May 2018

Michigan's Quantitative Reasoning Pathway

In early 2016, recognizing that successful implementation of the mathematics recommendation in the Michigan Transfer Agreement (MTA) would be critical to improving statewide transfer and credential completion, the Michigan Community College Association (MCCA) and the Michigan Association of State Universities (MASU) established The Right Math at the Right Time (RM@RT) initiative to strengthen the implementation of three primary mathematics pathways (quantitative reasoning, introductory statistics and preparation for calculus) across Michigan's two- and four-year public postsecondary institutions. In undertaking this work, Michigan joins a national network of colleges, supported by the Charles A. Dana Center at the University of Texas at Austin, who are building and strengthening mathematics pathways to promote student success and completion.

The Michigan RM@RT Steering Committee members represent community colleges and universities, the Michigan Department of Education and state mathematics associations. The 2016 report, The Right Math at the Right Time: Addressing Mathematics Challenges Facing Michigan Colleges and Universities, outlines a structure to help Michigan colleges and universities review and revise mathematics curricula to meet the needs of students and employers, design new, high-quality mathematics learning experiences, align learning outcomes for developmental and gateway mathematics courses and enable students who transfer to apply their math credits to their program of study.

Recent research in the field of mathematics suggests that, rather than requiring all students to complete courses intended to prepare them for advanced mathematics (including calculus), institutions of higher education should offer multiple mathematics pathways with relevant and challenging math content aligned to specific programs of study. Rather than asking students to memorize a set of skills that they are unable to apply in non-routine settings and whose importance to their future careers is not appreciated, recommendations from the Association of American Colleges and Universities (AAC&U), the Mathematical Association of America (MAA) and other entities stress the importance of conceptual understanding, problem-solving and communication across all math pathways. Courses in Quantitative Reasoning (QR) require students to think critically and apply basic mathematics and statistics skills to interpret data, draw conclusions and solve problems within a disciplinary or interdisciplinary context.

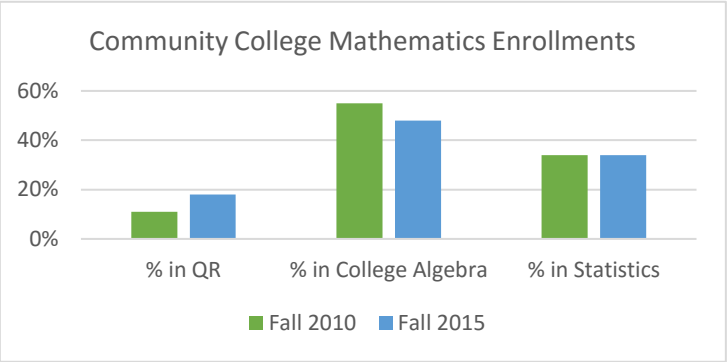
In 2017, the RM@RT Steering Committee established a working group of mathematics faculty from two- and four-year institutions to recommend a set of learning outcomes for entry-level, college-level courses in quantitative reasoning. Colleges and universities are currently reviewing the recommendations with the intent to *adopt* the learning outcomes in their own courses, *accept* courses with those learning outcomes in transfer and *apply* the courses to the appropriate programs of study.

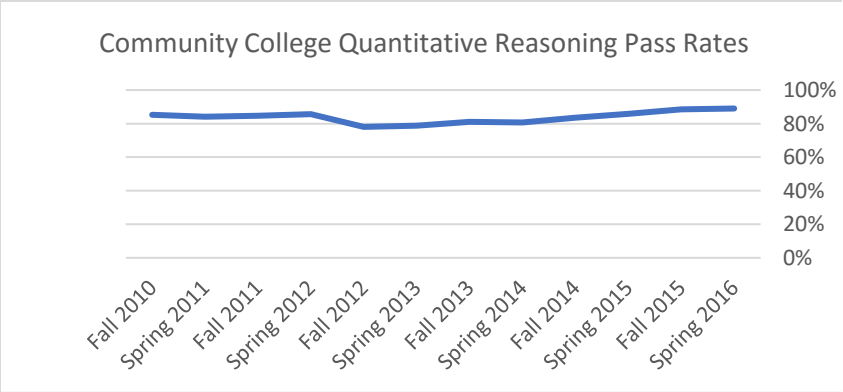
MICHIGAN'S MATHEMATICS PATHWAYS: QUANTITATIVE REASONING

Growth of Quantitative Reasoning Courses 2010-2016

Research from Michigan's Center for Educational Performance and Information (CEPI) shows that Michigan community college enrollments in Quantitative Reasoning courses have grown steadily from Fall 2010 through Fall 2015, both in actual numbers and as a percentage of students enrolled in entry-level, college level math courses. This trend has been accompanied by a corresponding decrease in college algebra enrollment rates.

During this period, overall community college enrollments in entry level, college-level mathematics courses grew from 5,538 to 7,029 and pass rates (D or better) remained relatively stable with close to 80% of students passing.





RM@RT Quantitative Reasoning Recommendations

The RM@RT Quantitative Reasoning workgroup identified a minimum skill level and a set of learning outcomes for college algebra and trigonometry courses that meet the MTA mathematics requirement.

Skill Level: To be successful in a Quantitative Reasoning course, students will be expected to apply basic algebra skills similar to those taught in high school algebra I in the Michigan Merit Curriculum or in beginning algebra.

Outcomes: The recommended outcomes come from The AAC&U Quantitative Literacy Rubric.

- **Interpretation:** Ability to explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words).
- **Representation:** Ability to convert relevant information into various mathematical forms (e.g., equations, graphs, diagrams, tables, words).
- **Calculation:** Ability to identify and perform appropriate calculations and communicate results.
- **Application / Analysis:** Ability to make judgments and draw appropriate conclusions based on the quantitative analysis of data, while recognizing the limits of this analysis.
- **Communication:** Expressing quantitative evidence in support of the argument or purpose of the work in terms of what evidence is used and how it is formatted, presented, and contextualized.

Read more in the White Paper on RM@RT Strategy I.

Quantitative Reasoning Course Transfer Patterns

Once colleges and universities adopt the learning outcomes, they are encouraged to accept courses from other institutions and post equivalencies to the Michigan Transfer Network (MTN). The RM@RT Steering Committee will periodically review these equivalencies to monitor progress toward accepting courses for transfer. This chart indicates current equivalencies listed in the MTN as of March 2018. Green boxes indicate direct equivalencies between courses identified as satisfying the MTA in quantitative reasoning by both entities, yellow indicate that the university offers general or departmental credit only and orange identifies where the university offers credit for a different course than the identified quantitative reasoning course. Boxes with a mix of green and yellow indicate that courses will be evaluated prior to credit being assigned. Blank boxes indicate that no information was available about the course in the MTN.

Quantitative Reasoning	University	Central Michigan University	Eastern Michigan University	Ferris State University	Grand Valley State University	Lake Superior State University	Michigan State University	Michigan State University	Michigan Technological University	Northern Michigan University	Oakland University	Saginaw Valley State University	University of Michigan-Ann Arbor	University of Michigan-Dearborn	University of Michigan-Flint	Wayne State University	Western Michigan University
Community College		MTH 103QR	MATH 110	MATH 117	N/A	MATH 110	MTH 101	MTH 102	MA 1020	MA 101	MTH 1118	MATH 125		MATH 131	MTH 112	MATH 1000	MATH 1140
Alpena Community College	N/A																
Bay College	MATH 107	GEN CR	MATH 110	MATH 117		MATH 110			MA 1020	MA 103	MTH 1118				MTH 112		MATH 1140
Delta College	MATH 118W	GEN CR	MATH 110	MATH 117		PER EVAL				MA 103	MATH 118				MTH 112		MATH 118
Glen Oaks Community College	N/A																
Gogebic Community College	MTH 108		MATH 110		GEN CR	PER EVAL			MA 1020	GEN CR					MTH 112		MATH 1140
Grand Rapids Community College	MA 124	GEN CR	MATH 110	MATH 117	GEN CR	MATH 102	MATH 103		MA 1020	GEN CR	MTH 1118	GEN CR		MATH 131	MTH 112		MATH 1140
Henry Ford College	MATH 131	GEN CR	MATH 110	MATH 117	GEN CR	PER EVAL				GEN CR	GEN CR			MATH 131	MTH 112	MATH 1000	MATH 1140
Jackson College	MAT 130	GEN CR	MATH 110	MATH 117	MTH 131					MA 1001							
Kalamazoo Valley Community College	MATH 115	GEN CR	MATH 110	MATH 117							MATH 114				MATH 105S		MATH 1140
Kellogg Community College	MATH 115	GEN CR	MATH 110	MATH 117	MTH 131					GEN CR					MTH 112		MATH 1140
Kirtland Community College	MTH 12500		MATH 110	MATH 117	GEN CR					MA 101		GEN CR			MTH 112		
Lake Michigan College	MATH 123	GEN CR	MATH 110	MATH 117	GEN CR	PER EVAL	GEN CR			MA 101	GEN CR				MTH 112	GEN CR	MATH 1140
Lansing Community College	MATH 119	MTH 103QR	MATH 110	MATH 117	GEN CR	PER EVAL	MTH 101			QUAR 1009N		GEN CR			MTH 112		MATH 1140
Macomb Community College	MATH 1100	GEN CR	MATH 110		MTH 131	PER EVAL	GEN CR			QUAR 1009N	MTH 1118	GEN CR		MATH 131	MTH 112		MATH 1140
Mid Michigan Community College	MAT 114	GEN CR	MATH 110	MATH 117	MTH 131		GEN CR		MA 1020	MA 101					MTH 112		MATH 1140
Monroe County Community College	MATH 154	GEN CR	MATH 110	MATH 117	GEN CR					GEN CR	MTH 1118			MATH 131	GEN CR		MATH 1140
Montcalm Community College	MATH 102	GEN CR	MATH 110	GEN CR	MTH 131	PER EVAL	GEN CR			MA 101	MTH 1118	GEN CR					MATH 1140
Mott Community College	MATH 115	GEN CR	MATH 110	MATH 117			GEN CR			GEN CR	MTH 0662	GEN CR		MATH 165	MTH 111		MATH 1100
Muskegon Community College	MATH 107A	GEN CR	MATH 110	MATH 117	MTH 131	GEN CR			MA 1020	QUAR 1009N	MATH 107				MTH 112	GEN CR	MATH 1140
North Central Michigan College	MATH 128	GEN CR	MATH 110	MATH 117	GEN CR	PER EVAL				QUAR 1009N	GEN CR	GEN CR			MTH 112	GEN CR	
Northwestern Michigan College	MTH 120	GEN CR	MATH 110	MATH 117	GEN CR	PER EVAL		MTH 102			GEN CR	GEN CR			MTH 112	GEN CR	MATH 1140
Oakland Community College	MAT 1525	GEN CR	MATH 110	MATH 117	MTH 131		MTH 101			QUAR 1009N	GEN CR	GEN CR		MATH 131	MTH 112	GEN CR	MATH 1140
Schoolcraft College	MATH 111	GEN CR	MATH 110	GEN CR		PER EVAL				GEN CR	GEN CR	GEN CR		MATH 131	MTH 112	GEN CR	
Southwestern Michigan College	MATH 128	GEN CR	GEN CR	MATH 117	GEN CR	GEN CR				GEN CR	GEN CR				GEN CR		MATH 1140
St. Clair County Community College	MTH 104		GEN CR	MATH 117						QUAR 1009N	MTH 1118	GEN CR			GEN CR	GEN CR	MATH 1140
Washtenaw Community College	MTH 125	GEN CR	MATH 110	MATH 117	MTH 131	PER EVAL				GEN CR	GEN CR	GEN CR			MTH 111	GEN CR	
Wayne County Community College District	MAT 135	MTH 103QR	MATH 110								GEN CR	GEN CR					
West Shore Community College	MTH 125	GEN CR	MATH 110	MATH 117	MTH 131										GEN CR		MATH 1140

MICHIGAN'S MATHEMATICS PATHWAYS: QUANTITATIVE REASONING

Quantitative Reasoning in Bachelor's Degree Pathways

A recent Michigan study sponsored by the Charles A. Dana Center at the University of Texas at Austin looked at minimum mathematics requirements in popular bachelor's degree programs at Michigan public universities. The findings suggest that courses with skill levels and content associated with Quantitative Reasoning (including elementary and intermediate algebra) would satisfy mathematics requirements in programs in Communication, Criminal Justice, English, Political Science, Psychology and Social Work in over half of the universities offering these programs.

In 2018, MCCA and the MASU will begin the process of creating multi-institutional associate to bachelor's degree pathways in the top majors in the state. This research will inform discipline faculty as they select appropriate math pathways for the disciplines and ensure articulated courses for transfer students. Read more about Michigan's Transfer Initiative here.

University	Communication	Criminal Justice	English	Political Science	Psychology	Social Work
Central Michigan University -- Mt. Pleasant	QR	QR	QR	QR	QR	QR
Eastern Michigan University -- Ypsilanti	QR	QR	QR	QR	QR	QR
Ferris State University -- Big Rapids	QR	QR	QR	QR	QR	QR
Grand Valley State University -- Allendale	QR	QR	QR	QR	QR or STAT	QR
Lake Superior State University -- Sault Ste. Marie	QR	CAL*	QR	QR	STAT	N/A
Michigan State University -- East Lansing	CA	CA	CA	CA	CAL	CA
Michigan Technological University -- Houghton	QR	N/A	QR	N/A	CA	N/A
Northern Michigan University -- Marquette	QR	QR	QR	QR	QR	QR
Oakland University -- Rochester	QR	QR	QR	QR	QR	QR
Saginaw Valley State University -- Saginaw	QR	CA/STAT/QR	QR	QR	QR	QR
University of Michigan -- Ann Arbor	QR or STAT	N/A	NR	NR	STAT	N/A
University of Michigan -- Dearborn	CA	CA	CA	CA	CA	N/A
University of Michigan -- Flint	QR	QR	QR	QR	QR	QR
Wayne State University -- Detroit	CA/STAT/QR	CA/STAT/QR	CA/STAT/QR	CA/STAT/QR	STAT	CA/STAT/QR
Western Michigan University -- Kalamazoo	QR	QR	QR	QR	QR	QR

CA= College Algebra
CAL=Calculus
QR=Quantitative Reasoning
STAT=Statistics
N/A= Program Not Offered
NR= No Required Math Course
* = Business Math/May Not Transfer