WTCS STUDENT SUCCESS CENTER

ACTION RESEARCH

Success in and timing of a student's first math enrollment influences graduation in identified programs

Hilary Barker, Ph.D. and WTCS Student Success Center Team (June 2020)

Course success in general education math and subsequent graduation:
A strong indicator of program completion is the student's grade in their first math course (Fig. 1).

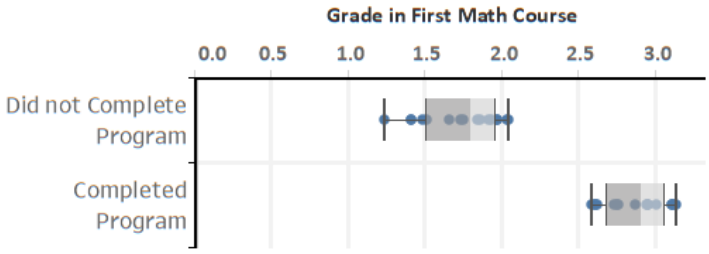

Figure 1. Boxplot of average math grades (0.0-4.0 scale where 4.0 = A) across districts for new program students in 2012-15 who both complete and do not complete their program within four years (many students are part-time)

While this result may reflect student preparation (e.g., students with fewer barriers perform better in math and are also more likely to graduate), this could highlight the importance of math success for student self-efficacy and subsequent program completion. Thus, teaching and delivery methods that increase student success in general education math will likely have a positive impact on program completion rates. Potential teaching and delivery methods that can increase math success, include:

- **Encouraging growth mindsets in math:** Students with a growth mindset perform better in math and have higher academic achievement overall. Luckily, mindsets are malleable throughout an individual's lifetime and thus course interventions can help students with fixed mindsets switch to a growth mindset. To learn about growth mindsets, visit mindsetkit.org, which provides strategies to promote growth mindsets, and how to redesign math problems to encourage learning rather than performance. While this toolkit was created for K-12 teachers, the lessons are also helpful and applicable for college (see the college course on growth mindsets and Columbia University's Inclusive Teaching Guide).
- **Guided pathways:** Math courses are aligned with the student's occupational program and provide contextualized content that is relevant to students with real-world problem solving and integrated supports.[1] Note, that while guided pathways promotes having students complete gateway courses in their first year, this research is generally based off of first-time full-time students, which may not apply well to all student populations (see Complete College America's math pathways data definitions).
- **Co-requisite coursework for students in need of math remediation:** Students in need of remedial math education are enrolled directly into the college-level math course and are provided with specific concurrent developmental or General College sections (in the Accelerated Learning Program model) and/or with additional supports (e.g., tutoring workshops).[2]

[1] Zachry Rutschow, Elizabeth. 2019. The National Academies of Sciences, Engineering, and Medicine Workshop on Understanding Success and Failure of Students in Developmental Mathematics: Developmental Mathematics Reforms.
[2] Daugherty, Lindsey, Celia Gomez, Diana Gehlhaus Carew, Alexandra Mendoza-Graf, and Trey Miller. 2018. Designing and Implementing Corequisite Models of Developmental Education. RAND Corporation.

Timing of first general education math enrollment:

While success in math is tied to graduation, a potentially easier change that colleges can make is the *timing* of a student's first math enrollment, which also affects graduation rates in identified programs. (Fig. 2).

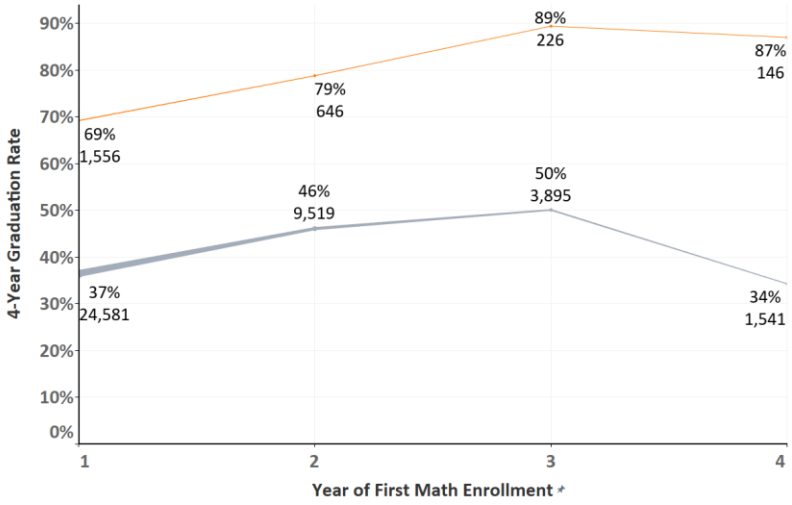

Figure 3. Four-year graduation rates for new program students in 2012-15, summarized by the year in which the student first enrolled in general education math (x-axis) and the length of the program that the student enrolled in (top orange line = 1-year technical diploma; bottom gray line = 2-year technical diploma and associate's degrees). The width of the line corresponds to the number of students in each category (shown under each percentage). The overall four-year graduation rate for these new program students was 45.8%.

If a student is enrolled in a 1-year or longer program, then their graduation rate increases if they first attempt general education math in their second or third year of coursework (Fig. 2, note that many students are enrolled part-time). Yet, this positive effect was only found for students enrolled in particular career clusters, including:

**Designates strong year effects for timing of math (odds ratio greater than 2)*

- *Business, Management and Administration*
- *Law, Public Safety and Security*
- *Manufacturing*
- *Arts, Audiovisual Technology and Communication**
- *Hospitality and Tourism*
- *Marketing, Sales and Service*
- *Education and Training*
- *Human Services**
- *Architecture and Construction*

For programs within the above career clusters, deans and faculty may want to consider the following questions when reviewing program maps and course sequencing:

1. What term is recommended within the program map for the general education math course?
2. If the term is in the first year, does the general education math course provide information that is *essential* for early program courses?
    a. If so, keep the math course as a first year (term 1 or 2) course recommendation.
    b. If not, potentially consider moving the math course to a later term (3 to 6). Note that this may require building program maps for part-time students.

The timing of a student's first math course attempt may be important due to potentially limiting their early exposure to program courses and/or the effects of early versus late setbacks in math. Taking general education courses in a student's first year may prohibit or limit them from being able to take occupational courses in their first year, which negatively affects program persistence.[3] In addition, WTCS students who do not successfully complete math in the first year of their academic program are substantially less likely to complete their program (16% completion rate) compared with students who experience this setback later (years 2-4) in their program (28-33% completion rate). This effect could be due to impacts on financial aid and/or a student's self-efficacy.

For information about the analyses and statistical methods for this project see the supplemental material.

[3] Jenkins, Davis and John Fink. 2018. New Insights for Guided Pathways Reforms from Research on Community College Student Momentum. Community College Research Center.