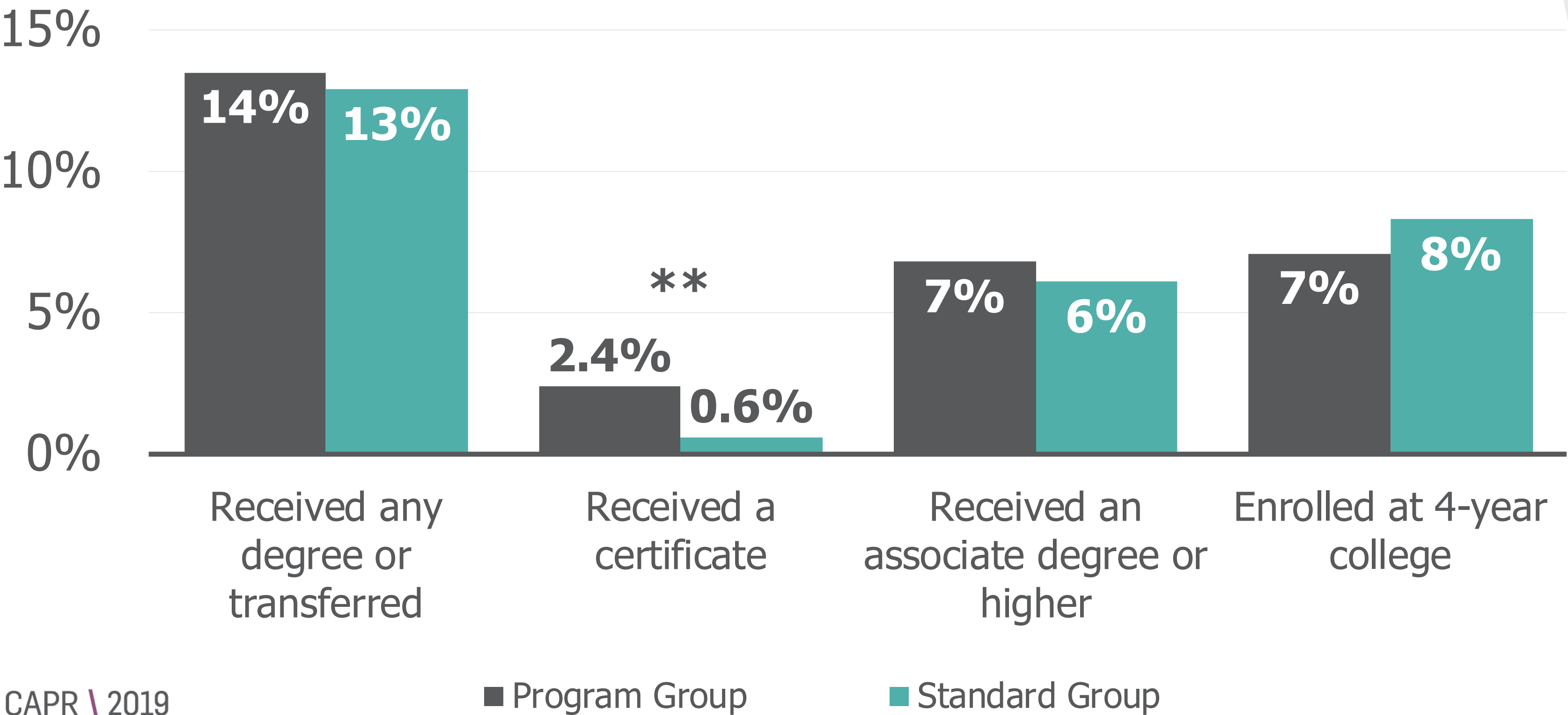


Impact on Graduation or Transfer

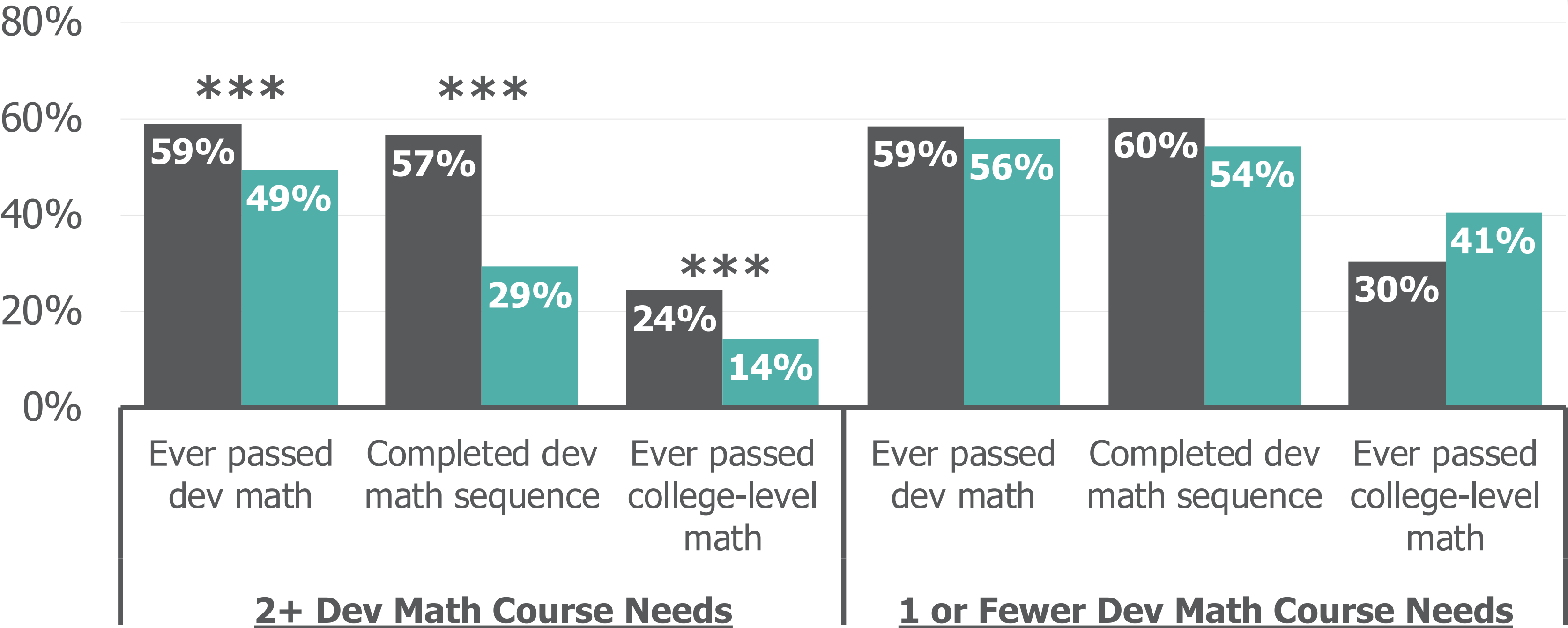


Early Impact on Graduation or Transfer

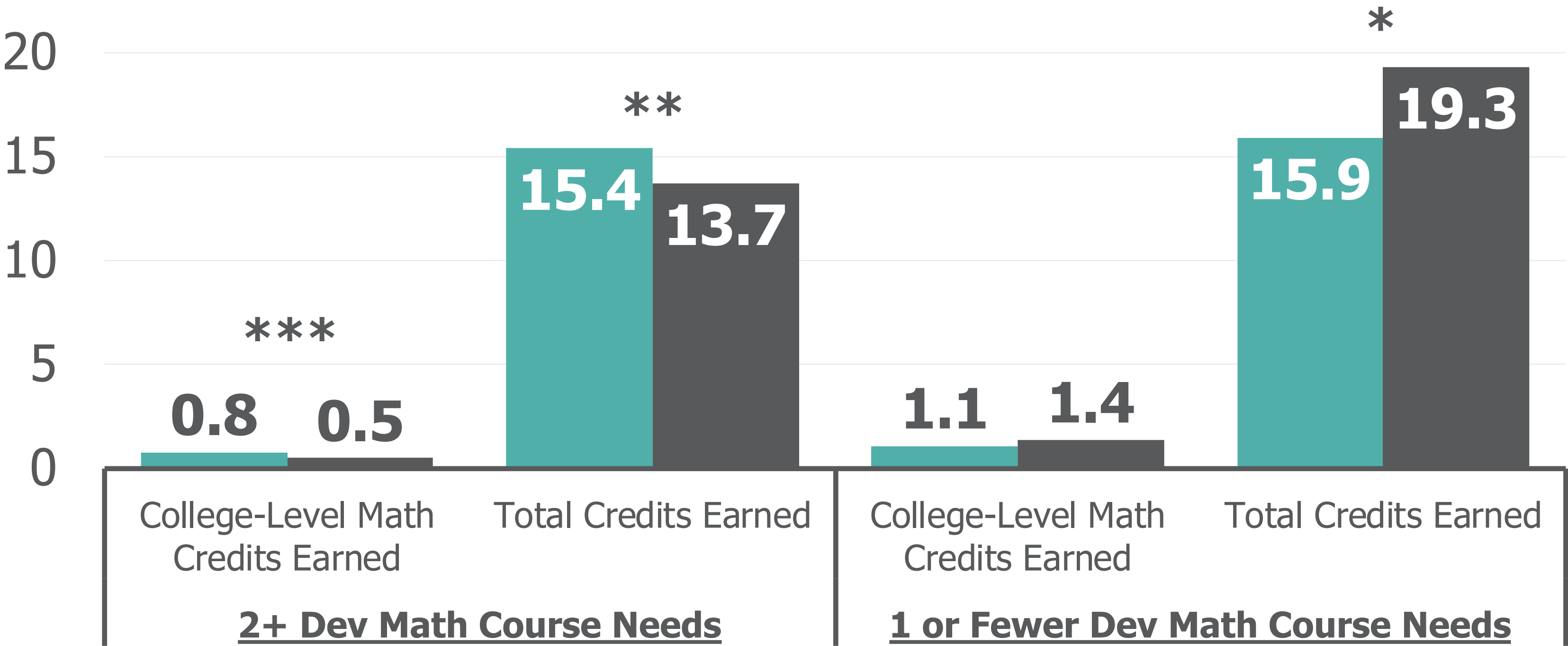
(4 semesters for 3 Cohorts Only)



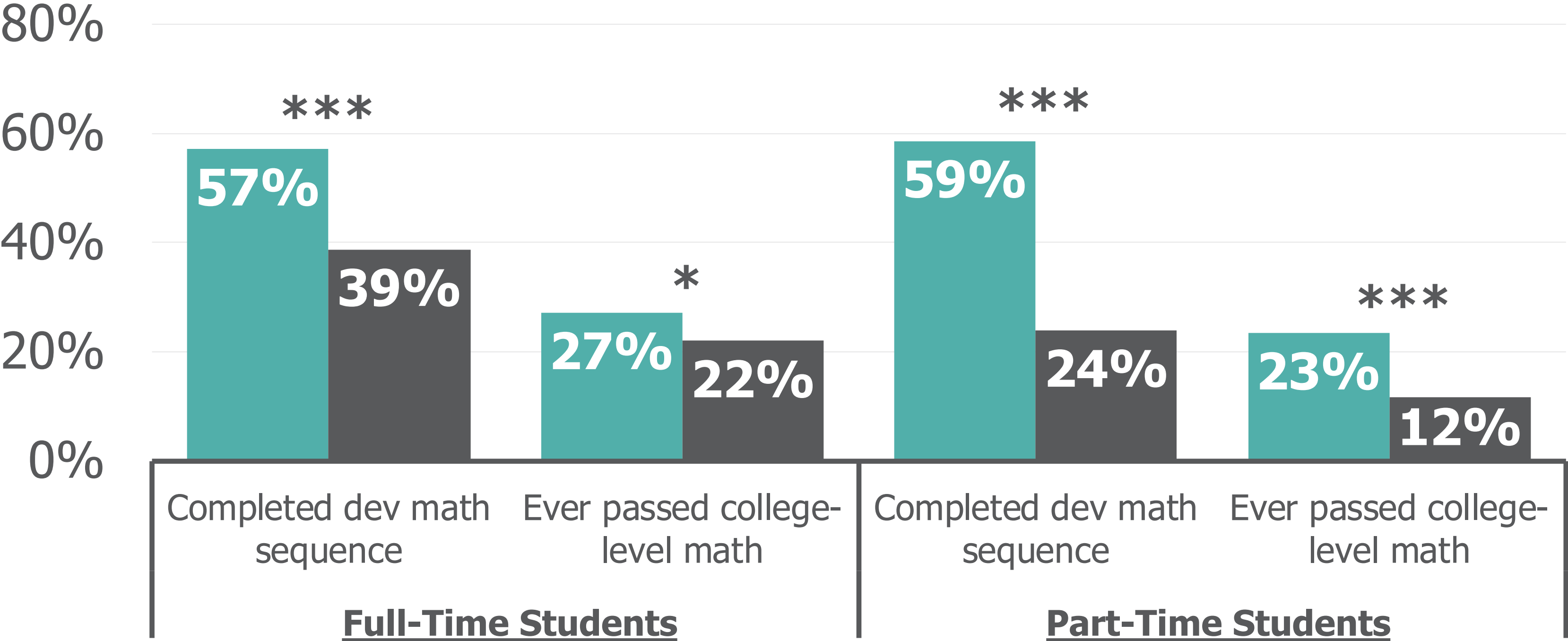
Exploratory Analysis: Impact by Level of Math Placement



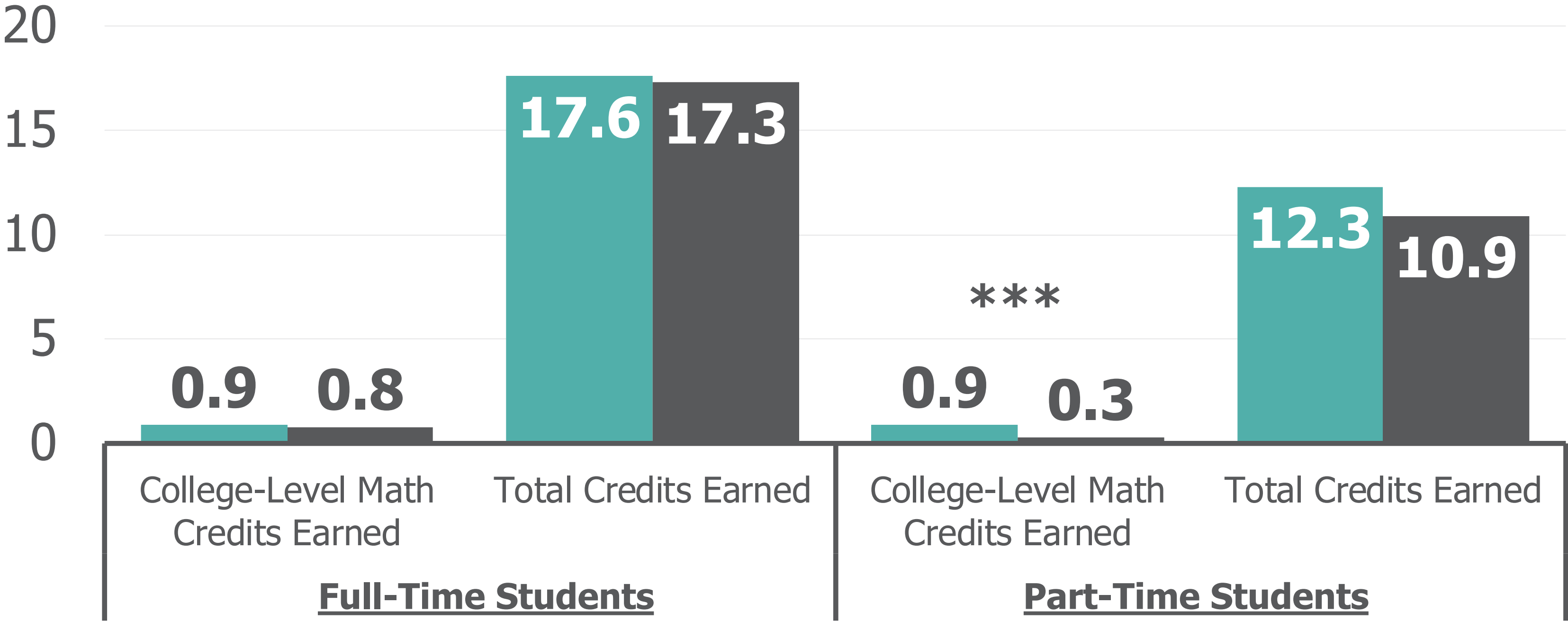
Exploratory Analysis: Impact by Level of Math Placement



Exploratory Analysis: Impacts by Enrollment Status



Exploratory Analysis: Impacts by Enrollment Status



The DCMP Evaluation

Implications

A Few Lessons from the Findings

- **The DCMP is effective in helping students succeed in college math**
 - More time is needed to assess effect on longer-term outcomes
- **Traditional instructional models continue to dominate math classes**
 - However, DCMP shows it's possible to change instruction and student perspectives
- **Math remains a significant barrier for student success**
 - Only a quarter of program students complete college-level math in 3 semesters
 - Less than 40% say they are confident in math or that math learning is enjoyable

What More Can We Do?

- **Find ways to improve students' interest in and enjoyment of math**
 - Student-centered, contextualized instructional models may help
- **Improve research on teaching and learning – and its connection to student outcomes**
 - Grades provide a rough measure – but what skills are students actually learning and how do they best learn them?
- **Pair math pathways with additional interventions**
 - Math pathways provides positive news about content and instruction
 - Comprehensive interventions may help bolster these outcomes

Thank you!

Elizabeth Zachry Rutschow

elizabeth.zachry@mdrc.org

www.postsecondaryreadiness.org