Math Pathways & CORE 42

Keys to Student Success Summit
April 12, 2019

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Context

Background

- Purpose is to improve completion rates
- Attainment Goal: 60% high-quality credentials by 2025
  - Remove barriers
- Results of legislation, around work we were already doing
- Mantra: Do what is in the best interest of students

Math Pathways

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

What are Math Pathways?

- Differentiated gateway math courses
  - Instruction in skills needed for success in program of study
- Gateway math courses
  - Articulated for each program
  - Outlined in an academic map and included in degree plans
- Fully articulated; not merely for general education
- Co-requisite; complete in one academic year.
- Support to make well-informed decisions
  - Advising for correct placement

Math Pathways Courses

- ***Precalculus Algebra***
- ***Precalculus (Algebra & Trigonometry)***
- ***Statistical Reasoning***
- ***Mathematical Reasoning and Modeling***

https://dhe.mo.gov/AAU-Initiatives-MathPathways.php

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

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.

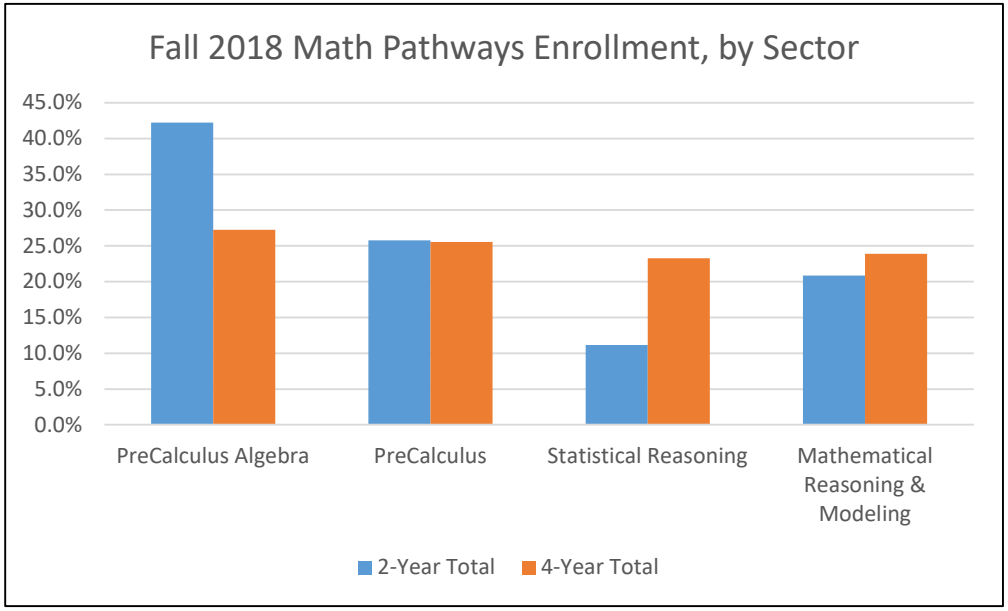
IV. Additional Topics as Determined by Individual Institutions

Math Course Enrollments

What we know about enrollments:

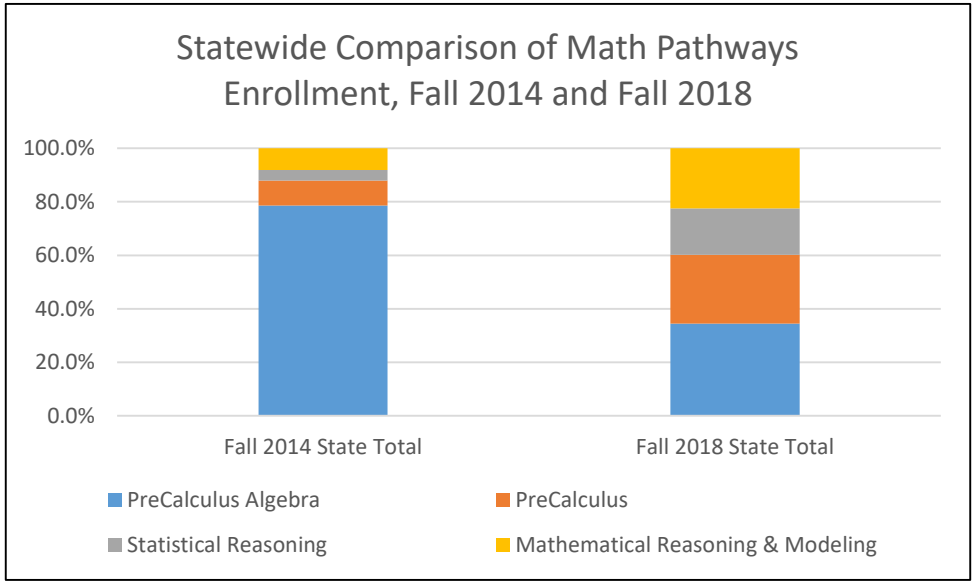
- 78.6% of students who take a gateway math course do so in their freshman or sophomore year
- Around 25% of first time, full-time, degree-seeking students take math in their first fall semester

Enrollment, Fall 2018



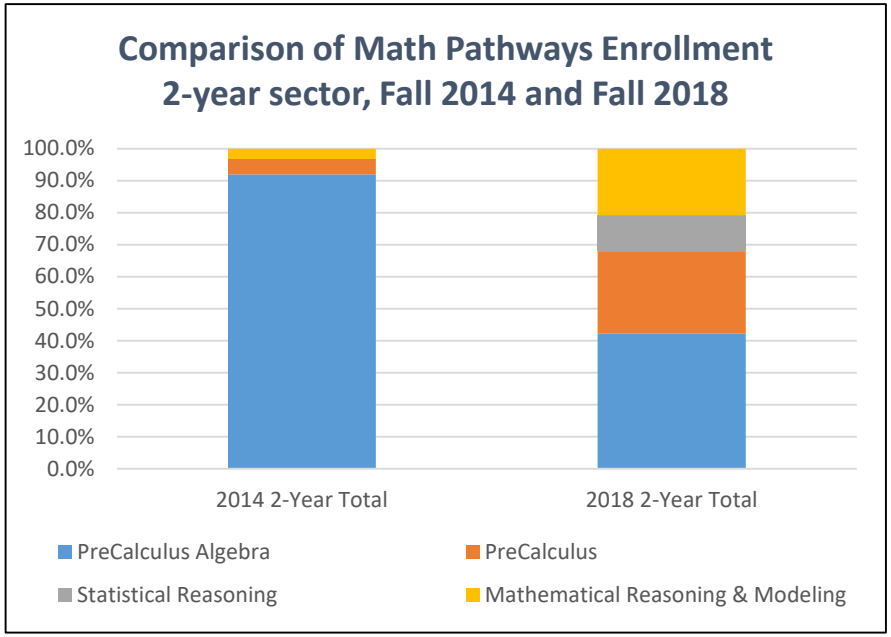
Fairly even distribution of students at 4-year institutions, 68% enrolled in PreCalculus Algebra or PreCalculus at 2-year institutions

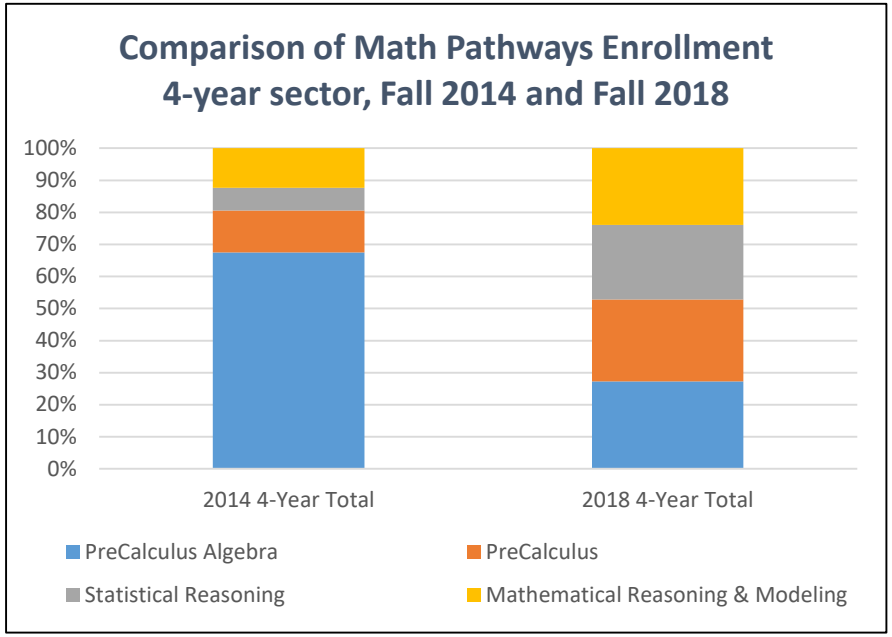
Enrollment Shifts



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

Enrollment Shifts, by sector

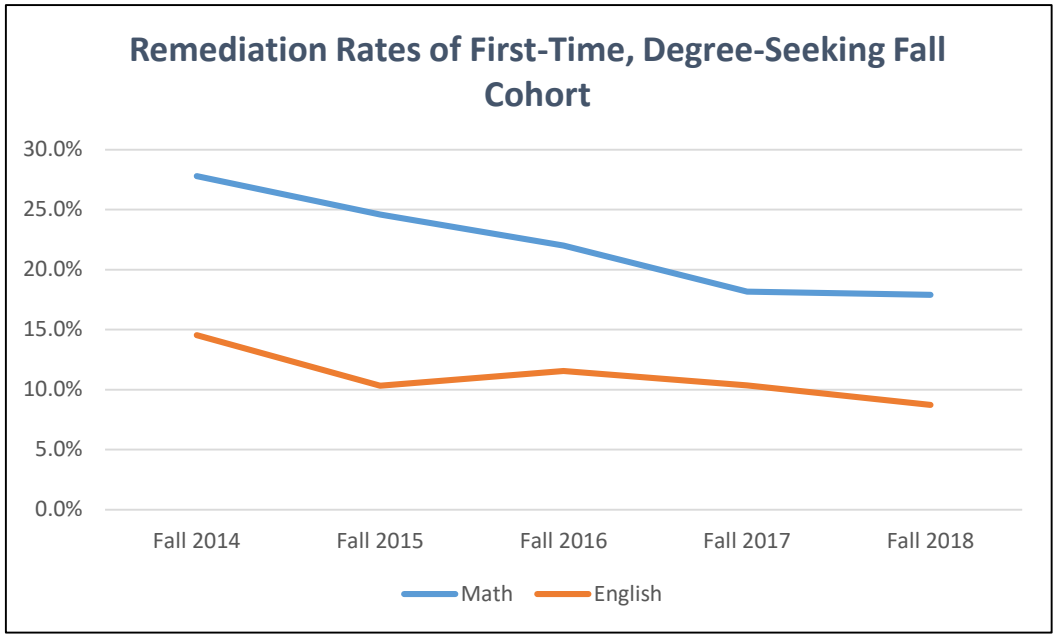




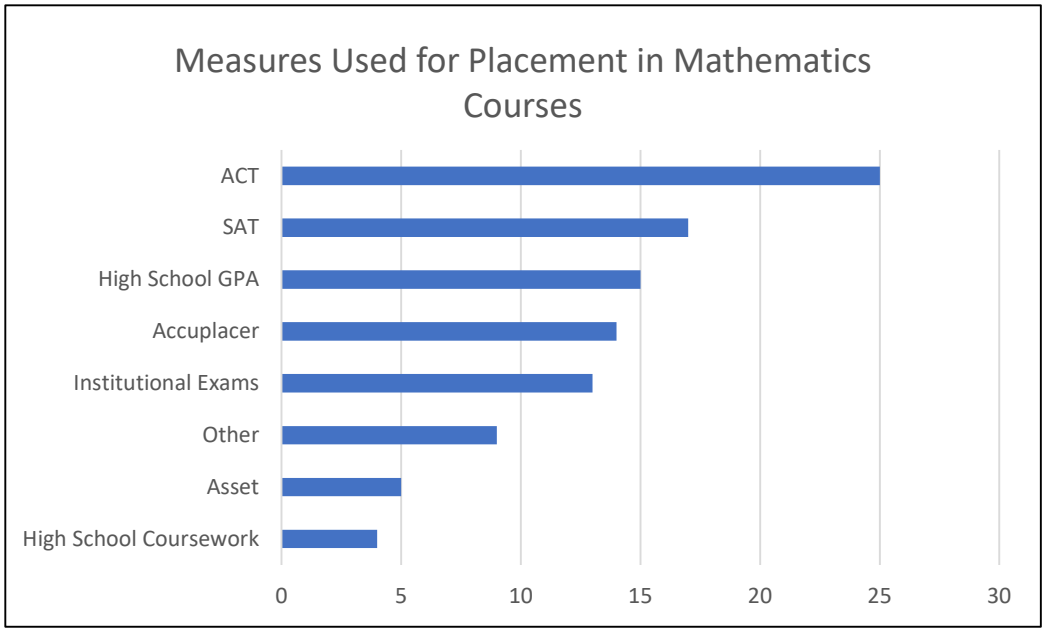
4-year sector more evenly distributed, but 2-year sector had 900% increase in students enrolling in non-PreCalculus courses

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%

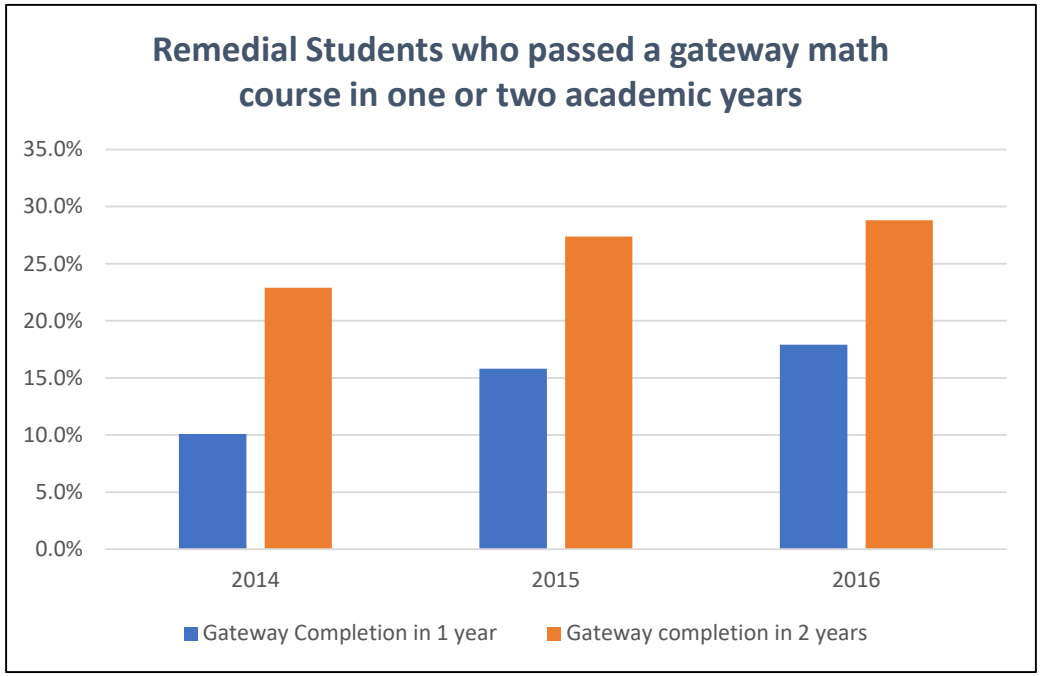


Measures for Placement



All 25 institutions which offer remediation use multiple measures for placement

Gateway Course Success



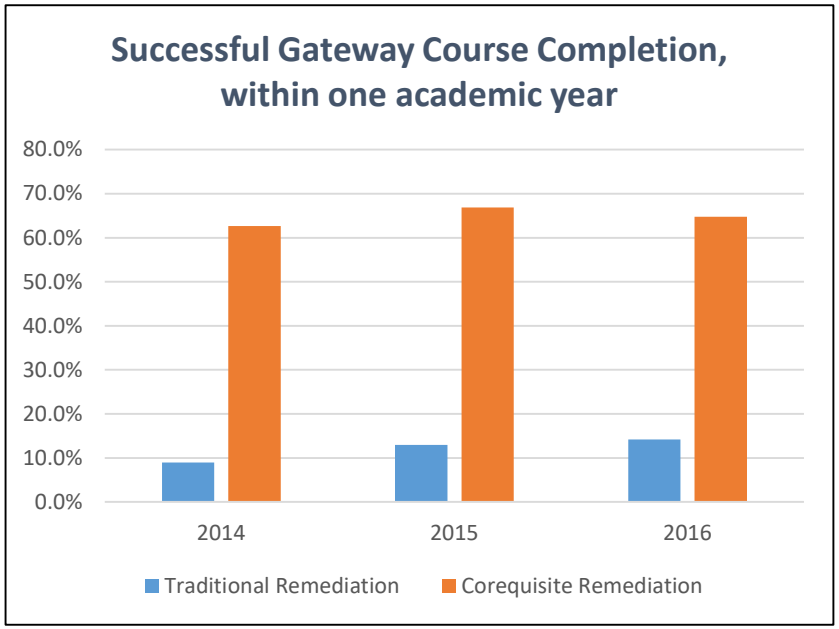
Percentage of remedial students completing a gateway math course is increasing

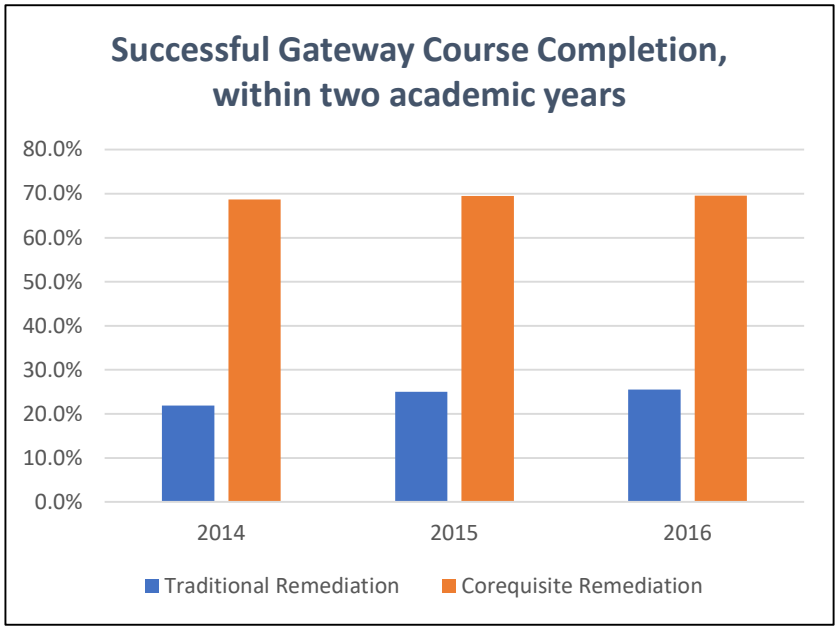
Success, by remediation type

	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





CORE 42

Transfer in Missouri

- Students transferring to 4 year institution <60 credits take one or two more courses than native
- Students transferring ≥60 credits take four or five additional courses
- Courses may or may not count toward general education or major requirements

Perkins, Katherine S. (2010). *The Effectiveness of Articulation and Transfer Agreements Between Missouri Community Colleges and Universities in Promoting the Successful Completion of a Four-Year Degree* (Doctoral dissertation). University of Missouri – St. Louis, St. Louis, Missouri.

Trends in General Education

38 states currently have a statewide, mandated general education core

Nearly all have a common set of learning outcomes for all undergraduate students

There is a focus on the integration of knowledge, skills and applications in the general education program

There is a movement to link general education to majors (guided pathways/meta-majors)

https://www.aacu.org/sites/default/files/files/LEAP/2015_Survey_Report2_GEtrends.pdf

Core Transfer Curriculum (CORE 42)

- Senate Bill 997 (2016)
- Recommended lower division core curriculum of at least 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

CORE 42: Guiding Principles

- Transfer should operate in the best interest of the student.
- Institutional autonomy should be preserved to the greatest possible extent.
- Completion of the CORE 42 meets all lower-division general education requirements at all institutions.
- Specific courses shall transfer one-to-one, and fulfill major and graduation requirements.
- Curriculum is the purview of faculty.

CORE 42: Process

- Core Curriculum Advisory Committee (CCAC)
  - Workgroups identify courses; provide descriptions
    - Communications
    - Humanities & Fine Arts
    - Life & Physical Sciences
    - Mathematics (Math Pathways Task Force)
    - Social & Behavioral Sciences
- Drafts vetted by Council of Chief Academic Officers (CCAO); discussions with MCCA & COPHE

CORE 42: Process

- Over 120 MOTRs and course descriptions established for AY 18-19
- Over 2,500 courses from all Missouri public two-and four-year institutions are active
- Course Transfer Tracker is live
- Appeals process established
- Over 500 new courses and nearly 100 course updates received for AY 19-20 review
- New independent institutional members: Avila University, Central Methodist University, Missouri Baptist University, and St. Luke's College of Health Sciences

CORE 42

Complete at least 42 credit hours, distributed among the Knowledge Areas listed below

Knowledge Areas

Social & Behavioral Sciences		Written Communications	Oral Communications	Natural Sciences	Mathematical Sciences	Humanities and Fine Arts
9 credits minimum from at least 2 disciplines, including at least one Civics course		6 credit hours minimum	3 credit hours minimum	7 credit hours minimum from at least 2 disciplines, including one course with a lab component	3 credit hours minimum	9 credit hours minimum, from at least 2 disciplines
Anthropology MOTR ANTH 101 General Anthropology MOTR ANTH 201 Cultural Anthropology **Economics** MOTR ECON 100 Introduction to Economics MOTR ECON 101 Introduction to Macroeconomics MOTR ECON 102 Introduction to Microeconomics **Geography** MOTR GEOG 101 World Regional Geography **History** MOTR HIST 201 World History I MOTR HIST 202 World History II **Political Science** MOTR POSC 201 International Relations MOTR POSC 202 Introduction to Comparative Politics **Psychology** 100 General	**Civics courses** MOTR POSC 101 American Government MOTR HIST 101 American History I MOTR HIST 102 American History II	MOTR ENGL 100 Composition I MOTR ENGL 110 Technical Writing MOTR ENGL 200 Composition II	MOTR COMM 100 Introduction to Communications MOTR COMM 110 Fundamentals of Public Speaking MOTR COMM 120 Interpersonal Communication MOTR COMM 125 Small Group Communication MOTR COMM 220 Argumentation & Debate	**Astronomy** MOTR ASTR 100 Astronomy MOTR ASTR 100L Astronomy with Lab **Biology** MOTR BIOL 100 Essentials in Biology MOTR BIOL 100L Essentials in Biology Lab MOTR BIOL 150 Biology MOTR BIOL 150L Biology with Lab **Chemistry** MOTR CHEM 100 Essentials in Chemistry MOTR CHEM 100L Essentials in Chemistry with Lab MOTR CHEM 150 Chemistry I MOTR CHEM 150L Chemistry I with Lab **Geography** MOTR GEOG 100 Physical Geography MOTR GEOG 100L Physical Geography with Lab **Geology** MOTR GEOL 100 Geology MOTR GEOL 100L Geology with Lab **Life Sciences** MOTR LIFS 100 Essentials in Human Biology MOTR LIFS 100L Essentials in Human Biology with Lab MOTR LIFS 150 Human Biology MOTR LIFS 150L Human Biology with Lab	MOTR MATH 110 Statistical Reasoning MOTR MATH 120 Mathematical Reasoning & Modeling MOTR MATH 130 Pre-Calculus Algebra MOTR MATH 150 Pre-Calculus **Courses that use one of the pathway courses as a prerequisite will meet the general education credit for math. For example, Calculus meets the General Education math requirement since Pre-Calculus Algebra is a prerequisite.*	**Art** MOTR ARTS 100 Art Appreciation MOTR ARTS 101 Art History I MOTR ARTS 102 Art History II **Civilization** MOTR WCIV 101 Western Civilization I MOTR WCIV 102 Western Civilization II **Film** MOTR FILM 100 Introduction to Film Studies **Foreign Language** MOTR LANG 101 French I MOTR LANG 102 French II MOTR LANG 103 Spanish I MOTR LANG 104 Spanish II MOTR LANG 105 Foreign Language I MOTR LANG 106 Foreign Language II **Literature** MOTR LITR 100 Introduction to Literature MOTR LITR 100F Introduction to Literature-Fiction MOTR LITR 100P Introduction to Literature-Poetry MOTR LITR 100D Introduction to Literature-Drama MOTR LITR 101 American Literature MOTR LITR 101A American Literature-Pre-Civil War MOTR LITR 101B American Literature-Post-Civil War MOTR LITR 102 British Literature

Appeals

- If MOTR courses do not transfer seamlessly, there is an appeals process which all participating institutions will be required to publish in their catalog.
- MDHE will collect data on the types of transfer disputes and the disposition of each case

Mathematical Sciences: Courses

3 credits minimum		
MOTR Number	**MOTR Title**	**Transfer Credits**
MOTR MATH 130	Pre-Calculus Algebra	3
MOTR MATH 120	Mathematical Reasoning & Modeling	3
MOTR MATH 110	Statistical Reasoning	3
MOTR MATH 150	Pre-Calculus	5

Course Database: https://dhe.mo.gov/core42.php

Resources

Course Transfer Tracker

- ***Will be available on Journey to College website***
  - ***https://journeytocollege.mo.gov***
- ***Provide general information around CORE 42***
- ***Allows students to see how courses transfer between public institution***

Earn a degree:

Course Transfer Tracker

Knowledge areas

Students must earn at least 42 credit hours in five knowledge areas to complete the general education requirements for most liberal arts and sciences degrees at public colleges and universities in Missouri.*

CORE 42 MOTRANSFER GUARANTEED

A minimum number of credit hours are required in each knowledge area.

Social and Behavioral Sciences	Written and Oral Communications
9 credit hours minimum, including at least one civics course	6 credit hours minimum written, 3 credit hours minumum oral

Natural Sciences	Mathematical Sciences	Humanities and Fine Arts
7 credit hours minimum, including one course with a lab	3 credit hours minimum	9 credit hours minimum from at least 2 disciplines

*General education requirements vary for some degrees, including engineering, education, and nursing. Check with the college or university you plan to attend for more information.

MISSOURI COORDINATING BOARD FOR HIGHER EDUCATION

Earn a degree:

Course Transfer Tracker

Participating colleges

All public two-year colleges and four-year universities in Missouri have adopted the Core 42 Curriculum, which establishes a block of at least 42 credit hours that will transfer as equivalent credit.

CORE 42 MOTRANSFER GUARANTEED

More than 2,000 courses – in five knowledge areas – are included in the CORE 42.

Select a college or university below to see the CORE 42 courses and general transfer courses it offers.

Public two-year colleges

- Crowder College
- East Central College
- Jefferson College
- Metropolitan Community College
- Mineral Area College
- Missouri State University–West Plains
- Moberly Area Community College
- North Central Missouri College
- Ozarks Technical Community College
- St. Charles Community College
- St. Louis Community College
- State Fair Community College
- State Technical College of Missouri
- Three Rivers College

Public four-year universities

- Harris-Stowe State University
- Lincoln University
- Missouri Southern State University
- Missouri State University
- Missouri University of Science & Technology
- Missouri Western State University
- Northwest Missouri State University
- Southeast Missouri State University
- Truman State University
- University of Central Missouri
- University of Missouri–Columbia
- University of Missouri–Kansas City
- University of Missouri–St. Louis

MISSOURI COORDINATING BOARD FOR HIGHER EDUCATION

Earn a degree:

Course Transfer Tracker

Participating colleges

Select the year to see the CORE 42 and general transfer courses.

CORE 42 MOTRANSFER GUARANTEED

Lincoln University

Select a year:

2018-2019

2019-2020

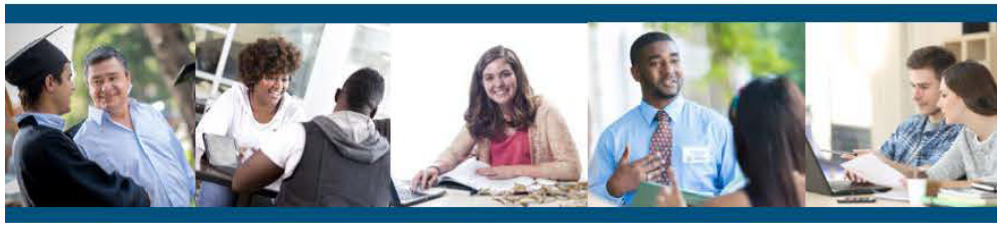
CORE 42 courses

Course name	Course number	Transfer credit	Transfer type/ Knowledge area
Macro Economics	ECON 0204	3	Core 42 - Social and Behavioral
Microeconomics	ECO 202	3	Core 42 - Social and Behavioral
General Psychology	PSY 101	3	Core 42 - Social and Behavioral
Introductory to Sociology	SA 201	3	Core 42 - Social and Behavioral
Developmental Psychology	PSY 308	3	Core 42 - Social and Behavioral
World Geography	GEO 200	3	Core 42 - Social and Behavioral
International Relations	PSC 460	3	Core 42 - Social and Behavioral
American National Government	PSC 203	3	Core 42 - Social and Behavioral
United States History I	HIS 205	3	Core 42 - Social and Behavioral
United States History II	HIS 206	3	Core 42 - Social and Behavioral
English Composition & Rhetoric I	ENG 101	3	Core 42 - Communications
Composition & Rhetoric II	ENG 102	3	Core 42 - Communications
Fundamentals of Speech	SPT 206	3	Core 42 - Communications
Introductory Astronomy	PHY 105	3	Core 42 - Natural Sciences
Introductory to Astronomy with Lab	PHY 105/106L	4	Core 42 - Natural Sciences
Principles of Biology	BIO 0141	3	Core 42 - Natural Sciences
Principles of Biology Lecture and Laboratory	BIO 103/104L	4	Core 42 - Natural Sciences
Organismal Biology	BIO 105	4	Core 42 - Natural Sciences
General Botany	BIO 106	3	Core 42 - Natural Sciences
Living with Chemistry	CHM 103	3	Core 42 - Natural Sciences
Living with Chemistry with Lab	CHM 107/108	4	Core 42 - Natural Sciences
General Chemistry I	CHM 101	4	Core 42 - Natural Sciences
Human Anatomy and Physiology	BIO 208	3	Core 42 - Natural Sciences
Human Anatomy and Physiology with Lab	BIO 208/209L	4	Core 42 - Natural Sciences
Earth Science	PHY 103	3	Core 42 - Natural Sciences

Journey College

MISSOURI DEPARTMENT OF HIGHER EDUCATION

About Plan Pay Finish Connect



Earn a degree:

Course Transfer Tracker

The Course Transfer Tracker can show you how general education courses you have completed at public colleges and universities in Missouri will transfer.

CORE 42 MOTRANSFER GUARANTEED

The tracker is based on Missouri's CORE 42 Curriculum – a block of at least 42 credit hours that will transfer as equivalent credit at all public higher education institutions in the state.

The curriculum fulfills the general education requirements for most liberal arts and sciences degress at Missouri's public colleges and universities.

More than 2,000 courses – in five knowledge areas – are included in the CORE 42.

Select degree type

Transfer from: | Prefix and course number | Transfer to:

Select all CORE 42 courses you have completed to track your progress toward meeting the general education requirements for your degree.

Track my progress

Earn a degree:

Course Transfer Tracker

Transfer from:

Metropolitan Community College

Prefix and course number

PHIL 203
ENG 102
HIST 120
HIST 121
MATH 120
POLS 136
COMM 100
PSYC 140
PHYS 106
MUSI 108
PHIL 100
add/delete

Transfer to:

Crowder College
East Central College
Jefferson College
Harris-Stowe State University
Metropolitan Community College
Mineral Area College
Missouri Souther State University
Missouri State University
Missouri State University-West Plains
Missouri University of Science & Technology
Missouri Western State University
Moberly Area Community College
North Central Missouri College
Northwest Missouri State University
Ozarks Technical College
St. Charles Community College
St. Louis Community College
Southeast Missouri State University
State Fair Community College
State Technical College of Missouri
Three Rivers College
Truman State University
University of Central Missouri
University of Missouri-Columbia
University of Missouri-Kansas City
University of Missouri-St. Louis

Add another college

Track my progress

Earn a degree:

Course Transfer Tracker

Columbia College +

University of Missouri-Kansas City

Metropolitan Community College

Course and credit hours:		Type of transfer	Course and credit hours:	
PHIL 203	3	CORE 42 - Humanities/Fine Arts	PHIL 321	3
ENG 101	3	CORE 42 - Communications: Writ-	ENG 110	3
ENG 102	3	CORE 42 - Communications: Writ-	ENG 225	3
HIST 120	3	CORE 42 - Social/Behavioral	HIST 101	3
HIST 121	3	CORE 42 - Social/Behavioral	HIST 102	3
MATH 120	3	CORE 42 - Mathematical Sciences	MATH 120	3
POLS 136	3	CORE 42 - Civics	POL-SCI 210	3
COMM 100	3	CORE 42 - Communications: Oral	COMM-ST 100	3
PSYC 140	3	CORE 42 - Social/Behavioral	PSYC 210	3
PHYS 106	3	CORE 42 - Natural Sciences	ASTR 150	3
MUSI 108	3	CORE 42 - Humanities/Fine	SONSVTY 120	3
PHIL 100	3	General transfer	PHIL 210	3

State Fair Community College

CHEM 100	3	CORE 42 - Natural Sciences	CHEM 100	3
ART 101	3	CORE 42 - Humanities/Fine	ART 210	3

add/delete

Add another college ▼

Add another college ▼

Track my progress

Save/Print

Earn a degree:

Course Transfer Tracker

Track my progress

You must complete at least 42 credit hours in five knowledge areas to meet the general education requirements for most liberal arts and sciences degrees at Missouri's public colleges and universities.

CORE 42 MOTRANSFER GUARANTEED

My general education progress*

0 credit hours — 42+ credit hours

*Based on information entered into the Course Transfer Tracker

Core 42 knowledges areas and courses:

Social and Behavioral Sciences

9 credit hours minimum, including at least one civics course

SOCIAL/BEHAVIORAL		CIVICS	
COMPLETED		COMPLETED	
HIST 121	3	POLS 136	3
HIST 121	3		

Written and Oral Communications

6 credit hours minimum written, 3 credit hours minimum oral

WRITTEN		ORAL	
		COMPLETED	
ENGL 101	3	COMM 100	3

Natural Sciences

7 credit hours minimum, including one course with a lab

NON-LAB		LAB	
PHYS 106	3		

Mathematical Sciences

3 credit hours minimum

COMPLETED

MATH 120	3

Humanities and Fine Arts

9 credit hours minimum from at least 2 disciplines

MUSI 108	3
PHIL 100	3

General transfer courses:

JRN 110	3
MDA 200	3

Questions?

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