A CALL TO ACTION TO IMPROVE MATH PLACEMENT POLICIES AND PROCESSES

SIX POLICY RECOMMENDATIONS TO INCREASE STEM STUDENT ASPIRATIONS AND SUCCESS WHILE DECREASING RACIAL AND INCOME GAPS

By Lara K. Couturier and Jenna Cullinane | MAY 2015

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This call to action is based on a simple but important premise: **The nation cannot allow placement policies, processes, and instruments to undermine promising efforts to increase student success in mathematics and increase attainment of STEM credentials**. Efforts to redesign math pathways hold great promise for improving the teaching and learning experiences of students who need college algebra—many of whom are STEM students—and helping those students persist toward and maintain STEM aspirations. But placement policies, processes, and instruments have not kept pace with math redesign efforts.

The nation needs more students prepared for STEM jobs—particularly low-income students, students of color, and underprepared students who historically have not had equitable access to preparation for and on-ramps to well-paying, dynamic STEM careers. To meet this need, mathematics course pathways must be a lever for helping students maintain and even increase their STEM aspirations. At the moment, however, far too many math courses—especially developmental math courses—serve as a serious obstacle and even deterrent to STEM-interested students seeking STEM credentials.

STEM careers offer a wage premium and solid career advancement, but low-income students and students of color remain highly underrepresented in STEM programs and professions. African Americans, Latinos, and Native Americans comprised 28.5 percent of the U.S. population in 2006 but only 9.1 percent of college-educated individuals employed in science and engineering occupations.

In response, many colleges and state policymakers are creating differentiated developmental and gateway math pathways. The goal is to target the math needs of particular academic programs and then improve teaching, learning, and support in those differentiated math classes. In the end, students who need algebra—many of whom are STEM students—will be in a redesigned math class better customized to their needs. Similarly, students in programs that do not require college algebra can take an alternative pathway—such as statistics or quantitative reasoning—that is better suited to their programs' needs.

In the end, students who need algebra—many of whom are STEM students—will be in a redesigned math class better customized to their needs.

Many colleges and states are implementing differentiated math pathways, but placement policies, processes, and supports have not kept up with the pace of change. As a result, students are being placed into math classes through methods that do not align with the content of, or that do not effectively predict or support success in, differentiated math pathways. Some of the workarounds in place may in fact be closing the door to STEM opportunities for students.

This call to action is designed to encourage states and colleges to analyze and revise their math placement policies, processes, and supports to ensure that STEM-interested students are properly placed into an on-ramp leading to well-taught math courses that maintain—and even increase—their STEM aspirations.

INTRODUCTION

Low-income students and students of color enroll disproportionately at community colleges, making community colleges one of the nation's key levers for opening educational opportunities and reducing class and racial imbalances in this nation's systems of educational attainment, career advancement, and wealth accumulation. In STEM fields, community colleges educate students for a group of robust jobs promising premium wages and requiring subbaccalaureate credentials, often referred to as middle-skill STEM.[1] Low-income students and students of color remain highly underrepresented in STEM programs and professions, however. According to the National Academy of Sciences, African Americans, Latinos, and Native Americans comprised 28.5 percent of the U.S. population in 2006 but only 9.1 percent of college-educated individuals employed in science and engineering occupations.[2]

To increase the pipeline of students entering STEM careers and to improve equity in STEM, the nation needs more students to aspire to STEM and then persist in and complete their STEM programs. At the Associate's degree level, 20 percent of students choose a STEM major at some point in their academic careers. But attrition rates in STEM are unacceptably high. The U.S. Department of Education reports that 69 percent of Associate's degree-seeking students who entered STEM fields between 2003 and 2009 dropped out of a STEM pathway by spring 2009; roughly half of those students left college altogether without earning a degree or certificate.[3]

STEM experts agree that math is a primary hurdle for STEM students. Developmental math in particular has been singled out as what some refer to as a "burial ground" for students. Over 60 percent of incoming community college students are placed into at least one developmental math course. Unfortunately, only 20 percent of those students successfully complete any college-level course within three years.[4] For underprepared STEM-intending students, the path from developmental courses to college algebra and eventually to the advanced mathematics required for many STEM degrees is a marathon few survive.

In response, a growing number of states and colleges are making a seismic shift: creating developmental math pathways that target the math needs of particular academic programs, also known as "differentiated math pathways," and then dramatically accelerating and improving the teaching and learning in those pathways.

WHERE ARE DIFFERENTIATED MATH PATHWAYS WORKING WELL?

Colleges in Texas, Ohio, Georgia, Indiana, Missouri, Montana, Colorado, and Nevada are making the transition to differentiated math pathways with significant support from the New Mathways Project (NMP) at The Charles A. Dana Center at The University of Texas at Austin. Other groups of colleges are doing similar work with key partners in the field through the California Acceleration Project (CAP) and the Community College Pathways program (Statway®/Quantway®) at the Carnegie Foundation for the Advancement of Teaching (CFAT). In addition, some states—including Massachusetts, North Carolina, and Oklahoma—have undertaken local math curricular initiatives and analyses, with expertise drawn from NMP, CAP, and CFAT, and arrived at their own versions of differentiated math pathways.

The New Mathways Project—a co-author of this call to action—is an evidence-based redesign of college math courses and sequences to successfully move students through both developmental and college-level math in no more than one year.[5] Central to the NMP model are the principles of aligning math courses with program requirements, acceleration, and teaching student success skills alongside math skills.

The New Mathways Project is building curricular resources to support three differentiated pathways: statistical reasoning, quantitative reasoning, and STEM-Prep (*see Figure 1*). Developmental students—regardless of pathway—begin by taking two co-requisite courses: 1)

"I don't know about you but I haven't done a quadratic equation in a long time, nor have I used one in my job as a college president. So one of the challenges at LaGuardia is we are trying to rethink: Do we really need that kind of math? Could a college-level statistics course be better for [some students]?" *—Gail Mellow, President, LaGuardia Community College*[7]

Foundations of Mathematical Reasoning, which builds the mathematical skills and understanding necessary for success in a quantitative literacy, statistics, or algebra course and 2) Frameworks for Mathematics and Collegiate Learning, which teaches concepts from the learning sciences to help developmental math students acquire the strategies and tenacity necessary to succeed in mathematics, in other college coursework, and in their future careers and lives as citizens.

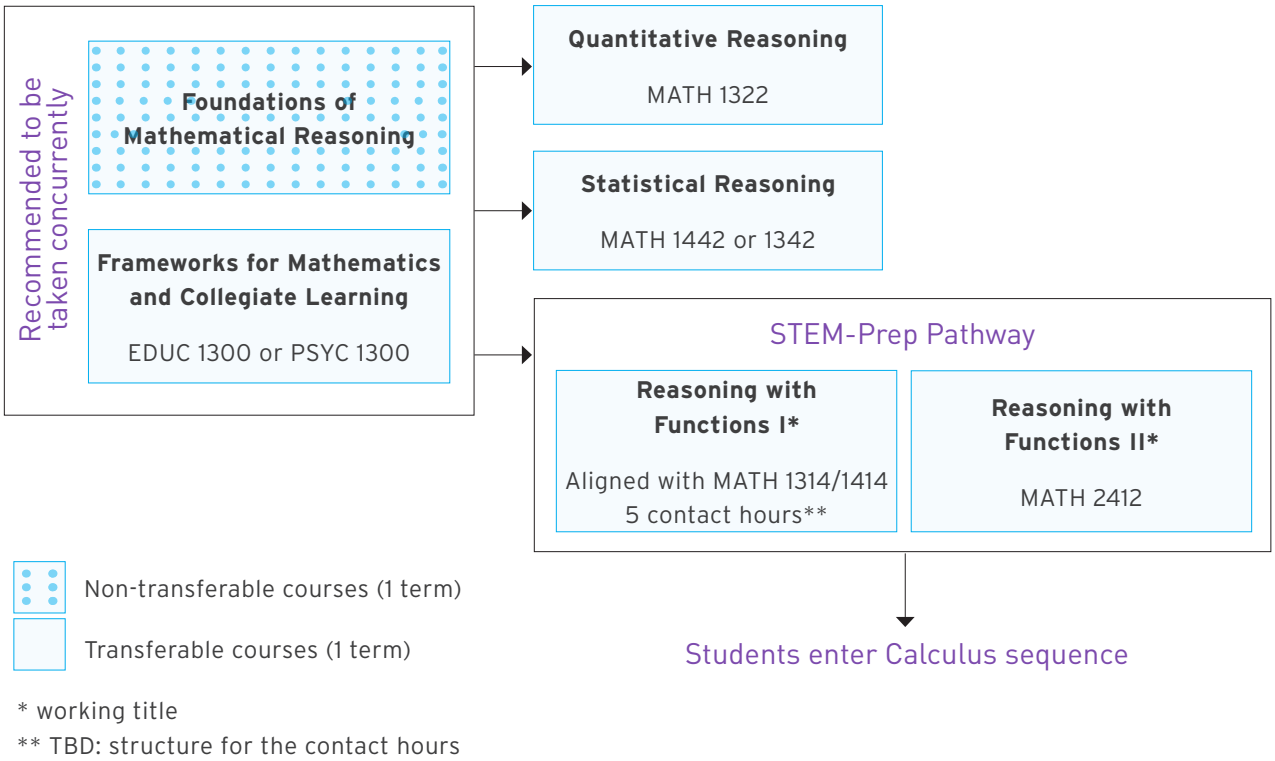
Depending on career interests, students then branch into an appropriate college-level course:

- **Statistical Reasoning:** This college-level course in the statistics pathway is designed for students with majors in the humanities or social sciences, where statistics may be relevant to career goals.
- **Quantitative Reasoning:** This college-level course in the quantitative literacy pathway serves students focused on developing quantitative literacy skills that will be meaningful for their professional, civic, and personal lives.
- **STEM-Prep Pathway:** The STEM-Prep pathway prepares students to enter the calculus track or technical programs that require strong algebraic skills.[6] This intensive pathway improves upon the traditional algebra sequence through its backward design from calculus, focus on critical thinking and reasoning skills, and application of mathematics to rich STEM contexts.

The goals of differentiated math pathways like the New Mathways Project include ensuring that:

- Students take courses relevant to and appropriate for their career goals.
- For all students, teaching and learning are improved within math courses. Students interested in a STEM program that requires algebra will experience an improved teaching and learning experience that helps them successfully complete their academic requirements while maintaining their interests and aspirations in STEM. At the same time, students interested in academic programs that do not require algebra are not unnecessarily stymied by college algebra if they will not need or use it later.[8]
- Students move more quickly into and through college-level mathematics.
- Students complete courses and sequences at significantly higher rates.
- Pedagogy and content are research based.
- Wraparound supports that encourage persistence and success are integrated into students' mathematics experiences.

Figure 1. Structure of the New Mathways Project



* working title
** TBD: structure for the contact hours

Promising Results from Several Differentiated Math Pathways Models

In 2012–2013, 52 percent of students in Statway® completed the full pathway and received college credit in one year, compared to 5.9 percent of non-Statway® developmental math students at a group of 18 colleges implementing Statway®: "Statway® students experienced over triple the success rate of students in traditional courses (52 percent versus 15.1 percent) in half the time (one versus two years)."[9]

In 2011–2012, 38 percent of developmental students in accelerated pathways supported by the California Acceleration Project completed a college-level statistics course in one year, compared to 12 percent of students in traditional sequences. At these 16 participating institutions, CAP students' odds of completing a college-level math course were 4.5 times greater after controlling for differences in student characteristics.[10]

The Texas Higher Education Coordinating Board reports that 26 percent of students in traditional developmental courses in 2012 completed their developmental education requirements and 4 percent completed a college-level math course in one year, while descriptive statistics from MDRC's evaluation of the New Mathways Project indicate 65 percent of students in NMP courses completed their developmental education requirements and 30 percent completed a college-level math course in one year. Among students who participated in high-fidelity NMP programs, 49 percent completed a college-level math course in one year.

WHAT IS THE MISMATCH BETWEEN DIFFERENTIATED MATH PATHWAYS AND EXISTING MATH PLACEMENT POLICIES?

The states and colleges implementing differentiated math pathways are ahead of the curve, embracing and implementing a strategy with a growing evidence base for improving outcomes for developmental math students. Still, there remain significant concerns: How do colleges help students choose the appropriate math pathway? Are math placement policies and processes keeping up with the move to differentiated math pathways? Are placement workarounds diverting STEM-interested students into math pathways that do not meet the requirements of their intended STEM program? If a student begins in a non-algebra math pathway, such as statistics, can she switch to a program requiring algebra later? If so, what systems and supports are in place to help her bridge to a new program and meet the algebraic math requirements?

Are placement workarounds diverting STEM-interested students into math pathways that do not meet the requirements of their intended STEM programs?

A Comprehensive Definition of Placement

The term "placement" often refers narrowly to the assignment of students to college courses according to an examination of student mathematics, reading, and writing skills. For the purposes of this brief, we recommend a more comprehensive definition of "placement" as an informed and well-rounded process that is intentionally supported by educators, advisors, and students and based upon information about student goals, prior academic experiences, outside-of-school obligations, attitudes, beliefs, and an assessment of academic skills.

At the moment, the processes and policies that drive student math placement and the content and intent of differentiated math pathways are misaligned in at least the following ways:

- Some states and colleges implementing differentiated math pathways have developed damaging workarounds in the absence of redesigned placement policies. Of particular concern is the use of cut scores as a means of differentiating eligibility for algebra-based pathways—in other words, students with low placement test scores are told they must go into a non-algebra-based pathway, effectively shutting them out of many STEM pathways.
- States and colleges are using existing advising schemes and placement instruments that do not reflect the differentiated content inherent in differentiated math pathways. Advisors regularly recommend college algebra or algebra-based developmental course sequences as a default for all students and all majors regardless of students' academic or career interests and the math preparation best suited to them. Almost all existing placement instruments are algebra based and do not adequately assess students for statistics or quantitative reasoning pathways.
- Student-advisor ratios in community colleges are far too low, often due to inadequate funding. As a result, students typically do not receive the level of advising necessary to help them make good choices among differentiated math pathways.
- Students articulate program choices late in their academic careers and thus rarely have the information needed to understand and adequately prepare for math requirements.
- A differentiated math pathway is designed as an on-ramp to an intended program of study, but all too often developmental math is positioned instead as a one-size-fits-all hurdle students must clear before they enter relevant credit-bearing courses.[11]

RECOMMENDATIONS

The Postsecondary State Policy Network, led by Jobs for the Future in conjunction with the Achieving the Dream National Reform Network, is a multi-state collaboration committed to identifying and advancing state policies that accelerate community college student success and completion. Seven states in the Postsecondary State Policy Network participate in a Cross-State STEM Workgroup (Connecticut, Florida, Hawaii, Massachusetts, Ohio, Oklahoma, and Virginia). The experiences and expertise of the Cross-State STEM Workgroup, in collaboration with experts from The Charles A. Dana Center, Jobs for the Future, and Achieving the Dream, inform the policy recommendations that follow.

The Postsecondary State Policy Network's Cross-State STEM Workgroup

With generous support from The Leona M. and Harry B. Helmsley Charitable Trust, and run by JFF in collaboration with the Achieving the Dream National Reform Network, the Cross-State STEM Workgroup is focused on identifying a policy agenda and building statewide capacity to facilitate the adoption and scale of middle-skill STEM pathways. The expertise and experiences of Workgroup participants were critical to the development of this call to action. Participating state lead organizations are:

- Connecticut Board of Regents for Higher Education
- Florida College System
- Massachusetts Department of Higher Education
- Ohio Association of Community Colleges
- Oklahoma State Regents for Higher Education
- University of Hawai'i Community Colleges
- Virginia Community College System

The following recommendations are designed to ensure that:

- The processes, policies, and supports that drive student math placement align with the content and intent of differentiated math pathways to improve student success among all entering students based on their academic goals.
- Students who are underprepared when entering community colleges are not shut out of STEM programs due to poor placement processes. In particular, the recommendations focus on ensuring that community colleges are increasing the STEM pipeline of low-income students and students of color, who enroll disproportionately at our community colleges but remain underrepresented in STEM careers.
- STEM-aspiring students receive the advising, supports, and preparation needed to help them persist toward and complete STEM pathways.

While these recommendations are focused on improving the success of STEM-aspiring students, they should produce positive results for all students.

RECOMMENDATION 1

Begin the placement support process early to ensure entering students are ready for college-level math.

Reach back to high schools, reengagement programs, and Adult Basic Education and put in place processes for making it very clear to students—as early as possible—what they need to do to be ready for college-level math. Students interested in a STEM program that requires algebra should understand and be actively working on meeting that math requirement. Examples of strategies that states and colleges can pursue include:

- **High school coaches:** Placing coaches in high schools who counsel students on career interests and then advise them on their math requirements.
- **Early assessment:** Providing opportunities for students to take college placement exams early, understand their scores, brush up on skills, and re-test.[12]
  - In high schools, this is often done as early as 10th grade.
  - For older adults, placement test review opportunities can be provided in collaboration with Adult Basic Education providers, One Stop Career Centers, and community-based organizations.
- **Summer bridge or STEM Starter Academies:** Providing intensive math courses during the summer before students enroll in college.[13]
- **Comprehensive intake:** Putting in place a comprehensive intake process that includes advising with integrated career counseling; placement test awareness, preparation, and re-test options; and educational planning.

RECOMMENDATION 2

Use multiple factors—such as a combination of career and academic goals, non-cognitive assessments, high school transcripts, and assessment scores—to determine whether students are placed into developmental courses and to determine which developmental or gateway courses are most appropriate.

Research suggests that existing placement instruments alone are not good predictors of student success in college, and that other measures, such as high school GPA, can work as well if not better for determining student placement into developmental education.[14] In reaction, many states and colleges are shifting placement practices to include:

- **Cognitive and non-cognitive measures:** Many colleges are supplementing placement tests with assessments of students' motivation, grit, life experiences, and prior learning.[15]
- **High school performance:** Particularly for recent high school graduates, evaluate high school coursework and performance to complement or replace the need for additional assessment.

- **Holistic advising:** Provide a holistic advising session that results in a placement recommendation that takes into account career interests, prior learning, attitudes about technology, academic performance, assessments, motivation, commitment to a program of study, and outside-of-school obligations. Both course content and delivery modality should be considered in placement.
- **Acceleration and co-requisite placement:** Place students who are near college ready into college-level courses with supplemental instruction to help them avoid the length and cost of developmental education.[16]

RECOMMENDATION 3

Require test makers to align placement tests with differentiated math pathways and improve their predictive value, even as states move toward using multiple measures of placement.

There will never be the perfect assessment instrument, but existing assessments often do not reflect differentiated content—and especially not content that would help place a student in a statistics or quantitative reasoning pathway. Test makers should develop appropriate questions in their test banks, working collaboratively with both mathematicians and representatives of other disciplines (e.g., business and chemistry). A collective demand from states that test makers add in modifications would go a long way toward improving the suite of measures at colleges' disposal.

RECOMMENDATION 4

Strengthen the role of student supports—especially advising—in the placement process.

Orientation, advising, and assessment services are key supports for accurate and equitable placements that help students make good program choices, determine their developmental and college-level math needs, and select courses that will count toward their intended programs. Students' goals and needs should drive the process of choosing courses and/or academic pathways. While this is true for all students, it is especially true for those STEM students who need to successfully complete algebra to move on in their pathway.[17] A process facilitated by advisors, counselors, faculty, and student-centered print or technology-based supports should help students register for and succeed in the courses they need to achieve their career interests. Examples of strategies that states and colleges can pursue include:

- **One door:** College leaders are realizing that students are treated very differently depending on how they enter the college (e.g., direct from high school, via a One Stop, or into a credit or noncredit program). In reaction, many colleges are redesigning student intake to ensure that all students—regardless of entry point—receive a consistent and comprehensive set of services.
- **Assess (and strengthen) institutional capacity for advising and supports:** Institutions would benefit from a rigorous internal analysis of their capacity to expand advising and support underprepared students with aspirations for STEM. Colleges with strong supports in place are likely to be more willing and able to encourage underprepared students to access pathways that lead to the exciting careers and solid wages offered by STEM.
- **Frequent and regular advising that integrates career and academic interests:** Many colleges are embedding career advising into academic advising sessions to ensure that students are choosing programs and courses aligned with their long-term interests.[18] In addition, advising support should not end after initial course selection. Some colleges allow students to work with mathematics faculty and advising staff to move into more or less advanced courses early in a semester based on student feedback about how well courses are meeting their needs.
- **Professional development and engagement:** Differentiated math pathways and their implications for placement represent a significant change to traditional practice in community colleges. Engage advisors, administrators, and faculty in understanding

the rationale for differentiated math pathways and devising new placement processes and be sure to attend to professional learning needs.

RECOMMENDATION 5

Prioritize student academic and career goals in the placement process.

In particular, keep STEM-aspiring students on STEM pathways. If a student declares the intent or desire to enter a STEM program, then colleges should make every effort to help that student enroll in and complete a STEM program. Examples of strategies that states and colleges can pursue include:

- **Broad career clusters:** Create cohorts of students grouped by their broad program interests, often referred to as meta-majors, communities of interest, career clusters, or broad program streams. Career clusters are a set of courses that meet academic requirements across a broad discipline grouping—such as health sciences, business, or education—to guide students through their early academic requirements. Student supports and career services are then aligned with the career cluster, and students experience both a cohort of like-minded students and faculty interactions aligned with their career interests. Colleges can align default recommendations about differentiated math pathways to career clusters. If an entering student declares a broad program stream such as information technology or allied health, her math requirements will be more easily identifiable to both student and advisor. Career clusters also facilitate early decision-making about programs of study and provide structure and support for students who begin college undecided about their majors.
- **Academic momentum in math:** The likelihood of student persistence in STEM programs is positively associated with taking math courses earlier in the academic career, taking more advanced math courses within the first year of enrollment, and earning a good grade in the first math course.[19] Colleges should advise students accordingly and provide supplementary instruction options that help students access college-level material as early as possible with just-in-time math supports.
- **Varying levels of readiness:** Support differentiated math pathways placement wherever students fall in the readiness continuum (i.e., regardless of whether a student's assessment results indicate the need for developmental education, are near the developmental education cut score, or suggest the student is ready for college-level courses). Students may begin at different places in developmental and gateway math sequences depending on their program of study pathway.

RECOMMENDATION 6

Create a bridging mechanism from non-algebra pathways to algebra pathways.

Even with the most robust placement processes and policies, some students will change their program choices in ways that affect which math course is needed for their majors. Evidence from system-wide data in Georgia suggests most changes of major occur within a broad program stream, such as social science, in which math course requirements are the same.[20] Although switching into a STEM major late in one's academic career is less common, the nation needs more students to choose STEM programs; colleges must be ready to support students through program shifts. Colleges and states need to design a means of helping a student who began in a non-algebra pathway to bridge into an algebra pathway later.

Bridging mechanisms have not been robust enough to date. One solution is to create a competency-based college-level algebra course. Students would progress at their own pace through content that supports the development of the essential procedural manipulation and algebraic reasoning skills that are essential for pursing math-intensive STEM fields. Content learned already through other courses would undergird, and hopefully accelerate, their progress. We hope this call to action will kick off further innovation in this area.

CONCLUSION

Efforts to redesign math pathways hold great potential for improving teaching and learning. Ideally, this will improve success for those students who need college algebra—many of whom are STEM students—while also helping students who do not need college algebra to complete college math requirements more quickly and successfully through alternatives such as statistics and quantitative reasoning. Furthermore, expanding the pipeline of low-income students and students of color into middle-skill STEM careers offers an opportunity to improve equity in our society. But at the moment, placement policies and processes are out of sync with reform trends and may in fact be diverting STEM-interested students from STEM pathways and further undermining equity.

We hope this call to action will kick off an important national conversation followed by state and college changes to assessment and placement policies, processes, and supports.

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[20] Research conducted by The Charles A. Dana Center. Email from Jenna Cullinane, January 21, 2015.

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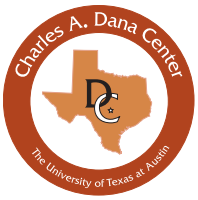

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