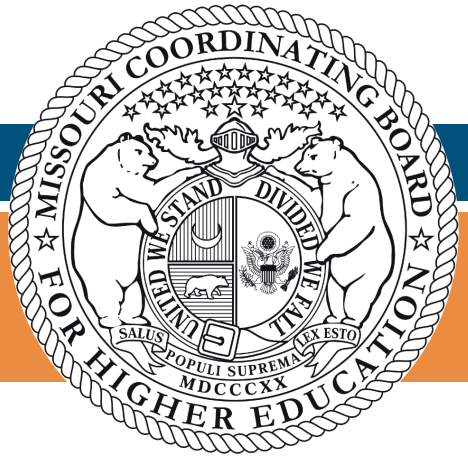
Meaningful Mathematics and Reformed Remediation

Math Pathways and Co-Requisite Supports in Missouri



Office of Academic Affairs

Background

Historical Context

- Senate Bill 389 (2008): “develop entry- and exit-level competencies from general education coursework” and align to Department of Elementary and Secondary Education
- Race to the Top (2009), Common Core State Standards, and Smarter Balanced Assessment Consortia Completion Academy (2010)
- House Bill 1042 (2012): “develop best practices in remediation” and “identify and reduce” ineffective methods—Institutional Survey

Historical Context—Senate Bill 997 (2016)

- Student Web Portal (transfer, financial aid, academic programs)
- Dual Credit Certification
- 15-to-Finish
- Guided Pathways
- Higher Education Core Curriculum (CORE 42)

Math Pathways: Background

- HB 1042: “replicate best practices in remedial education”
- Align gateway math courses to programs of study
- Meet the mathematics requirements for CORE 42
- Work with DESE to align secondary and postsecondary mathematics courses

Recommendations from Survey

- Develop consistent definitions of developmental education
- Develop statewide policy that includes multiple measures
- Pilot and scale successful initiatives, and include funding
- Plan for professional development
- Develop annual reporting instrument to collect data

Math Pathways

Math Pathways Taskforce

- Representatives from:
  - All 27 public postsecondary institutions
  - 3 independent institutions
  - The Missouri Department of Elementary and Secondary Education (DESE)
- Since 2014, there have been 45 members of the Taskforce

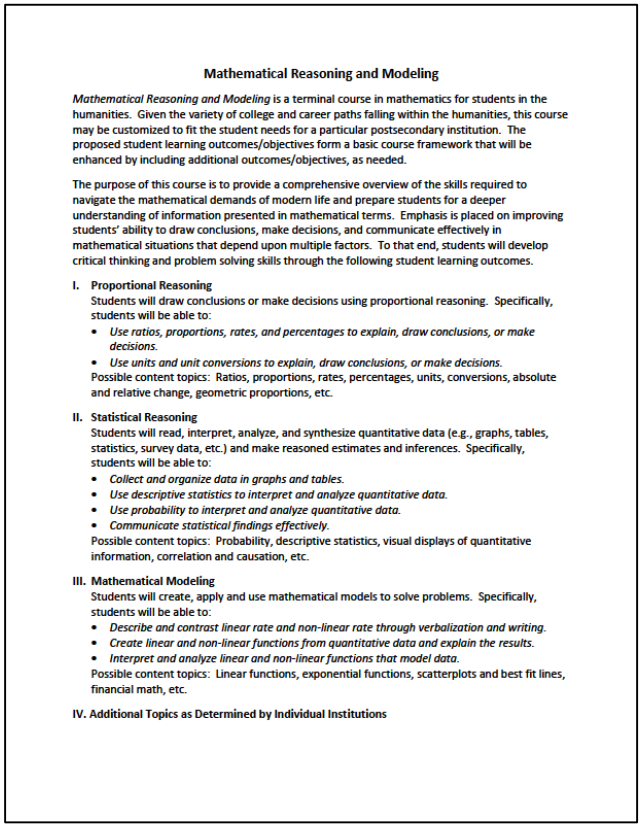
Math Pathways Taskforce

- Met over 20 times, for well over 100 hours of in-person time
- Faculty traveled for a combined 7,000 miles per meeting

- Countless hours spent working on pathways subcommittees and developing Student Learning Outcomes

Student Learning Outcomes

- 4 courses for 3 distinct pathways
  - Precalculus Algebra and Precalculus
  - Statistical Reasoning
  - Mathematical Reasoning & Modeling
- Faculty led and created to ensure transfer



Mathematical Reasoning and Modeling

Mathematical Reasoning and Modeling is a terminal course in mathematics for students in the humanities. Given the variety of college and career paths falling within the humanities, this course may be customized to fit the student needs for a particular postsecondary institution. The proposed student learning outcomes/objectives form a basic course framework that will be enhanced by including additional outcomes/objectives, as needed.

The purpose of this course is to provide a comprehensive overview of the skills required to navigate the mathematical demands of modern life and prepare students for a deeper understanding of information presented in mathematical terms. Emphasis is placed on improving students' ability to draw conclusions, make decisions, and communicate effectively in mathematical situations that depend upon multiple factors. To that end, students will develop critical thinking and problem solving skills through the following student learning outcomes.

I. Proportional Reasoning
Students will draw conclusions or make decisions using proportional reasoning. Specifically, students will be able to:
- *Use ratios, proportions, rates, and percentages to explain, draw conclusions, or make decisions.*
- *Use units and unit conversions to explain, draw conclusions, or make decisions.*

Possible content topics: Ratios, proportions, rates, percentages, units, conversions, absolute and relative change, geometric proportions, etc.

II. Statistical Reasoning
Students will read, interpret, analyze, and synthesize quantitative data (e.g., graphs, tables, statistics, survey data, etc.) and make reasoned estimates and inferences. Specifically, students will be able to:
- *Collect and organize data in graphs and tables.*
- *Use descriptive statistics to interpret and analyze quantitative data.*
- *Use probability to interpret and analyze quantitative data.*
- *Communicate statistical findings effectively.*

Possible content topics: Probability, descriptive statistics, visual displays of quantitative information, correlation and causation, etc.

III. Mathematical Modeling
Students will create, apply and use mathematical models to solve problems. Specifically, students will be able to:
- *Describe and contrast linear rate and non-linear rate through verbalization and writing.*
- *Create linear and non-linear functions from quantitative data and explain the results.*
- *Interpret and analyze linear and non-linear functions that model data.*

Possible content topics: Linear functions, exponential functions, scatterplots and best fit lines, financial math, etc.

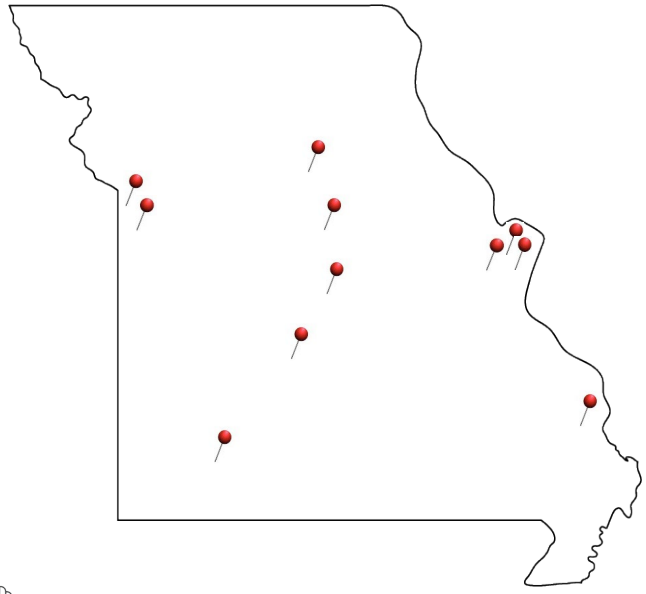
IV. Additional Topics as Determined by Individual Institutions

Student Learning Outcomes

- Involved over two years of discussion, evaluation, modification, and compromise
- Received input from math faculty and from experts in other disciplines
- Developed process by which courses can be reviewed and deemed equivalent
- Used to developed corequisite supports for students who need additional help

Spreading the Word

- Since September 2017, MDHE staff traveled over **2,600 miles** to facilitate regional meetings



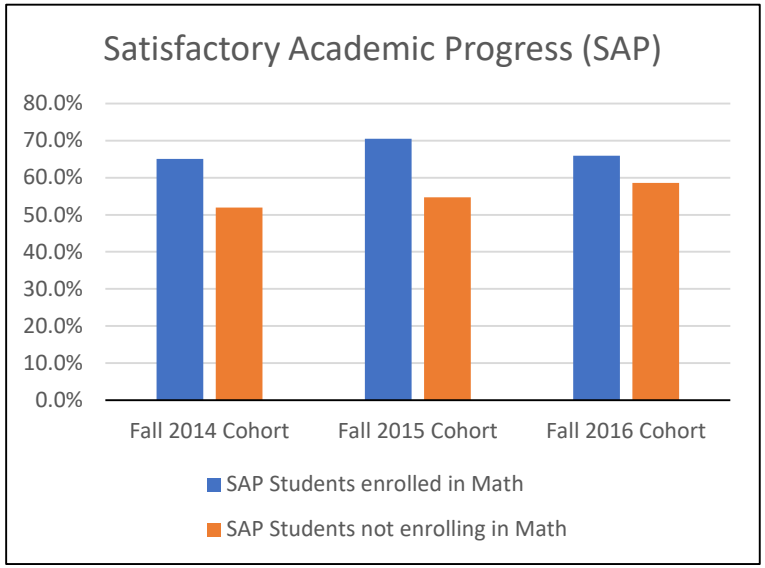
- Reached around **700 unique individuals**
  - **Admissions directors**
  - **Advisors**
  - **Deans**
  - **Department chairs**
  - **Dual credit instructors**
  - **Faculty**
  - **Guidance counselors**
  - **High school principals**
  - **Institutional research**
  - **Registrars**
  - **State representatives**
  - **Transfer and articulation officers**
  - **Vice provosts**

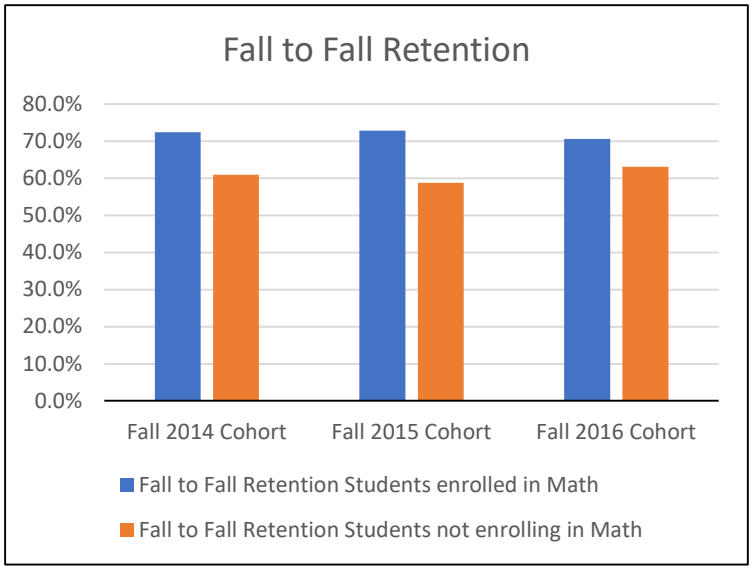
Math Course Enrollments

What we know about enrollments:

- 78.6% of students who take a gateway math course do so in their freshman or sophomore year
- Around 25% of first time, full-time, degree-seeking students take math in their first fall semester
    - Students who take a math course in their first semester have better SAP and retain at a higher level than those who do not

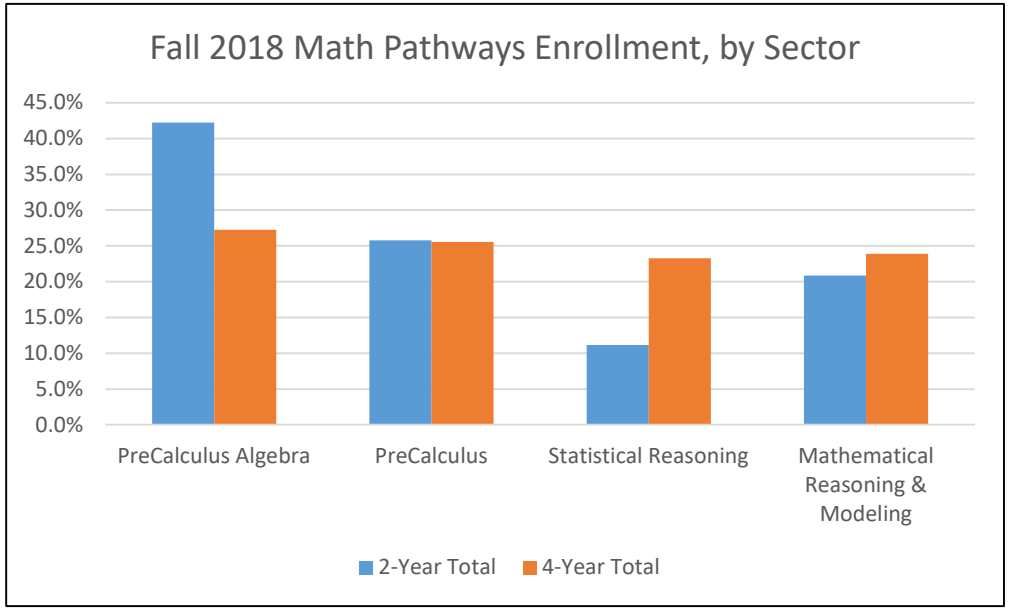
Student Success





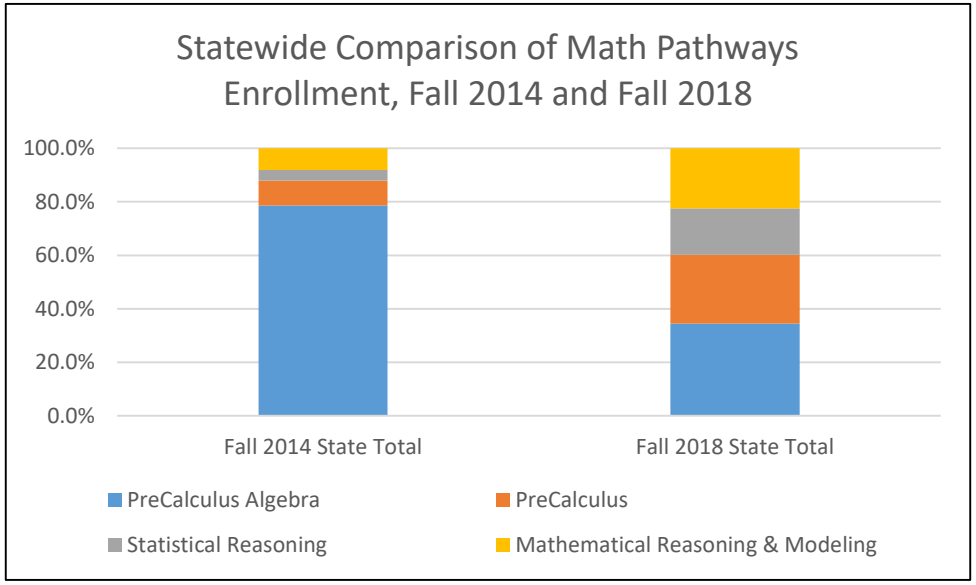
Unsure at this point if math in 1st semester helps student succeed and retain, or students who are successful take math in 1st semester

Enrollment, Fall 2018



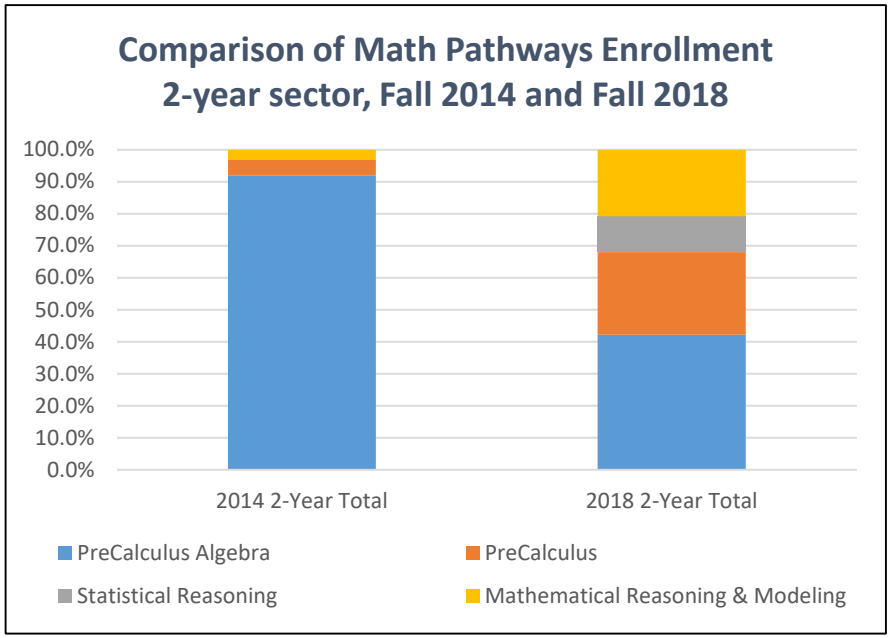
Fairly even distribution of students at 4-year institutions, 68% enrolled in PreCalculus Algebra or PreCalculus at 2-year institutions

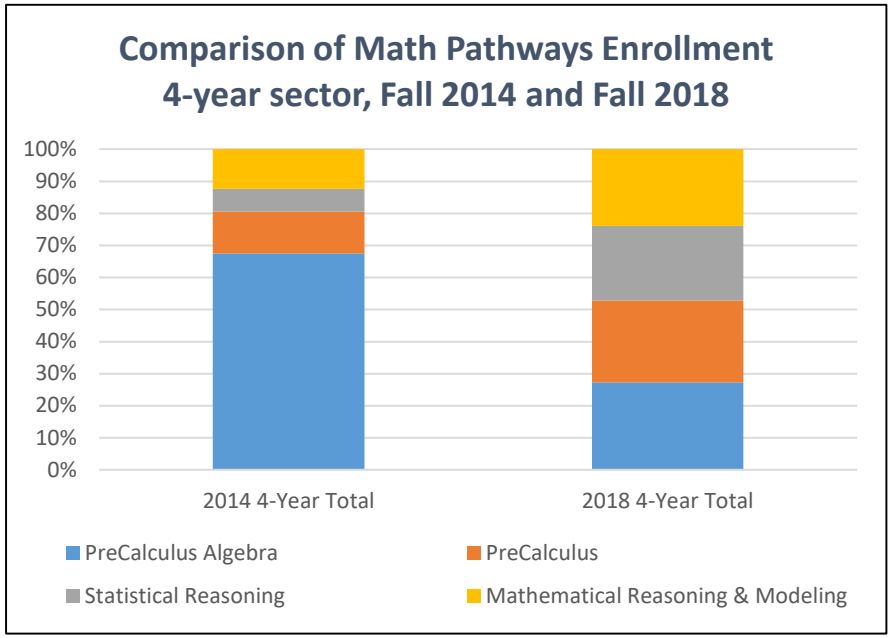
Enrollment Shifts



Visible shift in statewide enrollment patterns from Fall 2014 to Fall 2018

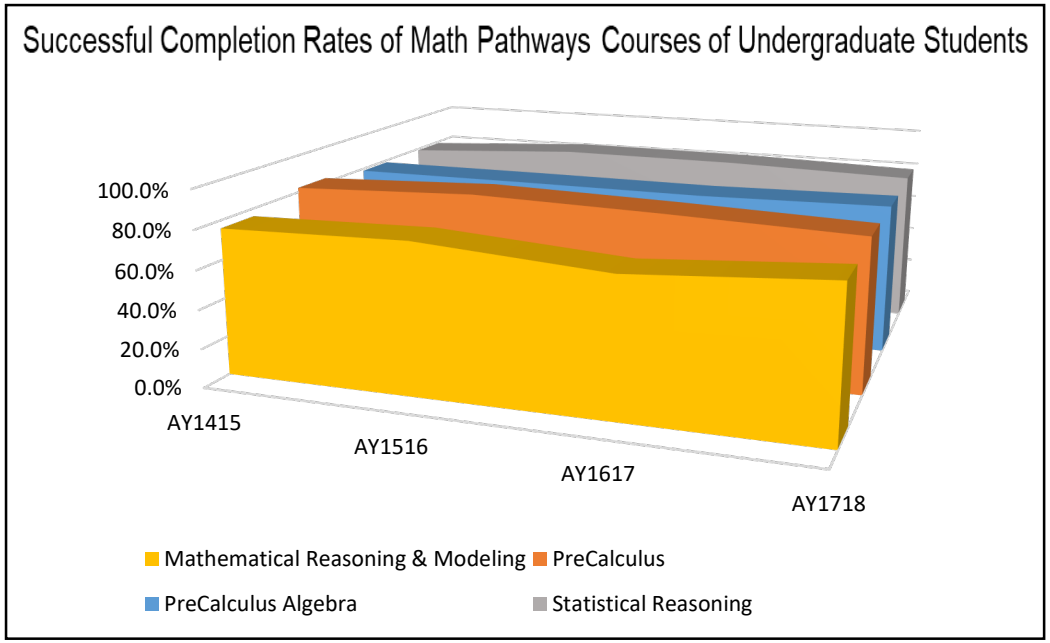
Enrollment Shifts, by sector





4-year sector more evenly distributed, but 2-year sector had 900% increase in students enrolling in non-PreCalculus courses

Early Results



Demonstration of early successes, as preliminary data indicate an average completion rate of 78.7 percent

Remediation Reform

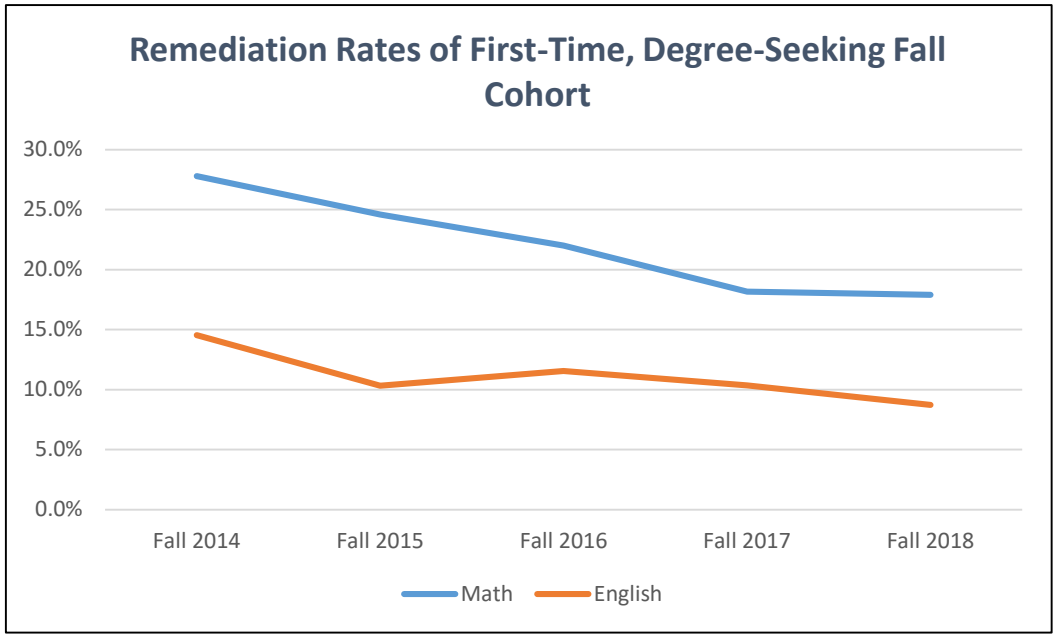
High School Graduates Report

	Fall 2014	Fall 2015	Fall 2016	Fall 2017	Fall 2018	% change, 2014-2018
Mathematics	26.2%	23.8%	21.5%	17.6%	17.5%	-33.17%
English	12.3%	10.0%	11.4%	10.1%	8.2%	-33.58%
Reading	7.6%	6.1%	6.6%	6.0%	5.2%	-31.45%
Total	30.8%	28.2%	26.8%	22.8%	21.5%	-30.36%

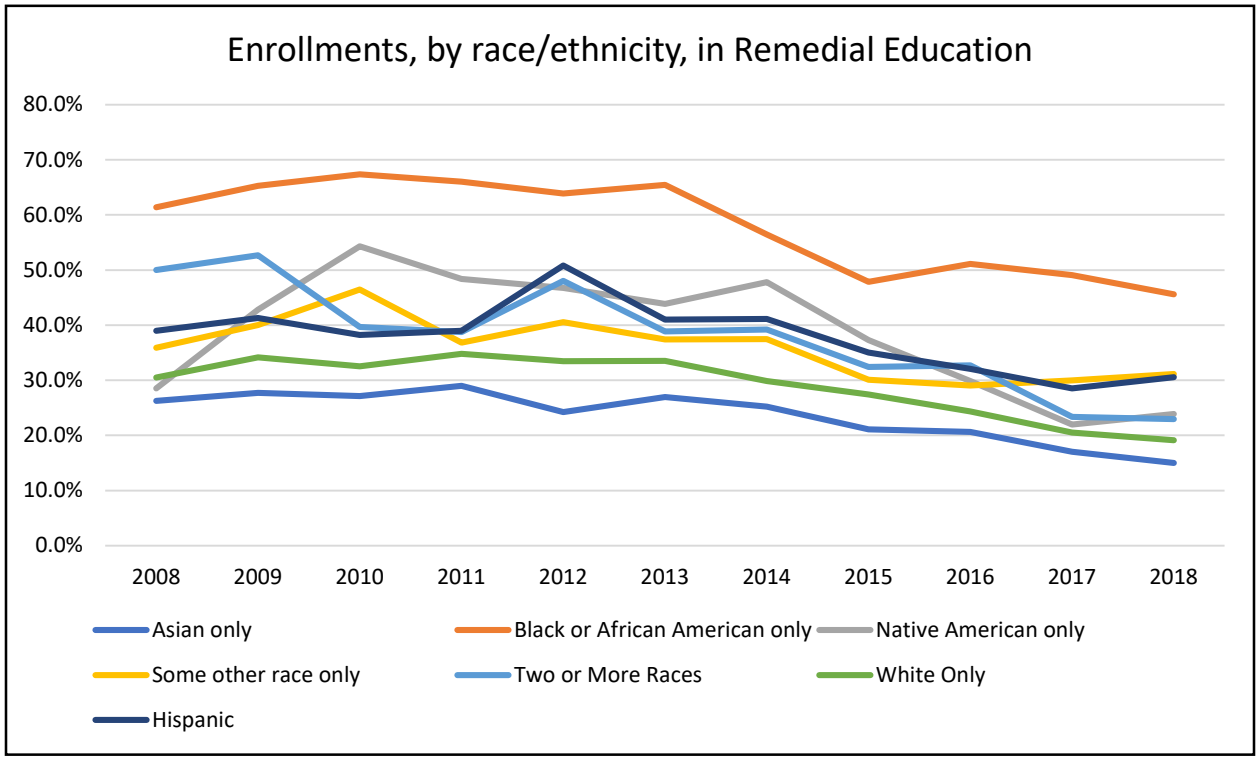
- Since 2014, the overall remediation rate for **recent high school graduates** has decreased by 30.4 percent.
- In mathematics, the rate has decreased over this five year period by 33.2 percent.
- The remediation rate for African-American students continues to steadily decrease, with 30 percent decrease in remediation in mathematics since 2014.

All First-Time, Degree-Seeking Students

	Fall 2014	Fall 2015	Fall 2016	Fall 2017	Fall 2018	% change, 2014-2018
Mathematics	27.8%	24.6%	22.0%	18.2%	17.9%	-35.63%
English	14.5%	10.3%	11.6%	10.4%	8.7%	-39.95%

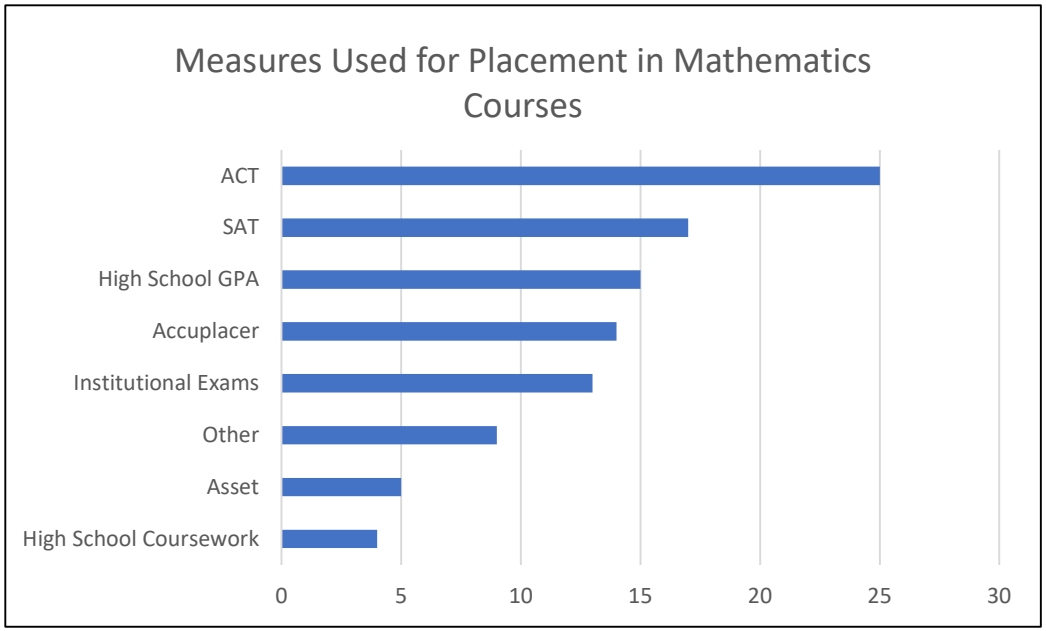


Remediation Rates by Race/Ethnicity



Disparities persist in remediation rates among race and ethnicity

Measures for Placement

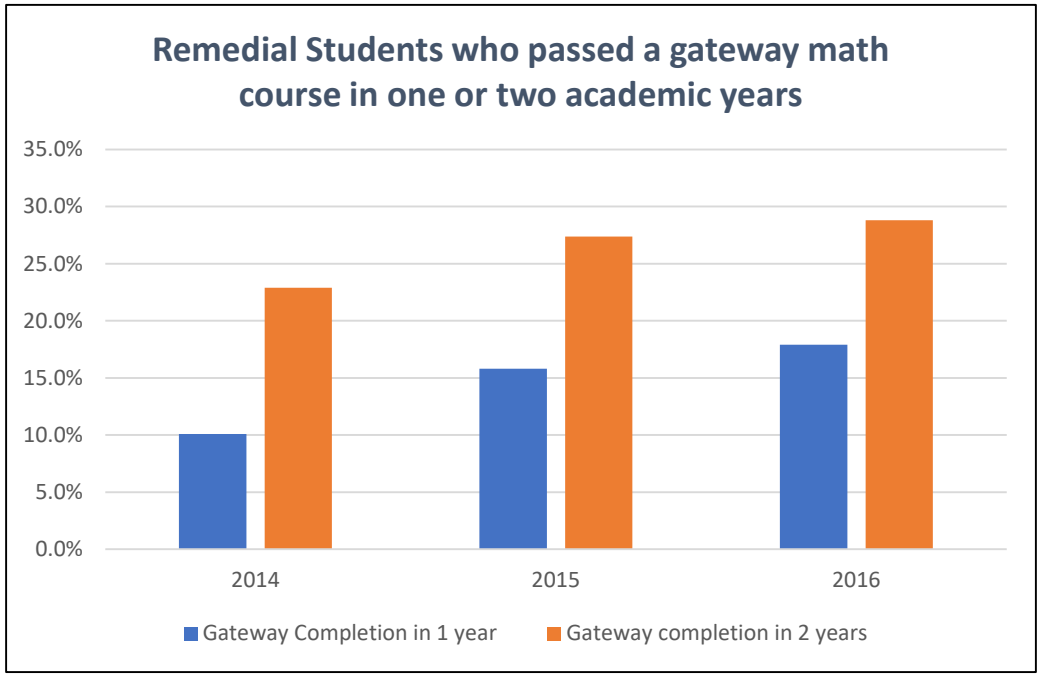


All 25 institutions which offer remediation use multiple measures for placement

Measures for Placement

- The number of institutions using multiple measures is up 19 percent from the previous year.
- Of those measures, 16 institutions are using more holistic measures, such as high school GPA, high school coursework, or both, an increase of 45 percent from the previous year.

Gateway Course Success



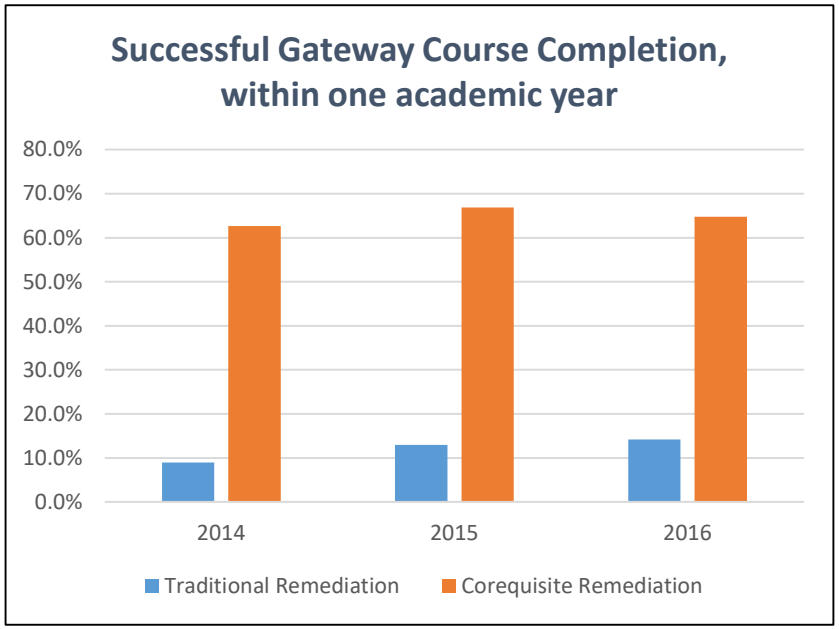
Percentage of remedial students completing a gateway math course is increasing

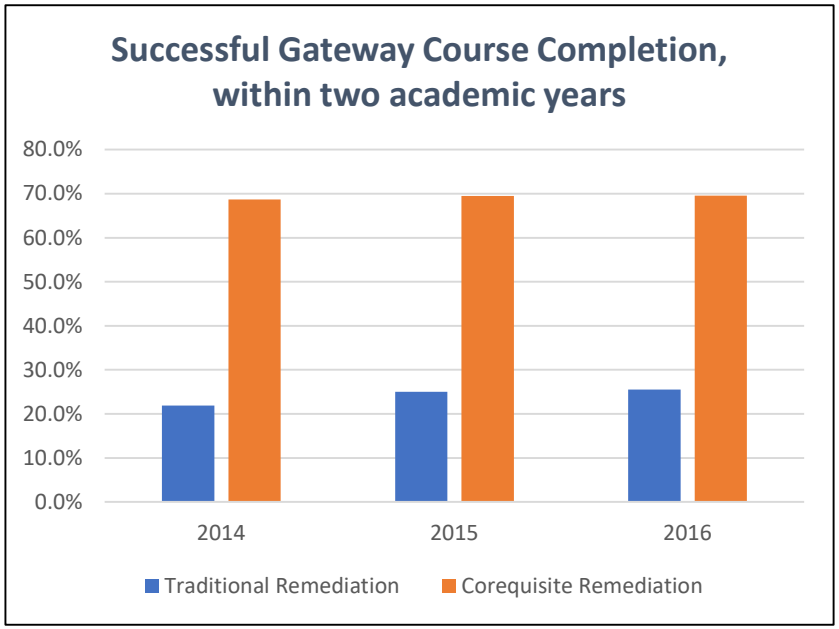
Success, by remediation type

	Coreq		Traditional	
	Gateway Completion in 1 year	Gateway completion in 2 years	Gateway Completion in 1 year	Gateway completion in 2 years
2014	62.7%	68.7%	8.9%	21.9%
2015	66.9%	69.5%	13.0%	25.0%
2016	64.8%	69.6%	14.2%	25.6%

- Success rates for students in both types of remediation are increasing
- Students who enroll in corequisite courses succeed in gateway courses at a much higher level

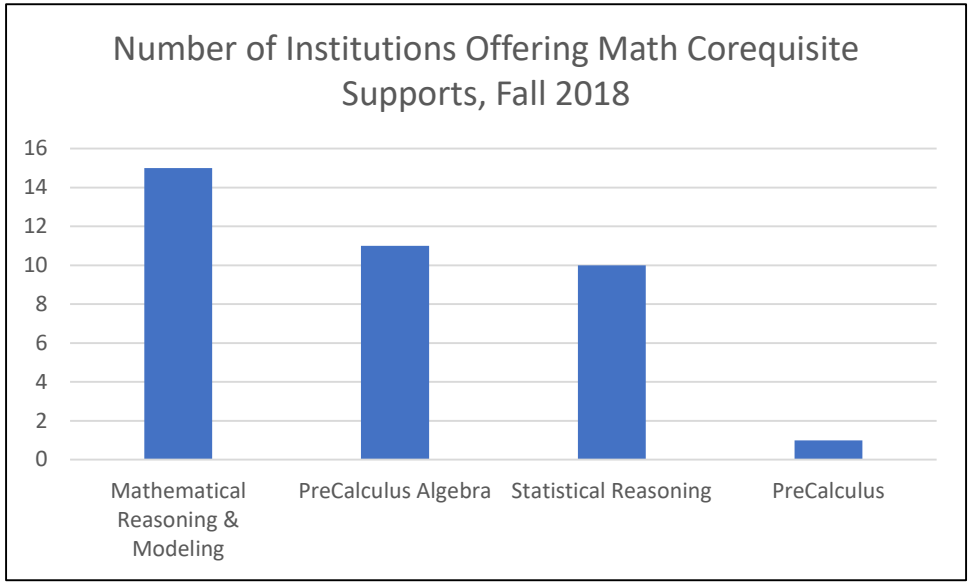
Success, by remediation type





Not Enough data at this point to disaggregate this by demographic detail in any meaningful way

Corequisite Supports



20 institutions reported offering at least one corequisite support, with 13 offering more than one

Corequisite Supports

What we know about corequisite supports:

- Lots of variation in how corequisite supports are offered
- Across the 20 institutions, 39 corequisite supports are offered
- 29 are stand-alone courses
- 13 have the same instructor
- 17 are credit-bearing

Overview of Data

- Data are from the Enhanced Missouri Student Achievement Study (EMSAS) files
- New student course-level data collection file for AY1415, AY1516, AY1617, AY1718
  - Allows us to identify course information, including type (remedial, college-level, dual credit) and grade
  - Able to match course data to EMSAS enrollment, term, and completions files

Limitations to Data

- Lists of gateway and math pathways courses came from institutions
  - Information for remedial coursework came from flags within the data
- Unlike EMSAS, no process for data validation
  - A lot of time spent cleaning and preparing the data
  - A lot of intensive manual work
  - “fuzzy” matching
  - Not as much deep analysis as we would like
- Not enough data for graduate outcomes

CORE 42

Core Curriculum Transfer Act (SB 997)

- Recommended lower division core curriculum of 42 semester credit hours
- Common course numbering equivalency matrix
- All IHEs adopt; include matrix in catalog
- 42-hour block transfers to all public IHEs
  - No additional general education courses
- Students receive credit for completed courses
  - Fulfill *major* and *degree* requirements
- Appeals process
- Evaluation of transfer practices

Conceptual Framework

- Basic framework identified in statute
  - Competencies: Valuing, Managing Information, Communicating, Higher Order Thinking
- Knowledge Areas:
  - Social and Behavioral Sciences
  - Mathematics
  - Written/Oral Communication
  - Natural Sciences
  - Humanities and Fine Arts
- Competencies achieved through completion of whole curriculum

Policy Implications

- Math Pathways
- Corequisite Remediation
- Dual Credit
- Guided Pathways/Meta-majors

Guided Pathways

Looking ahead

Guided Pathways

Performance Funding

- 12 public institutions missed performance funding metrics around retention
- General Assembly appropriated funds to assist
- Goal to reduce barriers to completion
- 12 institutions are first cohort to receive resource assistance for planning and developing guided pathways

Students “lost” over past 5 years

Institution	Full-time students not retained
Metropolitan Community College	5,512
Saint Louis Community College	5,472
St Charles Community College	2,025
Moberly Area Community College	1,940
Northwest Missouri State University	1,907
Jefferson College	1,846
State Fair Community College	1,830
Missouri State University-West Plains	1,234
Mineral Area College	1,183
East Central College	1,172
Lincoln University	1,039
Harris-Stowe State University	663

Credit hours “lost”

Institution	Credit hours
Metropolitan Community College	82,687
Saint Louis Community College	82,086
St Charles Community College	30,376
Moberly Area Community College	29,093
Northwest Missouri State University	28,612
Jefferson College	27,683
State Fair Community College	27,453
Missouri State University-West Plains	18,507
Mineral Area College	17,745
East Central College	17,576
Lincoln University	15,579
Harris-Stowe State University	9,952

Tuition dollars "lost"

Institution	Full-time students not retained	Total tuition dollars "lost"
Metropolitan Community College	5,512	$ 16,348,592
Saint Louis Community College	5,472	$ 17,400,960
St Charles Community College	2,025	$ 6,439,500
Moberly Area Community College	1,940	$ 6,180,840
Northwest Missouri State University	1,907	$ 17,227,075
Jefferson College	1,846	$ 5,807,516
State Fair Community College	1,830	$ 6,181,740
Missouri State University-West Plains	1,234	$ 4,939,702
Mineral Area College	1,183	$ 3,753,422
East Central College	1,172	$ 3,551,160
Lincoln University	1,039	$ 7,550,621
Harris-Stowe State University	663	$ 3,936,629

Sample CORE 42

Business and Communications Majors

Required:

MOTR ENGL 100	Composition I

Suggested:

MOTR ENGL 200	Composition II
MOTR COMM 100	Fundamental of Public Speaking
MOTR ECON 101	Introduction to Macroeconomics
MOTR ECON 102	Introduction to Microeconomics

Business Track

MOTR MATH 130	PreCalculus Algebra (Business)
MOTR LANG 10X	Foreign Language

Communication Track

MOTR MATH 110	Statistical Reasoning (Communications)
MOTR PERF 106NF	Creative Writing – Non-Fiction

Guided Pathways

SHEEO Communities of Practice in Seattle

- Came together to think through ways to improve guided pathways
- Identify “catapult” courses, comprising critical mass enrollments
- Use data to identify student course-taking patterns
- Evaluate course catalogs and IHE degree maps to come to statewide consensus

Next Steps

- Develop SLOs for CORE 42
- Establish regional symposia with performance funding cohort (similar to math pathways model)
- Statewide scale-up of guided pathways

Data for this presentation come from the *High School Graduates Report* and the *Report on the Condition of College and Career Readiness*

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