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State Superintendent of Schools

TO: Members of the State Board of Education
FROM: Karen B. Salmon, Ph.D.
DATE: August 27, 2019
SUBJECT: Maryland High School Graduation Task Force – Recommendations for Mathematics

PURPOSE:

To provide the State Board with information on the Maryland High School Graduation Task Force recommendations for a change in the graduation requirements for mathematics. In addition, information on the Maryland Mathematics Alignment Project will be shared with the State Board.

BACKGROUND:

The Maryland High School Graduation Task Force was first convened in January 2018 at the request of the State Board and the State Superintendent. The group was to make recommendations to the Board and Superintendent on the Code of Maryland Regulations (COMAR) 13A.03.02 *Graduation Requirements for Public High Schools in Maryland*. Specifically, the Task Force was asked to focus on three areas: credit and program requirements (number of credits, subject areas, and other requirements), assessments, and options for awarding high school diplomas. All decisions were informed by current research, data, and experts.

SUMMARY:

Language from the Annotated Code and COMAR will be shared with Board members along with the rationale for the recommendations of the Task Force on requirements for mathematics. The Maryland State Department of Education and Higher Education have been working collaboratively on a K-12/Higher Education Mathematics Initiative to address the changing role of mathematics in the economy, to develop a broader understanding of how mathematics will be used in the future, and to conduct an evaluation of the current mathematical pathways into and through college-level mathematics. Additionally, the information shared will include work conducted through the Maryland Mathematics Alignment Project.

ACTION:

For information only.

Attachments (3):

- I. High School Graduation Task Force: Credit Requirement for Mathematics and K-12/Higher Education Mathematics Initiative PowerPoint
- II. The University System of Maryland, First in the World Maryland Mathematics Reform Initiative (FITW MMRI) Project Overview
- III. Bridging the Gap Between High School and College Mathematics in Maryland
Maryland Mathematics Alignment Project (MMAAP)

High School Graduation Task Force Credit Requirement for Mathematics and K-12/Higher Education Mathematics Initiative



STATE BOARD MEETING

August 27, 2019

Mathematics Update

Purpose:

- Recommendation from the *High School Graduation Task Force* for mathematics credit requirements for graduation
- K-12/Higher Education – Mathematics Initiative

Credit and Program Regulatory Recommendations

Recommendation	State Board August 2019	State Board September 2019	State Board October 2019	Alignment with Commission on Innovation and Excellence in Education*
1.2 Mathematics: Increase credit requirements from 3 to 4 credits; allow Computer Science as math credit	X			Aligned
1.5 Health Education: Increase credit requirement from .5 to 1.0			X	Silent
1.8 Technology Education: Reduce credit requirement from 1.0 to .5			X	Silent
1.9 Graduation Pathway: Eliminate Advanced Technology option; require two pathways - Successful completion of a State- approved Career and Technology Education (CTE) program and/or completion of University System of Maryland (USM) requirements (two years of the same language, Algebra II, and two of three sciences as lab sciences)		X		Aligned
1.B Dual Enrollment: Dual Enrolled students who successfully complete a college course that is aligned with MD standards should receive high school (HS) credit.		X		Aligned

Annotated Code

7-205.1(c) High school curriculum and graduation requirements

Beginning with the **9th grade class of 2014**,..., each student shall **enroll in a mathematics course in each year of high school** that the student attends high school.

Code of Maryland Regulations (COMAR)

COMAR 13A.03.02.03(A)

Beginning with students **entering the 9th grade class of 2014 – 2015** school year, each student shall **enroll in a mathematics course in each year of high school** that the student attends, **up to a maximum of 4 years of attendance**, unless in the 5th or 6th year a mathematics course is needed to meet a graduation requirement.

COMAR 13A.03.02.03(B)(3)

Mathematics — **three credits**, including **one with instruction in algebra aligned with the Maryland High School Assessment for algebra** or **one or more credits in subsequent mathematics courses** for which Algebra I is a prerequisite, and **one with instruction in geometry** aligned with the content standards for geometry.

Rationale of the Task Force for Recommendations regarding Mathematics

1. Education Commission of the States – two states require two credits; 26 states require three credits; 16 states require four credits; one state has no standard diploma pathway/math credit requirements vary by pathway; and six states do not specify – credits are locally determined or competency based (January 2019 report).
2. The Task Force reviewed a number of rigorous research studies and found that greater exposure to math in high school is linked with better labor market outcomes including wages, increased financial literacy, and increased student engagement in high school. One recent study found that state changes to minimum high school math requirements is especially beneficial to students of color.
3. Beginning with the 9th grade class of 2015, each student was required to enroll in a mathematics course each year of high school. However, students were not required to obtain 4 credits in math, they only had to earn 3 credits. They did have to be enrolled each year they were in high school unless they were in high school for a 5th or 6th year. The recommendation of the Task Force aligns the credit requirement with the requirement to be enrolled in a mathematics course each year in high school.
4. The Task Force supported courses being aligned to students' goals and pathway.
5. 15 local school systems already require 4 credits in mathematics for graduation.
6. University of Maryland requires four years of math, including Algebra I, Geometry, and Algebra II. Students who complete Algebra II prior to their final year must complete the four-year entrance mathematics requirement by taking a course or courses that utilize non-trivial algebra (Algebra II, Trigonometry, Precalculus, Calculus, Statistics, College Algebra, etc.)

Recommendations of the Task Force

Students must be enrolled in a math course each year in high school and earn four math credits as part of their graduation requirements. This is an increase from three to four credits required in mathematics for graduation.

- Students must earn credits in Algebra 1 and Geometry.
- High school credits should match the academic pathway appropriate to the student's goals.
- Computer Science may be substituted for one math credit.

Discussion

K-12/Higher Education Mathematics Initiative

Maryland Mathematics Alignment Project (MMAP)

K-12/Higher Education – Mathematics Initiative

The University System of Maryland

First in the World Maryland Mathematics Reform Initiative (FITW MMRI)

- The initiative resulted in the development and implementation of multiple high-quality mathematics pathways for students that are relevant for their chosen career path.

Pathways

- Traditional mathematics pathway leading to calculus
- Statistics
- Quantitative Literacy

Background

Forum

Conference Board of Mathematical Sciences (CBMS)
*High School to College Mathematics Pathways:
Preparing Students for the Future*

Issues Addressed

- Changing role of mathematics in the economy
- Broader understanding of how mathematics will be used in the future
- Evaluating current mathematical pathways into and through college-level mathematics

Maryland Mathematics Alignment Project (MMAP) - Overview

Problem Statement

Concern that many students who are graduating from Maryland's public schools and who go to Maryland's institutions of higher education are not prepared to take credit-bearing college-level mathematics courses.

Goal

To increase the number of students who place directly into and successfully complete a college-level, credit bearing mathematics course upon enrolling in a Maryland Institution of Higher Education within two years of their graduation from a Maryland public school.

MMAP Overview (continued)

Area of Work

Develop additional mathematics pathway options for high school students who have met their Maryland mathematics graduation requirements by aligning post-secondary and K-12 content expectations and practices.

Issues to be addressed

- Curriculum Standards
- Messaging/Advising/Counseling
- Instructional Practices
- Policies/Procedures
- Placement Practices
- Methods for Dealing with Anticipated Risks

Opportunities

- Reduce number of students needing developmental mathematics coursework.
- Increase degree completion.
- Provide students with coursework more relevant to intended major.

Risks

- Tracking
- Equity Issues
- Challenges associated with changing majors

MMAP Task Force Membership

Leadership Team

- Deputy Superintendent - MSDE
- Associate Vice Chancellor – University System of Maryland
- Coordinator of Mathematics - MSDE
- 2-year and 4-year Higher Education Mathematics Educators
- Local School System Mathematics Educators

Task Force Membership

- Institute of Higher Education Admissions and Advising
- Institute of Higher Education Leadership
- Local School System Superintendent
- Maryland Business Roundtable
- Governor's Office
- Maryland State Board of Education
- Counselor
- Teacher
- Parent
- Student
- Baltimore City

**The University System of Maryland
 First in the World Maryland Mathematics Reform Initiative (FITW MMRI)
 Project Overview**



Background

The University System of Maryland, in collaboration with the Maryland Community Colleges and the other private and public institutions of higher education in Maryland, are working to address the mathematics “pipeline” issues that have created a significant bottleneck for postsecondary students. The Maryland Mathematics Reform Initiative (MMRI) is a collaborative effort currently underway between the public four-year USM institutions and the two-year community colleges in Maryland to develop and implement multiple high-quality mathematics pathways for students that are relevant for their chosen career path while also ensuring that the new courses have sufficient mathematical integrity and rigor to be deemed “college-level.”

As part of that larger statewide MMRI steering committee work, the USM applied for and was awarded a grant from the U.S. Department of Education’s First in the World (FITW) program to develop, implement, and evaluate a statistics pathway in order to accelerate developmental students’ progress into credit-bearing postsecondary courses and help more of those students reach certificate or degree completion effectively and efficiently. Project goals include reducing costs for students who will not have to languish in developmental courses, and saving the state and higher education institutions at least a portion of the estimated \$72 million spent annually in Maryland on developmental education.

In order to meet those goals, the FITW MMRI program supports the development of a new developmental statistics pathway leading to a general education statistics course. The twelve partnering institutions—five USM institutions and seven community colleges serving approximately 158,000 new students each year—are the “early adopters” of the new mathematics pathway and have been leading the development of the new pathway for Maryland’s 29 public higher education institutions.

Partner Institutions
Anne Arundel Community College
Cecil College
College of Southern Maryland
Coppin State University
Garrett College
Harford Community College
Howard Community College
Montgomery College
Towson University
University of Baltimore
University of Maryland, Baltimore County
University of Maryland, University College

Theory of Action

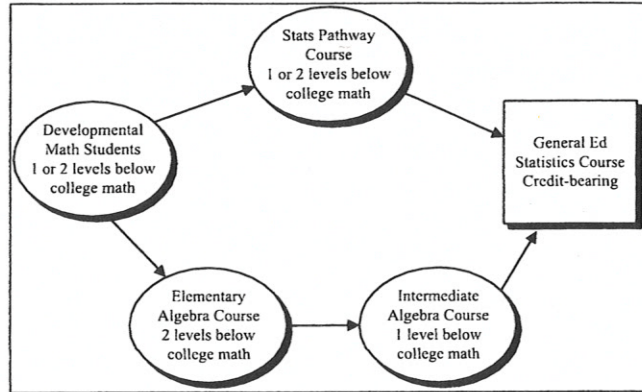
FITW MMRI hypothesizes that one significant underlying problem with developmental mathematics course sequences is the “disconnect” between the mathematics content students are learning and the mathematics they need to be successful. The key intervention in the project proposed here focuses on a rigorous pathway in statistical reasoning. In the FITW MMRI theory of action, this pathway would be more appropriate, more relevant, and more useful for students who are either undecided about their major or whose college major relies on a fundamental-studies statistics course either in place of, or in addition to a traditional college algebra course. By creating a single, intellectually-rigorous developmental statistics course that meets the needs of students who are up to two levels below college-level math and for whom algebra is not a requirement, the new Statistics Pathway is a strategy with the potential to reduce barriers (costs and time associated with taking multiple developmental-level math courses) to college credit accumulation and successful completion of a postsecondary degree.

**The University System of Maryland
First in the World Maryland Mathematics Reform Initiative (FITW MMRI)
Project Overview**



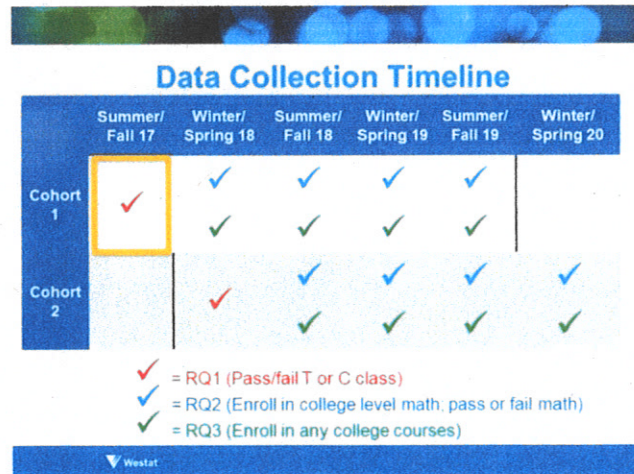
Research Plan & Findings

The main study includes two student cohorts, those from (1) summer/fall 2017 and (2) winter/spring 2018, and compares their performance in the treatment (stats pathway) or comparison (algebra-intensive pathway) “gateway” course (last developmental course before credit-bearing math). Our main research questions concern the following outcomes: (1) student success in the stats pathway versus “traditional” developmental math courses; (2) enrollment and success in a credit-bearing statistics course; and (3) college retention in the five semesters following the stats pathway or traditional developmental course.



Preliminary analyses found that **in fall 2017, students were more likely to pass the gateway treatment class than the comparison class**, after adjusting for demographics ($n = 1,234$). This finding did *not* vary by gender, race (White vs. non-White), or Hispanic ethnicity. We also conducted exploratory analyses to determine the effects of age, full-time status, and math level placement on success. Exploratory analyses found the older students passed both the treatment and comparison classes at a higher rate than younger students. Full-time students were more likely to pass the treatment course than full-time students in the comparison course. Finally, within the treatment course, students who had higher math scores at the beginning were not more likely to pass than student with lower scores—an encouraging, though inconclusive, finding.

The figure to the right shows the data collection timeline for the analyses planned to answer our main research questions.



Project Timeline

- 2015-2016: Project planning; pathways course design and development; advisor training; student recruitment
- 2016-2017: Launch MMRI Statistics Pathways courses at partner institutions; collect data on Cohort 1
- 2017-2018: Collect data on Cohort 2; analyze data collected to date; report on findings
- 2018-2019: Collect data on continued performance; analyze data collected to date; report on findings
- 2019-2020: No-cost extension year; dissemination of findings; recommend scaling to other USM institutions

**The University System of Maryland
 First in the World Maryland Mathematics Reform Initiative (FITW MMRI)
 Project Overview**



The table below shows the planned outcome measures, cohorts, and timeline for data collection.

Outcome measure	Fall 2017 cohort	Spring 2018 cohort
1) Success (pass/fail) in Stats Pathway or the traditional developmental math course	Fall 2017 semester	Spring 2018 semester
2) Enrollment and success (pass/fail) in a college-level statistics course, in the semester following	Winter 2017/8 and spring 2018 semesters	Summer 2018 and fall 2018
3) College retention in the five semesters following the Stats Pathway or developmental math course.	Winter 2017/8-Fall 2019	Summer 2018-Spring 2020

Bridging the Gap Between High School and College Mathematics in Maryland Maryland Mathematics Alignment Project (MMAP)

The gap between high school and post-secondary mathematics continues to be a challenge in Maryland, just as it is across the nation. While meeting the needs of many college students, the traditional algebra to calculus mathematics pathway, required by most colleges, does not provide the mathematical skills needed for some majors and often has become a barrier to graduation for capable students. Over the last five years curriculum reform has expanded mathematics options for college students. This reform is often referred to as *mathematics pathways*. Many colleges in Maryland currently offer mathematics pathways that include courses such as Statistics and Quantitative Literacy, as well as the traditional courses that lead to Calculus and beyond. These pathway courses provide a variety of general education mathematics options for college students. The Maryland Mathematics Alignment Project (MMAP) is designed to explore opportunities (and potential risks) for high school students to participate in mathematics pathways options before they enter college.

Maryland began its work on the Mathematics Pathways in 2014 through the work of the First in the World Maryland Mathematics Reform Initiative. As a result, progress has been made in the offerings of more mathematics pathways at the college level. However, Maryland is still missing a bridge between the high school mathematics coursework and the new college-level mathematics pathways. To begin to address this issue, representatives from the Maryland State Department of Education and the University System of Maryland, along with representatives from Maryland's K-12 and IHE communities, participated in a forum (May 5-7, 2019) hosted by the Conference Board of Mathematical Sciences entitled "CBMS High School to College Mathematics' Pathways: Preparing Students for the Future"

Maryland was one of 22 states invited to participate in the forum, hosted by The Conference Board of the Mathematical Sciences (CBMS), in collaboration with the Charles A. Dana Center at the University of Texas, Austin, and Achieve. CBMS has eighteen members whose primary objective is advancing the mathematical sciences. The Mathematical Association of America (MAA); the American Mathematical Society (AMS); the Association of Mathematics Teacher Education (AMTE); the National Council of Supervisors of Mathematics (NCSM) and the National Council of Teachers of Mathematics (NCTM) are among CBMS members. Drawing on the Dana Center Mathematics Pathways work and the expertise of various members of the CBMS societies, the forum provided an opportunity for a dialogue among a broad array of national stakeholders. The May convening was designed to provide support to state-leadership teams who wished to create a state-based task force that would work to put policies and practices in place to reduce or eliminate gaps between high school and college mathematics.

The Forum focused on three issues:

- **Responding to the changing role of mathematics in the economy.** The avalanche of data across all fields is spurring exciting and important work in mathematics. The transition years of grades 11–14 are critical for building the foundations for a workforce that can meet the evolving needs of the new economy.
- **Ensuring college readiness today and tomorrow.** High school and college mathematics educators are working collaboratively on this issue, recognizing the need for college-ready students, but also student-ready colleges. CBMS societies acknowledge the need for a broader understanding of how mathematics is and will be used, encompassing modeling, statistics, and data science. They also understand the need for active learning approaches that promote problem solving abilities and higher order thinking.
- **Articulating the mathematical pathways that will serve all students.** Changes in demographics, economic demands, and the mathematical sciences themselves are forcing reconsideration of the pathways into and through college-level mathematics. It is necessary to evaluate whether the course structures now in place still serve their intended purpose and to understand the alternatives that are available.

Through the forum Maryland has the opportunity to build a leadership team that will work to help Maryland bridge the gap between high school and college-level mathematics coursework. The first step in this project will be to build a "Maryland Mathematics Alignment Project Task Force (MMAP Task Force)." To be truly effective, the MMAP Task Force

should consist of representatives of all interests across the state including business and industry, as well as those who shape educational policy and those who implement it at both high school and post-secondary levels, both two- and four-year colleges and universities. The MMAP Task Force will address curriculum standards, instructional practices, policies and regulations, professional development needs and messages.

If you would like to learn more the Maryland Mathematics Alignment Project, please contact Debby Ward, Coordinator of Mathematics, Maryland State Department of Education (Debra.ward@maryland.gov).

Maryland's Mathematics Alignment Taskforce Leadership Team

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