

MATHEMATICS PLACEMENT TESTS: ARE THEY REALLY NECESSARY FOR STUDENT SUCCESS?

Dr. Lori Austin

Dr. Lynne Kowski

Raritan Valley Community College



INTRODUCTION

- ❖ Over 60% of incoming community college (CC) students require postsecondary developmental education (American Association of Community College, 2012)
- ❖ Postsecondary developmental education is intended to reduce disparities between high school graduates who are college-ready and those who are not
- ❖ Different pathways don't all require traditional remediation.
- ❖ In 2008 in New Jersey, state mandated transfer agreements forced placement based on a single test score. Since then evidence in New Jersey and other states have shown this to be ineffective.



DEFINING ALGEBRA

NCTM, 2008

Algebra is a way of thinking and a set of concepts and skills that enable students to generalize, model, and analyze mathematical situations. Algebra provides a systemic way to investigate relationships, helping to describe, organize, and understand the world. ...Knowing algebra opens doors and expands opportunities, instilling a broad range of mathematical ideas that are useful in many professions and careers. All students should have access to algebra and support for learning it.

RESEARCH QUESTION

When placement tests are used to decide rather than recommend developmental education, what short- and long-term effects do developmental education have on postsecondary educational attainment?

Specifically, what effect does postsecondary developmental mathematics have on educational achievement at community colleges?



STATEMENT OF THE PROBLEM: CHALLENGE OF POSTSECONDARY DEVELOPMENTAL EDUCATION

- ❖ Promotes equity for many ill-prepared high school graduates, the majority of who are lower-income minorities
 - Without developmental education, college would not even be an option or would lead down a path to failure
- ❖ Provides a necessary role in helping students obtain their educational goals
- ❖ Increases the number of requirements and extends the time to degree
 - Developmental education may negatively impact student outcomes such as persistence, major choice, and eventual labor market return



STATEMENT OF THE PROBLEM: SERVING GREATEST NUMBER OF STUDENTS

- ❖ Many high school graduates are academically unprepared for college-level mathematics, mathematics beyond algebra II
- ❖ Less than half of students in community colleges who begin the developmental mathematics sequence successfully complete a college-level mathematics course
- ❖ If there is to be an increase in college success rates, then there must be an improvement in the pass rates of developmental mathematics students through freshmen college-level mathematics

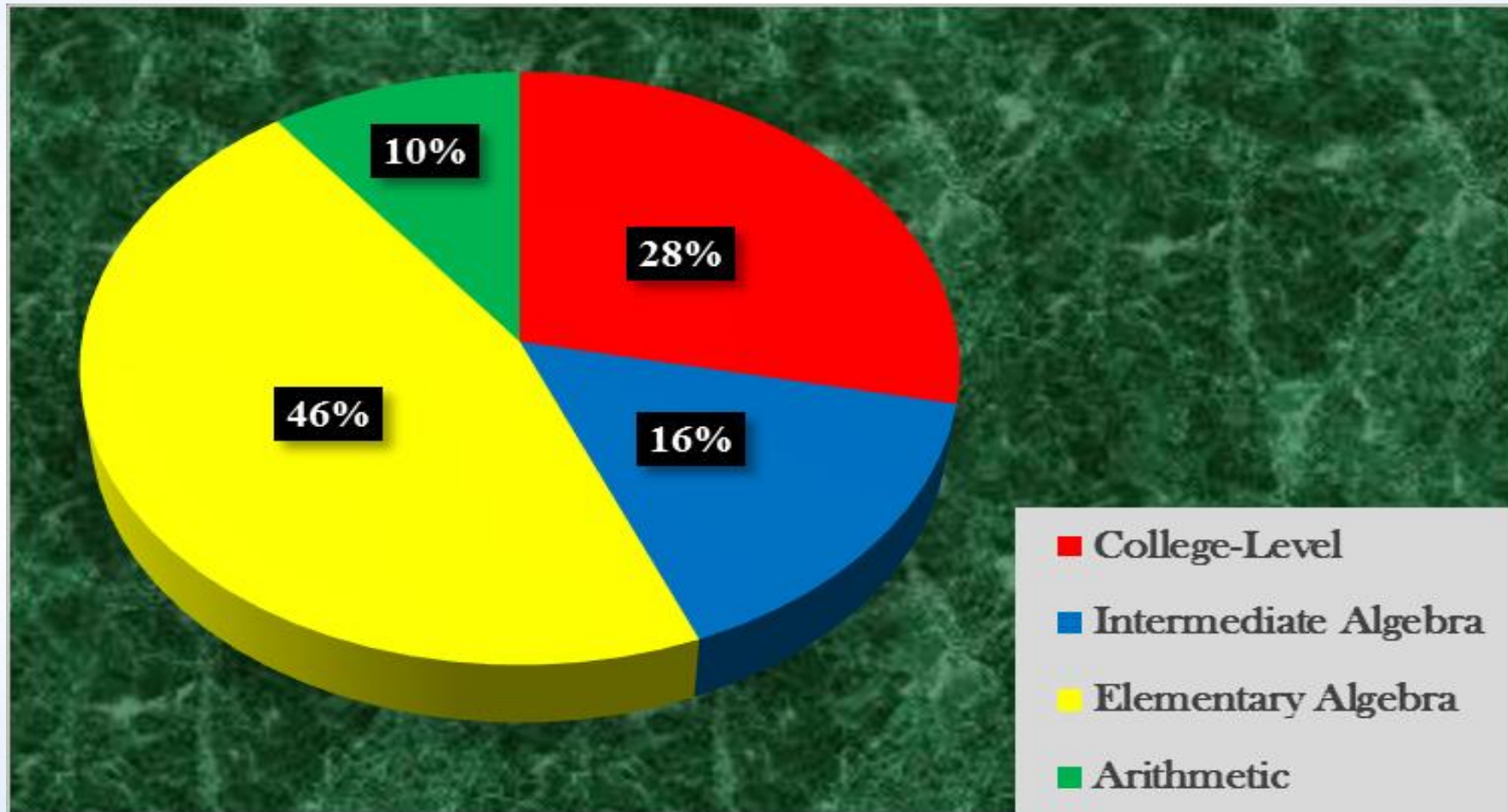


STUDY SYNOPSIS

The effectiveness of the developmental mathematics program for traditional age college freshman was tested by comparing the academic outcomes of students who successfully achieve college-level mathematics skill through postsecondary developmental mathematics with those students who did not require developmental mathematics to achieve college-level mathematics skill



MATHEMATICS PLACEMENT (2010)



HGLM: SUCCESSFUL MATHEMATICS REMEDiation (2010)

Fixed Effect	Coefficient	Standard error	p-value (d.f. = 597)	Odds Ratio	Probability
GENDER	-0.486	0.170	0.004	0.615	0.381
RACE-BLACK	-1.197	0.288	<0.001	0.302	0.232
ENGL-050	-0.938	0.316	0.003	0.391	0.281
MATH-020	1.922	0.184	<0.001	6.836	0.872
MATH-030	2.176	0.245	<0.001	8.815	0.898



SUMMARY OF RESULTS: SUCCESSFUL MATHEMATICS REMEDIATION

Significant variables:

- ❖ Developmental Mathematics:
 - Intermediate Algebra versus Arithmetic
 - Elementary Algebra versus Arithmetic

- ❖ Gender:
 - Female versus male students

- ❖ Developmental English:
 - Reading/Comprehension 1 versus college-level English



HGLM: COLLEGE-LEVEL MATHEMATICS GRADE \geq C (2010)

Fixed Effect	Coefficient	Standard error	p-value (d.f. = 490)	Odds Ratio	Probability
GENDER	-0.480	0.188	0.011	0.619	0.382
GRANT	0.661	0.155	<0.001	1.937	0.659
LOAN	-0.726	0.251	0.004	0.484	0.326
ENGL-060	-0.618	0.286	0.031	0.539	0.350
MATH-020	-0.697	0.239	0.004	0.498	0.332



SUMMARY OF RESULTS: COLLEGE-LEVEL MATHEMATICS GRADE \geq C

Significant variables:

- ❖ Developmental Mathematics:
 - Elementary Algebra versus college-level mathematics
- ❖ Gender:
 - Female versus male students
- ❖ Financial Aid (2010 cohort):
 - Federal loans versus no financial aid
 - Non-Pell grants versus no financial aid



HGLM: GRADUATE (2010 MATHEMATICS)

Fixed Effect	Coefficient	Standard error	p-value (d.f. = 851)	Odds Ratio	Probability
GENDER	-0.829	0.256	0.001	0.436	0.304
PELL	-0.696	0.313	0.027	0.499	0.333
GRANT	0.943	0.271	<0.001	2.568	0.720
ENGL-060	-0.956	0.243	<0.001	0.385	0.278
MATH-013	-1.793	0.487	<0.001	0.166	0.143
MATH-020	-1.040	0.145	<0.001	0.353	0.261
MATH-030	-0.690	0.201	<0.001	0.502	0.334



SUMMARY OF RESULTS: TAKE ANY MATHEMATICS & GRADUATE

Significant variables:

- ❖ Developmental Mathematics:
 - Intermediate Algebra versus college-level mathematics
 - Elementary Algebra versus college-level mathematics
 - Arithmetic versus college-level mathematics
- ❖ Gender:
 - Female vs. male students (2010 cohort)
- ❖ Financial Aid:
 - Pell Grants vs. no financial aid
 - Non-Pell grants versus no financial aid



HGLM: GRADUATE (2010 COLLEGE-LEVEL MATHEMATICS)

Fixed Effect	Coefficient	Standard error	p-value (d.f. = 450)	Odds Ratio	Probability
GENDER	-0.869	0.240	<0.001	0.419	0.295
RACE-WHITE	0.768	0.197	<0.001	2.154	0.683
GRANT	0.418	0.163	0.011	1.518	0.603
LOAN	-0.563	0.205	0.006	0.570	0.364
ENGL-060	-0.941	0.302	0.002	0.390	0.281



SUMMARY OF RESULTS: TAKE COLLEGE-LEVEL MATHEMATICS & GRADUATE

Significant variables:

❖ Gender:

- Female vs. male students (2010 cohort)

❖ Financial Aid:

- Non-Pell grants versus no financial aid
- Federal loans versus no financial aid (2010 cohort)



STUDY INFORMATION: STUDENT POPULATION

Full-Time First-Time students needing only a Liberal Arts Math Course (non-STEM)

2012 Cohort over three years

3 NJ Community Colleges

2012 COURSE SEQUENCE AT NJ COLLEGES

Non - STEM Students

- Basic Math (NC)
- Elementary Algebra (NC)
- College level Liberal Arts math course (C)
 - Number Systems
 - Quantitative Reasoning
 - Contemporary Math
 - Topics in Math

STEM Students

- Basic Math (NC)
- Elementary Algebra (NC)
- Intermediate Algebra (NC)
- College Level Math
 - Precalculus /College Algebra
 - Statistics I



CONTENT OF COURSES

Elementary Algebra

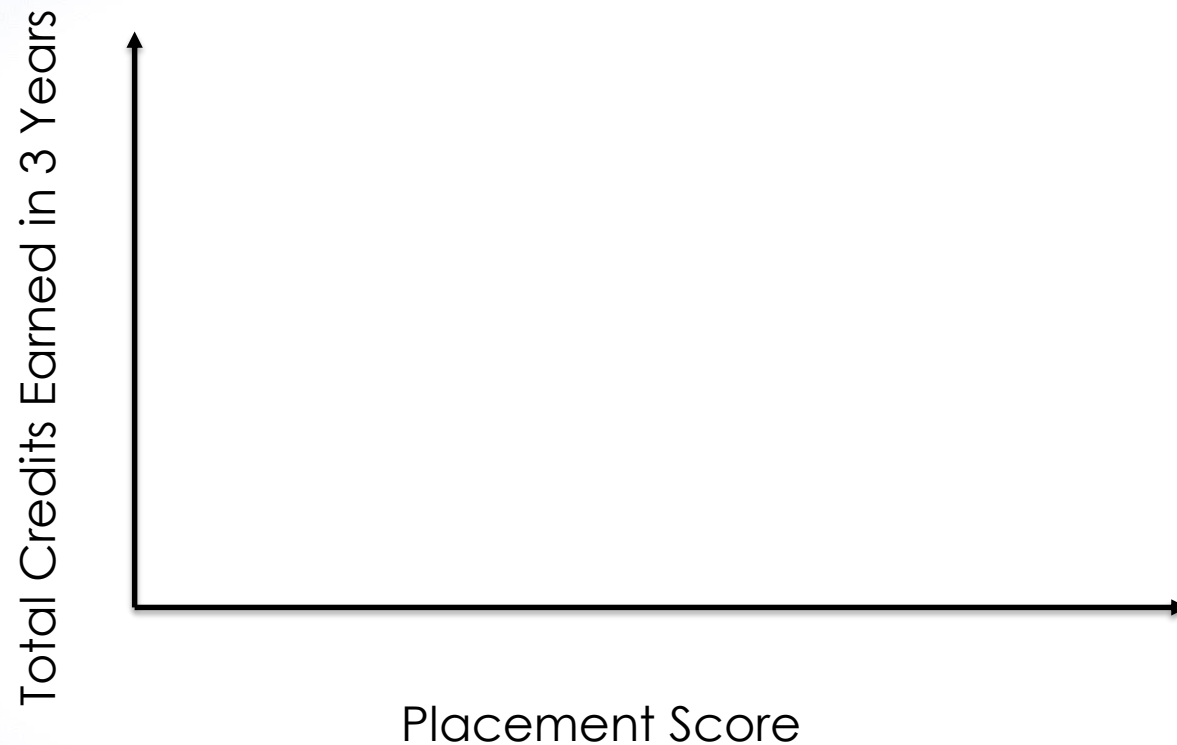
- Expressions
- Equations
- Graphing
- Systems of Equations
- Polynomials
- Factoring
- Rational Expressions and Equations
- Operations on Radicals
- Quadratic Equations

Liberal Arts Math Course

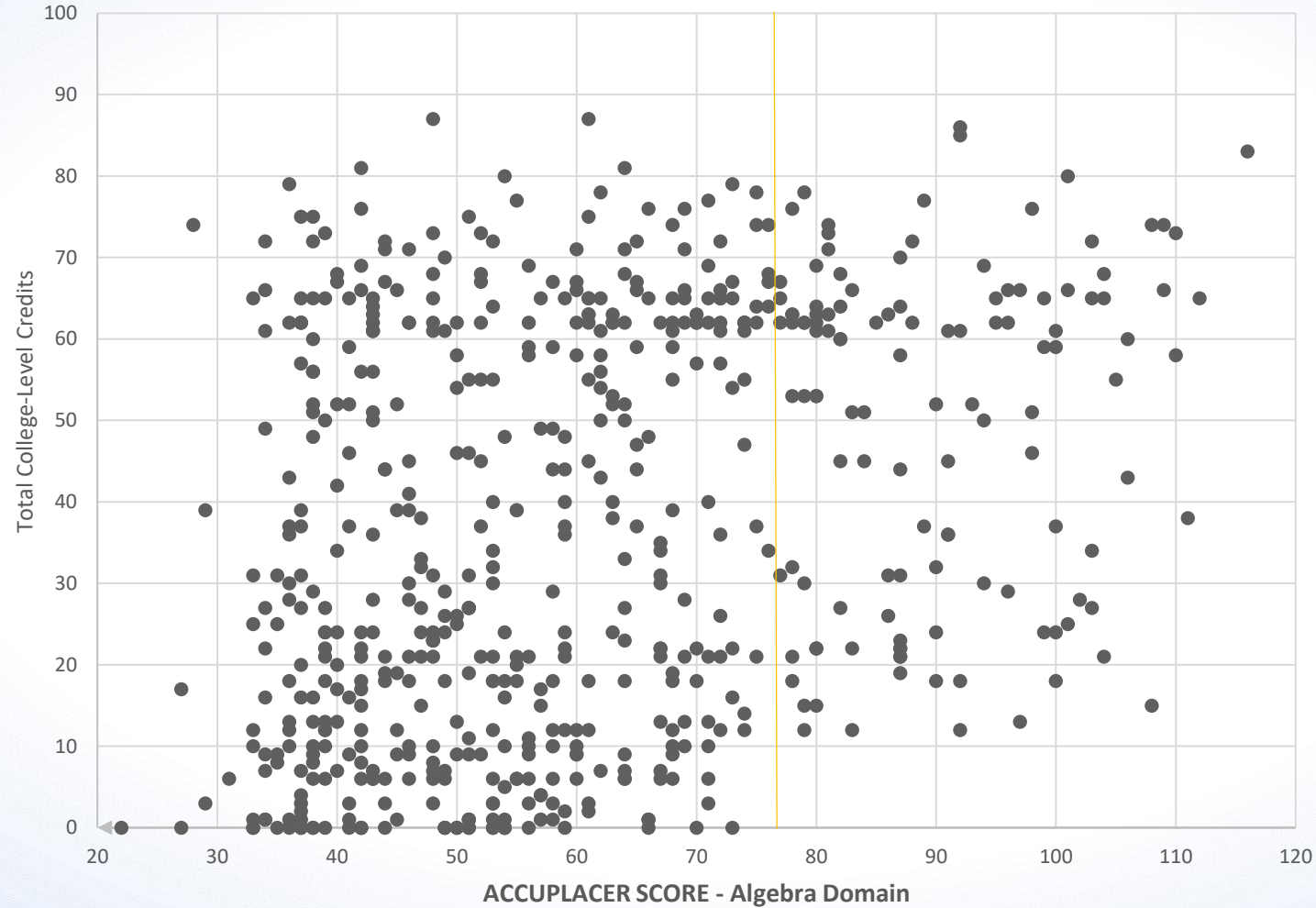
- Mathematical Logic
- Basic Set Theory
- Number Systems (Ancient, Bases other than 10)
- Geometry
- Probability
- Statistics
- Modular Arithmetic
- Rational Numbers



If you compare a student's placement score in Math to total credits earned in 3 years, what do you expect to see?



SCATTER PLOT OF TOTAL CREDITS EARNED IN THREE YEARS BASED ON PLACEMENT SCORE



NJ COMMUNITY COLLEGE STUDY OF STUDENTS TAKING A LIBERAL ARTS MATH COURSE

Group 1

*Needed Elementary Algebra
before College-Level math*

- 1st Semester Math Success Rate of all students who placed in Elementary Algebra – **28.7%**
- 1st Semester Math Success Rate of only students who scored within four points of the cutoff and placed in Elementary Algebra – **48.9%**

Group 2

*Placed Directly in College-Level
Math*

- 1st Semester Math Success Rate of all students who placed directly into a college level math course– **69.9%**
- 1st Semester Math Success Rate of only students who scored within four points above of the cutoff and placed directly in a college level math course– **70.0%**



CUNY RESEARCH - STATISTICS TRACK

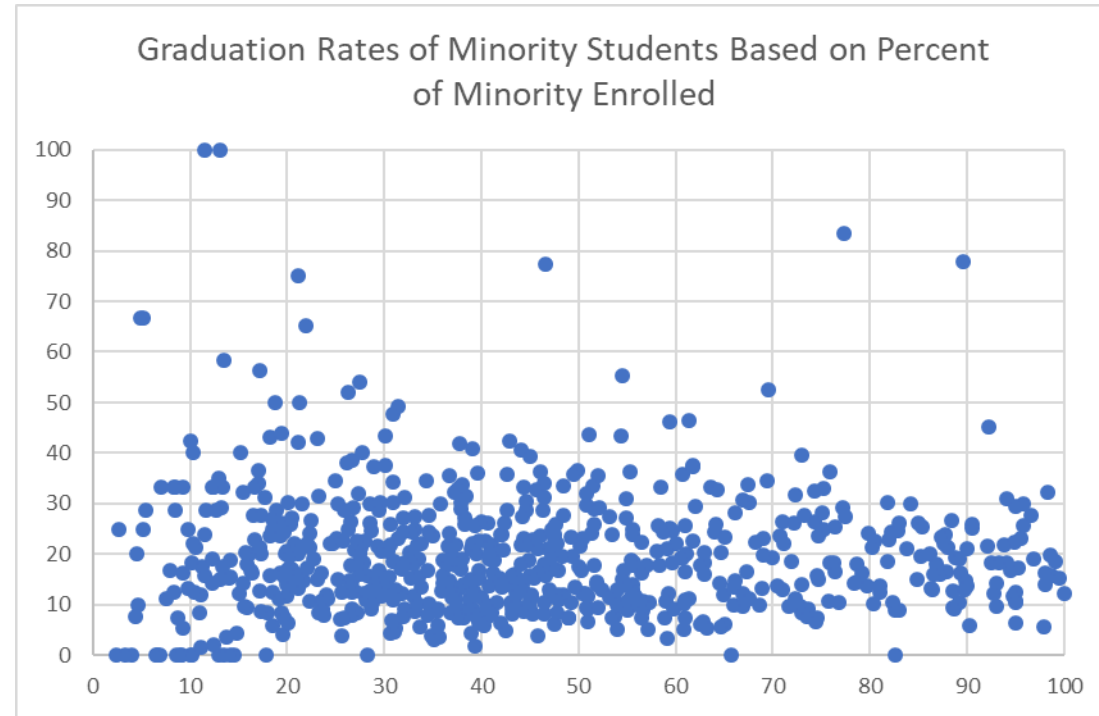
Students had a 16 percent greater chance of passing a college-level statistics course than they had of passing a developmental elementary algebra course (Logue, Wantabe-Rose, & Douglas, 2016).



**AT LEAST 3,459,400 STUDENTS ARE
STARTING IN OUR INSTITUTIONS AND
NOT EARNING ANY DEGREE WITHIN 6
YEARS!**

GRADUATION RATES OF MINORITY STUDENTS BASED ON PERCENT OF MINORITY ENROLLED

3 Year Graduation Rates



Percent of Minority Enrolled



COLLEGES WITH 50% OR HIGHER MINORITY GRADUATION RATES

- ❖ White Mountains Community College
- ❖ Nicolet Area Technical College
- ❖ Pamlico Community College
- ❖ Mayland Community College
- ❖ North Central Kansas Technical College
- ❖ Kirtland Community College
- ❖ University of Arkansas Community College-Batesville
- ❖ Warren County Community College
- ❖ Flint Hills Technical College
- ❖ Western Wyoming Community College
- ❖ Mesalands Community College
- ❖ Lancaster County Career and Technology Center
- ❖ Lakes Region Community College
- ❖ Tillamook Bay Community College



WHAT DO THE OUTLIERS HAVE IN COMMON?

Significant Remedial Education Reforms:

- ❖ Corequisite courses
- ❖ Using High School GPA
- ❖ Allowing Students to Bypass developmental courses
- ❖ Intrusive Academic Advising



STUDENT CHOICE

Students need to be informed of their options

- ❖ Opting out of remedial education
- ❖ Providing alternatives
- ❖ Focus on readiness for chosen major/career



CAPR: MULTIPLE MEASURES PLACEMENT USING DATA ANALYTICS

“Use of the alternative placement system reduced the gap in college-level math placement between men and women by 7.7 percentage points (from a gap of 8.6 percentage points to a gap of 0.9 percentage points), reduced the gap in college-level math enrollment by 5.0 percentage points (from a gap of 12.2 percentage points to a gap of 7.2 percentage points), and reduced the gap in college-level math enrollment and completion by 4.5 percentage points (from a gap of 4.9 percentage points to a gap of 0.4 percentage points).”

Source: Barnett, E. A., et al. (2018) Multiple measures: An implementation and early impacts report.
<https://postsecondaryreadiness.org/multiple-measures-placement-using-data-analytics/>



PPIC: REMEDIAL EDUCATION REFORMS AT CALIFORNIA'S COMMUNITY COLLEGES

- ❖ Students at early implementer colleges (AB 705) are two times more likely to start in a transfer-level course
- ❖ For African American students the average access rate to transfer-level courses was three times as high (18% to 56%).
- ❖ Less than 25% of underrepresented students complete a transfer-level math class within one year – The early implementer colleges had almost half complete a transfer-level course in one year.
- ❖ Narrowing of the achievement gap - throughput rate:
 - ❖ Gap between Latino and White: Statewide 16% - Early implementers 6%
 - ❖ Gap between African American and White: Statewide – 17% Early Implementers- 1%

Source: Rodriguez, O., Mejia, M. C., Johnson, H., (2018) Remedial Education Reforms at California's Community Colleges.
<https://www.ppic.org/publication/remedial-education-reforms-at-californias-community-colleges-early-evidence-on-placement-and-curricular-reforms/>



CAL STATE REMEDIAL EDUCATION REFORMS HELP THOUSANDS MORE STUDENTS PASS COLLEGE-LEVEL MATH CLASSES

BY [TERESA WATANABE](#) STAFF WRITER FOR LA TIMES FEB. 25, 2019

“I was nervous we would push students into coursework they were unprepared for, and I’m delightfully embarrassed to admit I’m wrong,” said David Zeigler, chairman of Sac State’s mathematics and statistics department.



WHAT CAN WE DO NOW

- 1) Ensure your developmental math courses are preparing students for the courses that are appropriate for their major.
- 2) Different courses require different placement – not one size fits all.



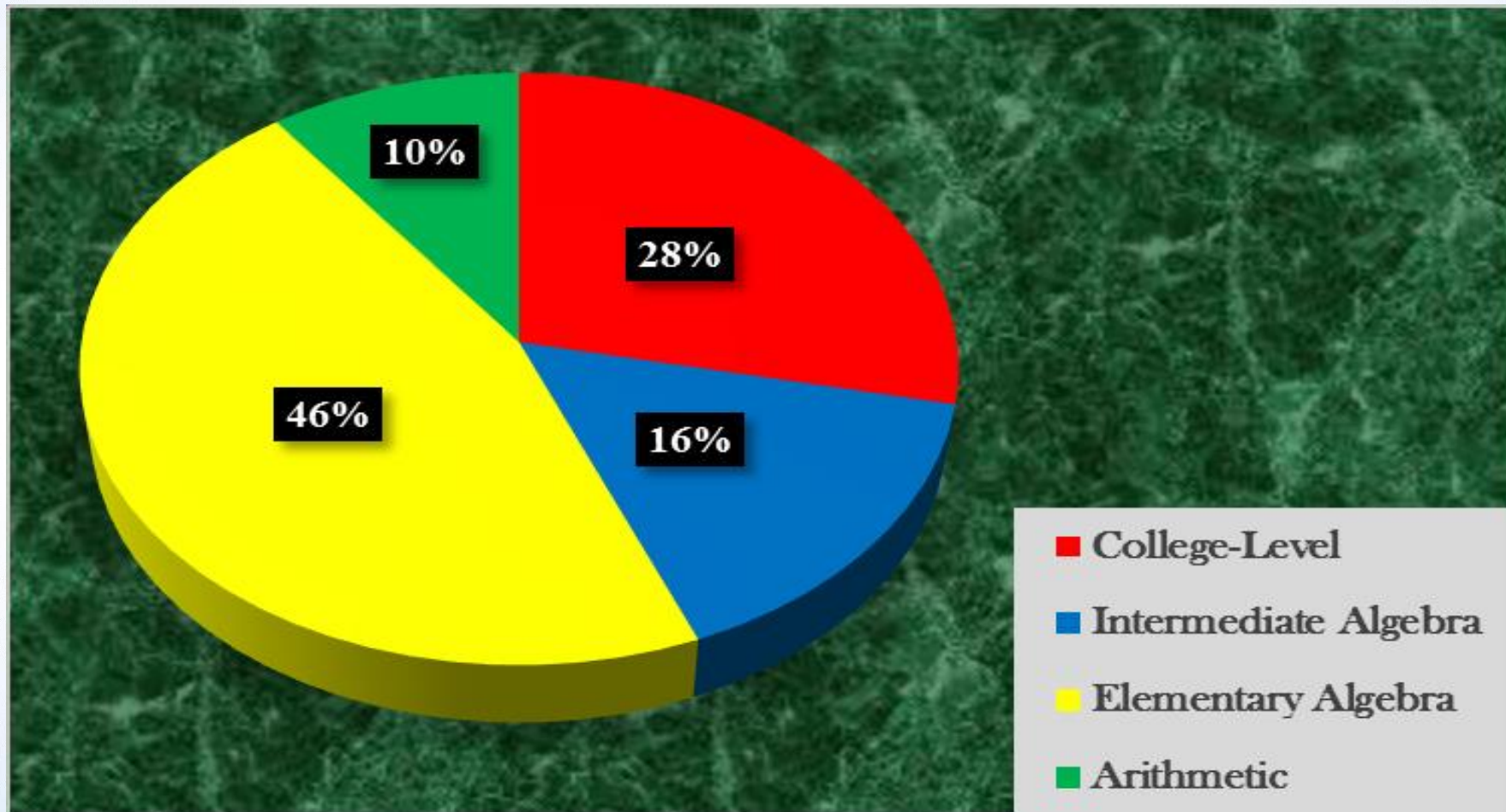
STRATEGIES FOR BETTER PLACEMENT

What we could be doing

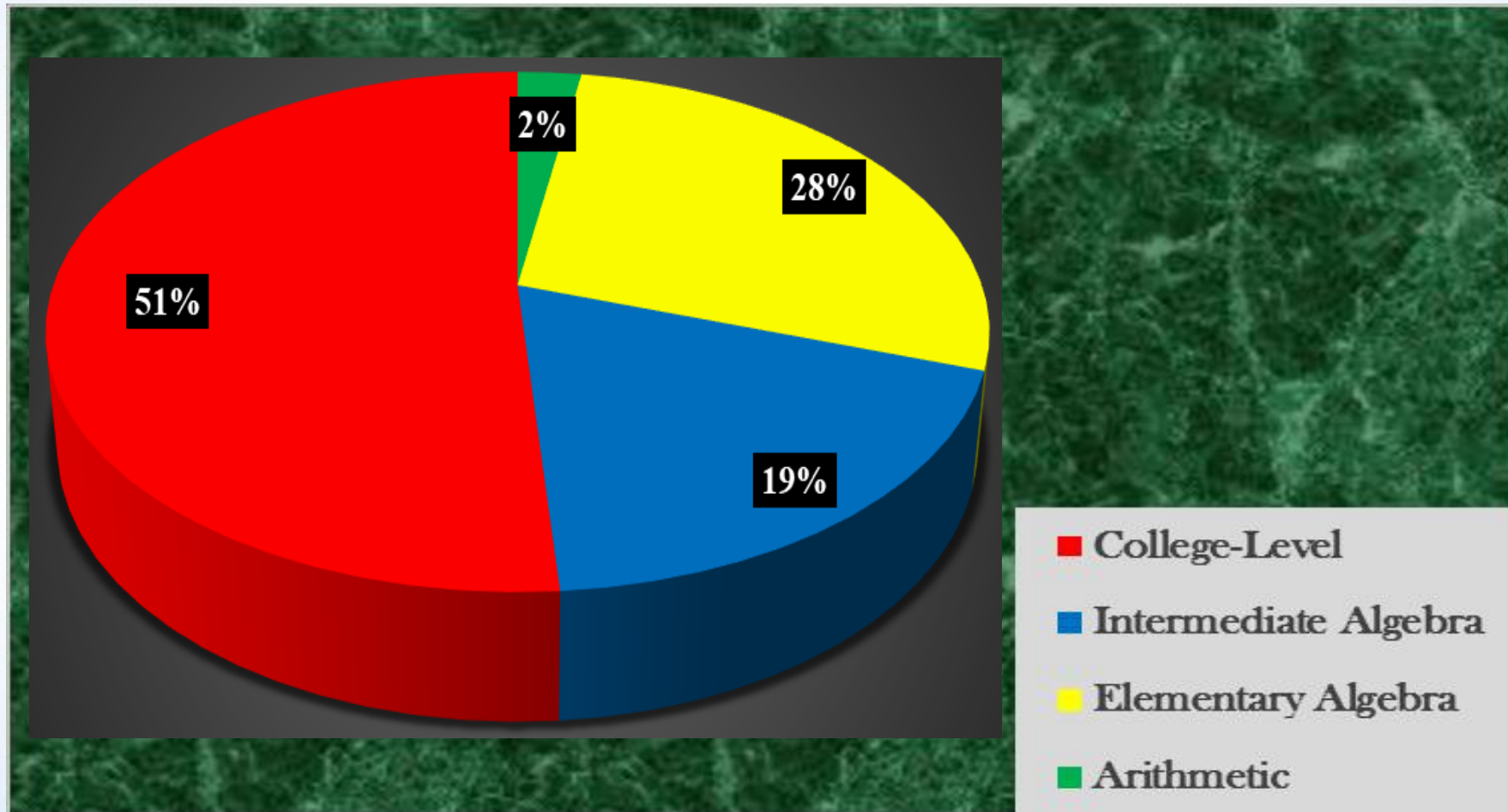
- Differentiated placement for different programs
- High School GPA
- Grade in most recent Math/English course
- Concurrent Enrollment Programs
- Diagnostic Tests
- Allow student choice
- Waivers
- Noncognitive assessments
- Honest and Intrusive Advising
- Traditional Placement Tests used properly
- *State level uniformity*
- *Coordination with four year institutions*



MATHEMATICS PLACEMENT (2010)



MATHEMATICS PLACEMENT (2010)



QUESTIONS?

