

MICHIGAN CENTER FOR STUDENT SUCCESS

An Initiative of the Michigan Community College Association



The Right Math at the Right Time: Addressing Mathematics Challenges Facing Michigan Colleges and Universities

October 27, 2016

Across the country, consensus is growing that a traditional one size fits all college mathematics sequence is no longer meeting the needs of today's students, institutions and the workforce. While most acknowledge that mathematics proficiency is vital for student success in many college programs, developing this proficiency is currently an obstacle for too many students. High rates of student failure in mathematics courses are contributing to disturbingly low postsecondary completion rates and to employers' perceptions that students are unprepared for the demands of today's labor market. Numerous reports from mathematics associations, policy centers and state and federal agencies have begun to emphasize a common conclusion: students need different mathematics skills depending on their career interests and programs of study. To address this need, new approaches are needed to modernize the content of curricula, create more high-quality mathematics learning options for students, align developmental and college-level mathematics offerings and requirements for particular programs of study, and increase the transferability of mathematics courses.

Faculty from mathematics and other disciplines are now beginning to identify programs and student populations that are not well served by the usual sequence of courses progressing from beginning algebra to calculus, and states and institutions are reorganizing and redesigning gateway and developmental mathematics courses, especially in quantitative reasoning and statistics, to create math pathways linked to specific fields of study. Since 2013, statewide task forces in nine states have recommended reforms supporting this pathways approach. In 2015, Michigan was invited to join a cohort of five states supported by the Charles A. Dana Center at the University of Texas in Austin who are now beginning this work.

The Challenge

With one of the most decentralized structures of higher education governance in the nation, Michigan's community colleges and universities enjoy a high degree of autonomy. This has facilitated the evolution of a diverse set of institutions primarily linked by disciplinary affiliations and local articulation agreements. In recent years, growing scrutiny of college and university completion rates from government, business leaders and the public, along with the increasing mobility of the student

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population, have put new pressure on this loosely defined system to operate more effectively and demonstrate return on investment to both students and taxpayers.

Being mathematically prepared for college, independent of eventual career or degree path, is a strong indicator of future success for Michigan students. Sixty-one percent of Michigan community college students currently test into one or more areas of developmental education, and data from recent high school graduates suggest that math is the most frequently taken developmental course in the state's community colleges. Three-year completion and transfer rates for Michigan community college students who did not need to enroll in a developmental math course were an average of 12 percentage points higher between 2010 and 2012 than the rates for students who required developmental math. In public universities, far fewer students enroll in developmental math, but the discrepancy in completion rates is more pronounced; students enrolled between 2010 and 2012 who did not need developmental math had an average completion rate nearly 24 points higher than the rates for those who did (Michigan's Center for Educational Performance and Information, 5/20/2016). Based on national data, only 20 percent of students requiring developmental mathematics will ever pass a college-level math course.

Success in mathematics courses or sequences is also a challenge for Michigan students who are academically ready to take college-level courses. Although completion rates are higher for students who did not require developmental math, two thirds of all students at Michigan community colleges and one third of students at Michigan universities who entered college in 2009 [had not completed a degree or certificate within six years or 8 years](#). According to national data, only 50 percent of all students in the most commonly enrolled gateway course, College Algebra, pass the course. Research has also shown that many students find their progress slowed by choosing the wrong math course or courses for their desired major or by poor alignment of math expectations when they transfer from one institution to another.

Increasing success in both developmental and college-level mathematics clearly has the potential to bring enormous value to Michigan. If Michigan colleges and universities are to improve student outcomes in math courses and sequences, including making it easier for students to transfer with the right math courses for their desired major, then they must work to provide students with better experiences learning math.

Michigan's Response

To address this challenge, two- and four-year postsecondary education associations and their member institutions—led by the Michigan Community College Association (MCCA) Center for Student Success and the Michigan Association of State Universities (MASU)—are now collaborating to significantly overhaul developmental and college-level mathematics education in Michigan. Their work will build on past and ongoing efforts to improve course success and postsecondary transfer and completion rates for Michigan students.

In 2012, Michigan's 28 community colleges and 15 public universities came together in response to a directive from the state legislature to improve the transferability of core college courses between two and four year institutions. The [Michigan Transfer Agreement](#) (MTA), enacted in 2014, is a set of consensus recommendations for transferable general education requirements for courses in English,

communication, humanities, social science, natural science and mathematics, intended to streamline the transfer experience for students. Identifying a set of courses to meet the mathematics requirement was an important component of this agreement. To accomplish this, in 2013 the MCCA partnered with the Presidents' Council of the State Universities of Michigan (now MASU) to convene focus group discussions comprised primarily of community college and university math faculty and a handful of academic administrators. In early 2014, a formal MTA Math Task Force was appointed which included representatives from public community colleges and universities as well as a faculty member from an independent college selected in partnership between the leadership of MichMATYC, MAA, MCCA and MASU.

[The final MTA math recommendation](#) includes three distinct mathematics pathways for Michigan higher education:

- a pathway to prepare students for majors requiring calculus, particularly STEM programs;
- a pathway emphasizing statistics for business and some social science majors; and
- a pathway emphasizing quantitative reasoning for all other majors.

This recommendation recognizes that students who follow diverse educational and occupational pathways need multiple points of entry into college level mathematics. It also recognizes the variety of mathematics requirements of the programs the students will eventually complete, whether they enter directly into a four-year university or transfer from a community college. The MTA Math Task Force agreed that while there are certain core skills that indicate that a student is prepared for college-level mathematical study, not all students are well-served by being advised into a traditional pre-calculus course sequence.

In 2015, an Associate's Degree Transfer Study Committee was charged by the legislature to consider strategies to increase the transferability and applicability of the associate of arts and associate of science degrees. The study committee recognized that while many institutions have developed strong local and regional partnerships, there are few opportunities for two- and four- year institutions to collaborate on statewide transfer issues. In a [March 2016 report](#), this study committee recommended creating a statewide Steering Committee for all state-level transfer and articulation initiatives, as well as an online portal to share transfer information across the state's institutions. This Transfer Steering Committee (TSC) met for the first time on October 27, 2016.

Recognizing that successful implementation of the MTA math recommendation will be critical to improving statewide transfer and credential completion, MCCA and MASU created The Right Math at the Right Time (RM@RT) Task Force in early 2016 to strengthen the implementation of math pathways across Michigan's two- and four-year postsecondary institutions.

The Task Force members represent community colleges and universities, the Michigan Department of Education, and state mathematics associations. They were primarily recruited from the previous MTA Math Pathways Task Force or appointed by their institutions. The RM@RT Task Force began meeting in February 2016 and completes its initial work with the publication of this document. Its goal was to recommend a structure to help Michigan colleges and universities review and revise math curricula to meet the needs of students and employers, design new, high-quality math 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.

The RM@RT Task Force recommends three strategies to strengthen mathematics pathways in Michigan:

Strategy 1: Establish a process to align learning outcomes for a set of introductory college level mathematics pathway courses across institutions and sectors.

Strategy 2: Support program faculty and administrators within community colleges and universities in adopting appropriate mathematics pathway courses aligned with students' educational goals and programs of study.

Strategy 3: Promote the widespread implementation of evidence-based approaches to increase the number of underprepared students who succeed in mathematics pathway courses.

Measuring Success

These three strategies and the accompanying recommendations detailed below are intended to provide an infrastructure for Michigan's community colleges and universities to collaborate on efforts to improve math pathways. One indicator of the success of these strategies will be the degree of engagement from faculty and staff at the institutions implementing math pathways reforms. Ultimately, though, success must also be measured in terms of student outcomes before and after the strategies are implemented.

The autonomous structure of higher education in Michigan has led to a historical lack of consistent statewide data on student outcomes. The lack of useful data poses a significant challenge to efforts to increase student success across all institutions. A relatively recent expansion of the state longitudinal data system has enhanced Michigan's capacity to collect and analyze course and program completion rates in community colleges and public universities, but more effort is needed to generate the level of information required to support statewide reform efforts focused on specific disciplines, including mathematics.

MCCA, MASU and the state's two- and four-year institutions are collaborating with Michigan's Center for Educational Performance and Information (CEPI) to gather and analyze data on mathematics course enrollment and completion rates. They will continue to work together to develop reports that can demonstrate increased student enrollment in mathematics pathway courses associated with high-enrollment bachelor's degree programs and increased rates of student success in gateway college-level math courses, including the rates for students who are underprepared for college-level work. MCCA and MASU will also advocate for the continued enhancement of Michigan's capacity to collect and report data supporting reforms focused on increasing student success in higher education.

Discussion and Recommendations:

Strategy 1: Establish a process to align learning outcomes for a set of introductory college level mathematics pathway courses across institutions and sectors.

Discussion: This process will operate under the supervision of the new statewide Transfer Steering Committee (TSC), which will prioritize state-level transfer initiatives. In 2014, the MTA Math Task Force described the broad outlines of three mathematics pathways, including quantitative reasoning, statistics, and preparation for calculus. These outlines, based on research and emerging practices in other states, include statements that address pre-requisites, topics and descriptors for each pathway.

The TSC will charge a RM@RT standing committee of mathematics faculty to take the next steps to create actionable learning outcomes that will ensure the transferability of a set of initial courses in the quantitative reasoning, statistics and calculus preparatory pathways. Within the state's decentralized context, a collaborative process involving a diverse set of stakeholders offers an opportunity not only to align expectations for student achievement in mathematics at all levels but also to develop a deeper statewide understanding of the critical role of mathematics learning across the disciplines as students move from secondary to postsecondary education. This strategy should be fully implemented by June 2017.

Recommendations:

- Establish a RM@RT standing committee on mathematics transfer under the umbrella of the newly created MCCA/MASU Michigan Transfer Steering committee.
 - Involve representatives from K-12, community colleges, universities, the mathematics professional associations and business and industry partners.
- Building on the descriptors in the January 2014 report from the MTA Math Committee, the standing committee should recommend broad learning outcomes for a set of college-level courses in quantitative reasoning, statistics and preparation for calculus.
 - Include outcomes describing the development of common critical mathematical thinking skills, as well as mastery of pathway-specific topics and pre-requisite skills for later courses as applicable.
- In collaboration with community colleges, universities and state mathematics professional associations, the RM@RT committee should hold mini-conferences or other communication events to refine and disseminate the recommended learning outcomes for first college-level courses in quantitative reasoning, statistics and preparation for calculus.
 - Acknowledge in recommendations that institutions serve different regions and student populations and will accommodate those differences.

Strategy 2: Support program faculty and administrators within community colleges and universities in adopting appropriate mathematics pathway courses aligned with students’ educational goals and programs of study.

Discussion: This strategy will promote changes at the institutions to make it easier for students to choose and follow a program pathway by clarifying the expectations for mathematics learning within each pathway. Research on the use of mathematics in the workplace indicates that students in many programs may be better served by rigorous alternatives to the traditional “algebra to calculus” sequence, including courses in statistics or quantitative reasoning. However, faculty outside of mathematics may be less aware of recent developments in math education. Some mathematics faculty may also need professional development to support the development and implementation of new approaches.

The TSC will appoint or recognize faculty-led committees to determine the articulation of courses and alignment of degree requirements within their disciplines, including at least one gateway college-level mathematics course chosen in consultation with colleagues from mathematics.

Recommendations:

- The standing committee will develop a series of Michigan mathematics pathways handbooks for faculty within and outside of mathematics describing learning outcomes for mathematics pathway courses and case studies of implementation in popular majors.
 - The handbook will be available online from MCCA and MASU and will be widely disseminated by these and other professional associations via conference presentations, webinars, campus representatives and other available channels.
- Cross-institutional, discipline/program-specific workgroups established under the umbrella of the Michigan TSC will participate in discussions with members of the RM@RT Committee as a core component of their work in aligning program requirements across 2- and 4-year institutions.
 - These discipline/program-specific workgroups should consider information from the handbooks along with criteria from accrediting bodies and institution-specific curricular requirements in selecting appropriate mathematics content for the program(s) of study.
- Institutions elect to revise mathematics requirements as needed, targeting high-enrollment bachelor’s degree programs.
 - Institutions that have revised mathematics requirements should track enrollment and success in mathematics pathway courses to document improvements.

Strategy 3: Promote the widespread implementation of evidence-based approaches to increase the number of underprepared students who succeed in mathematics pathway courses.

Discussion: Research indicates that undecided students and those who begin in developmental mathematics take longer and are less likely to complete any degree than students who connect to a program of study early on and advance more quickly into courses related to their major. Michigan’s community colleges and universities have already recognized this and are implementing initiatives to streamline developmental course sequences, revise the delivery of gateway courses, and organize their program offerings into broad areas of interest that allow students to explore multiple options while making steady progress toward a degree. Examples include: implementation of co-requisite approaches for students needing developmental English; guided pathways reforms within community colleges; and an institutional learning community dedicated to improving outcomes in gateway courses.

Mathematics pathways have a large role to play in these efforts. Once program faculty identify the gateway math courses in their pathways, students who need developmental instruction should be offered experiences that are aligned with their skill level and the demands of their program of study. This may include opportunities for placement directly into college level courses, co-requisite instruction or other successful models of embedded support, and engagement with mathematics content related to their area of interest or eventual program of study at a level appropriate to their skills. A recent statewide survey of the scale of developmental education reform found that Michigan community colleges are experimenting with a number of evidence-based models for developmental math, though no single format has achieved significant scale as of yet.

In implementing Strategy 3, the Task Force will focus on facilitating a community of practice while seeking funding to begin to scale models that are gaining the most support among the colleges.

Recommendations:

- The Michigan Center for Student Success (MCSS), in collaboration with MASU and the state mathematics professional associations, will establish a statewide learning network for developmental mathematics.
 - Membership in the network will be voluntary and based on institutions’ agreement to: implement strategies that enable students to enroll in and complete a college-level math course more quickly than in the traditional developmental math sequence; help students develop skills as learners; and employ curriculum design and pedagogy based on proven practice.
- Underprepared students will be offered mathematics learning opportunities that prepare them for the mathematics required in areas of focus and/or specific programs of study aligned to their interests and abilities.
 - Learning opportunities will be designed to minimize or replace lengthy sequences of developmental mathematics courses and to accommodate exploration of majors and careers during the first few semesters for undecided students.

Appendices:

- A. RM@RT Task Force Membership February-October 2016
- B. Transfer Steering Committee Summary
- C. Selected Resources

Appendix A: The Right Math at the Right Time Task Force Membership February – October 2016

RM@RT Task Force Members

Community College and University Representatives

Jeff Morford (Co-Lead)	Henry Ford College	Math Faculty Co-Director of Undergrad Studies
Pavel Sikorskii (Co-Lead)	Michigan State University	Math Faculty
Peter Brown	Lake Michigan College	Dean of Arts and Sciences
Todd Butler	Jackson College	Mathematics Professor
Eddie Cheng	Oakland University	Mathematics Professor
Stephen DeBacker	University of Michigan-Ann Arbor	Math Faculty
Ken Hinzman	Bay College	Math Faculty
Barbie Hoag	Oakland Community College	Mathematics Department Chair
Michael Lachance	University of Michigan-Dearborn	Math Faculty
Doug Mace	Kirtland College	Dean, University Relations
Donna Petras	Macomb Community College	Chair, Math Division
David Redman	Delta College	Math faculty
Jack Rotman	Lansing Community College	Department Chair
Kirk Weller	Ferris State University	Chair, Mathematics Department
Steven Ziebarth	Western Michigan University	

Ex-Officio Representatives

Jenny Schanker (Facilitator)	Michigan Community College Association
Erica Orians	Michigan Community College Association
Katie Giardello	Michigan Community College Association
Bob Murphy	Michigan Association of State Universities
Dan Hurley	Michigan Association of State Universities
Gregg Dionne	Michigan Department of Education
Richard Kazis (Consultant)	The Charles A. Dana Center

Appendix B: Transfer Steering Committee Summary

On March 1, 2016, a study committee submitted a report to the Michigan Legislature in response to the intent to develop a process to increase the transferability and applicability of associate of arts and associate of sciences degrees as a block of credits between community colleges and public universities on a statewide basis. The study committee included representatives from ten Michigan community colleges, ten public universities, private colleges and universities, MACRAO, and Michigan legislators.

The report included four guiding principles: supporting state educational attainment and talent goals; enhancing transparency; adopting a voluntary involvement model; and ensuring quality and alignment of courses and programs. Six recommendations encouraged: the investment in research and data analysis on transfer pathways; further definition of the focus and scope of the associate's degree transfer; the review of current and best practices; the adoption of specific transfer pathways that meet program requirements for both associate's and bachelor's degree programs; enhanced communication strategies to share information about transfer options with students, faculty, staff, advisors, and the public; and the promotion of holistic transfer that includes a comprehensive examination of student and academic services. The report identified two immediate next steps:

Create a Collaborative Foundation for Prioritization, Dialogue, and Planning

Form a single, representative body to act as a Steering Committee for all state-level transfer and articulation initiatives in Michigan. The report further outlines the structure and purpose of this committee, including clear deliverables to measure progress.

Create a Student Portal to Share Transfer Information

Aligned with recommendations from the Michigan Association of Collegiate Registrars and Admissions Officers (MACRAO) Michigan Transfer Network (MTN) Replacement Committee and the Michigan Postsecondary Credential Attainment Workgroup, it is recommended that the state invest in a communication tool to share information about postsecondary options in Michigan, including essential tools for transfer planning.

During spring and summer 2016, MCCA and MASU finalized the membership of the Transfer Steering Committee which will include up to 15 members from public universities and 15 members from community colleges. Members include individuals who served on the transfer study committee and others who serve in a leadership role at their institutions. The first meeting of the Transfer Steering Committee is scheduled for October 27, 2016.

Appendix C: Selected Resources

[A Call to Action to Improve Math Placement Policies and Processes](#) (The Charles A. Dana Center and Jobs for the Future)

[Call to Action to Expand Access to Statistics](#) (The Charles A. Dana Center)

[Changing Equations: How Community Colleges are Rethinking College Readiness in Math](#) (LearningWorks)

[A Common Vision for Undergraduate Mathematical Sciences Programs in 2025—Final Report \(Draft\)](#) (The Mathematical Association of America)

[Core Principles for Transforming Remediation within a Comprehensive Student Success Strategy: A Joint Statement](#) (American Association of Community Colleges, Achieving The Dream, Complete College America, The Charles A. Dana Center, Education Commission of the States, and Jobs for the Future)

[Degrees of Freedom: Probing Math Placement Policies at California Colleges and Universities](#) (Policy Analysis for California Education)

[Mathematics Prerequisites for Success in Introductory Statistics](#) (The Charles A. Dana Center)

[Modernizing Entry-Level Mathematics Programs: the Case for Math Pathways](#) (The Charles A. Dana Center)

[Modernizing Mathematics Pathways at Texas Universities: Insights from the New Mathways Project Transfer Champions](#) (The Charles A. Dana Center)

[Position on the Appropriate Use of Intermediate Algebra as a Prerequisite Course](#) (American Mathematical Association of Two-Year Colleges)

[Promoting Gateway Course Success: Scaling Corequisite Academic Support](#) (Complete College America)

[What Does It Really Mean to Be College and Work Ready? The Mathematics Required of First Year Community College Students](#) (National Center on Education and the Economy)