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POLICY BRIEF

Impact Findings from the Dana Center Mathematics Pathways Long-Term Follow-Up Study

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The conclusions of this research do not necessarily reflect the opinion or official position of the Texas Education Research Center, the Texas Education Agency, the Texas Higher Education Coordinating Board, the Texas Workforce Commission, or the State of Texas.

Executive Summary

Large numbers of students entering community colleges are deemed not academically prepared for college-level math. These students have historically been assigned to one or more non-credit-bearing courses for remedial math instruction before they can take college-level courses. Research has found that most students assigned to traditional developmental math course sequences never complete those sequences nor attain a credential. The Dana Center Mathematics Pathways (DCMP) model was created in 2011 to better support the needs of these students. The early version of DCMP implemented in this study diversified developmental and college-level math course content, separating it into distinct pathways that better align with students' career interests including a statistics pathway for students majoring in social and health sciences and a quantitative reasoning pathway for students majoring in the humanities. It also streamlined the developmental math sequence so that students were prepared to advance to any math pathway after only one semester, even students who tested two or more levels below college-ready in math. It also included curriculum and classroom instructional practices that engaged students in active problem solving pertinent to real-life situations, and provided academic and social supports for students that were both integrated into the developmental math courses and aligned with other college services.

This brief highlights the findings from a rigorous long-term follow-up study of an early version of the DCMP model. The study found that the model had a sustained impact on students' successful completion of their first college-level math course of 5.6 percentage points after five years. This impact on college-level math completion did not lead to discernible effects on credential completion, however. Since the launch of this early version of DCMP, the Dana Center has continued to refine and update the model over time and the findings in this study do not reflect the effects of the current version of the DCMP model. The findings do offer some insights that may inform the current implementation of math pathways and other developmental math reforms. Please see here for more information on the study and findings.

What We Studied

Community colleges have been struggling for decades to better support the large number of students entering college who are deemed academically underprepared for college-level work in math. Historically, these students have been required to take and pay for a sequence of one to three or more semester-length non-credit-bearing courses, referred to as developmental math courses, before moving on to college-level math. By the early 2000s, 59 percent of students entering two-year institutions were taking at least one developmental math course and students of color and students from lower-income backgrounds were more likely than their White and higher-income peers to take these courses.[i] Unfortunately, this policy has not been successful in supporting underprepared students. Research has found that most students identified for traditional developmental math education never completed their developmental sequence nor completed any college-level math credits, leaving them unable to attain a credential.[ii]

How We Analyzed the Data

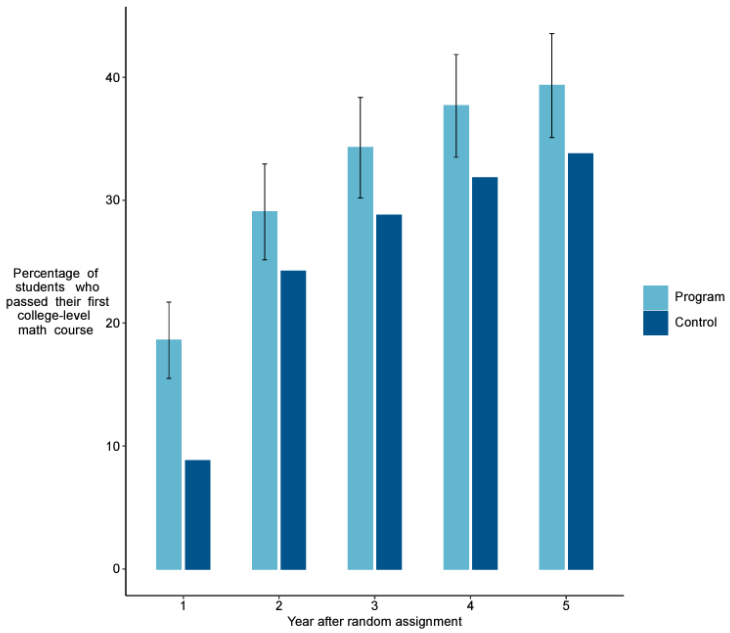
A rigorous randomized controlled trial (RCT) of this early version of DCMP was launched in 2014 at four Texas colleges.[iii] It found that DCMP had a positive impact on students' completion of the developmental math sequence, increasing their likelihood of taking and passing college-level math and thus the number of math credits earned during the first three semesters.[iv] The colleges in the study include El Paso Community College, Trinity Valley Community College, and two colleges from the Dallas County Community College District: Brookhaven College and Eastfield College. Students were enrolled in the study in four cohorts from the fall 2015 semester through the spring 2017 semester. A total of 1,411 students were enrolled—856 were assigned to DCMP and 555 were assigned to the colleges' standard developmental math sequence. The study targeted students who planned to major in the social sciences or liberal arts and were referred to one or more levels of the developmental math sequence. Over 60 percent of students were female, over 50 percent were Hispanic, and over 80 percent tested at least two levels below college-ready on the math placement exam.

The main research question of this follow-up study is what is the effect of the opportunity to participate in DCMP on students' college-level math course completion, college credit accumulation, and credential attainment or transfer to and persistence at a four-year institution? This brief summarizes the long-term findings of the study, looking at the impacts on students through five years after random assignment.

What We Discovered

As shown in Figure 1, the early version of the DCMP model evaluated in this study had a positive impact (amounting to almost 10 percentage points) on students' math completion during the first year, and the impacts persisted through the five-year follow-up period, with students who were offered DCMP still 5.6 percentage points more likely to have successfully completed their first college-level math course in the fifth year.

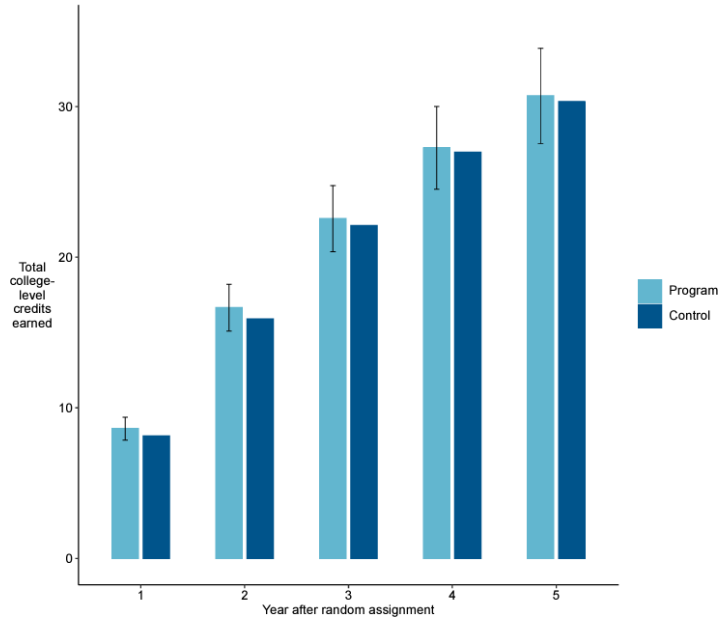
Figure 1. Impact on Completing First College-Level Math Course



SOURCE: Data provided by the Texas Education Research Center.
NOTES: The vertical lines (or error bars) at the top of each program bar represent the 90 percent confidence intervals around the impact estimates.
Sample size is 1,411.

As shown in Figure 2, while more students who were offered DCMP passed their first college-level math course, the early version of the DCMP model had no discernible effect on students' total college-level credits earned during any year of the study. This finding suggests that while DCMP helped students succeed in college-level math, it did not lead to students taking or passing more college classes in general.

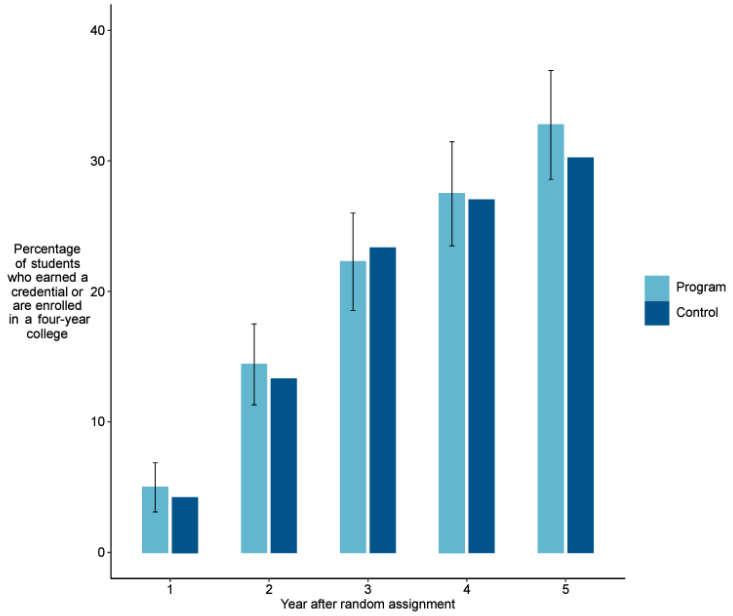
Figure 2. Impact on Total College-Level Credits Earned



SOURCE: Data provided by the Texas Education Research Center.
NOTES: The vertical lines (or error bars) at the top of each program bar represent the 90 percent confidence intervals around the impact estimates.
Sample size is 1,411.

As shown in Figure 3, this early version of the DCMP model did not have a statistically significant impact on students' credential completion or current enrollment at a four-year college during any of the five years.[v] There were also no impacts on ever earned a certificate, associate's degree, or bachelor's degree after five years when measured separately. At five years after the start of their participation in the study, just under a third of students who were offered DCMP had earned some type of credential or were currently enrolled in a four-year institution.

Figure 3. Impact on Credential Completion or Current Enrollment at a Four-Year College



SOURCES: Data provided by the Texas Education Research Center and the National Student Clearinghouse.
NOTES: The vertical lines (or error bars) at the top of each program bar represent the 90 percent confidence intervals around the impact estimates.
Sample size is 1,411.

Policy Recommendations

This early version of the DCMP model had an initial and sustained positive impact on students' completion of a first college-level math course through five years after random assignment. The requirement to pass college-level math is a major obstacle to attaining a credential for many students, and this model supported more students in overcoming that obstacle. These impacts on math completion did not lead as hypothesized to broader impacts on academic progress and attainment. The only impact found on those outcomes was on college persistence (that is, current enrollment in college or previously earned a credential) and only during the fifth year. Perhaps the expectation that a single math intervention targeted to incoming students would affect college completion was overly optimistic.

It is also possible that some adjustments to this early version of the DCMP model could make it more effective. Over the ten years since this study began, the Dana Center has been working on ways to strengthen the model's impact. For example, the center has integrated a corequisite remediation course structure into their model recommendations. This structure further accelerates students' entrance into credit-bearing courses. Instead of the one-semester developmental course included in the version of the DCMP model in this study, students may enter directly into a college credit course in their pathway. At the same time, those students in need of developmental assistance may receive holistic services that include a companion support course, tutoring, and help from an advisor, among other services.[vi] A recent long-term experimental study of corequisite remediation in a math pathway setting in three City University of New York (CUNY) colleges found impacts of that program on completing associate's and bachelor's degrees.[vii] Those findings suggest that the Dana Center's current effort to move to a corequisite remediation model may lead to stronger effects on academic progress and success. One of the key hypotheses for what might make corequisite remediation effective, especially when combined with a math pathways model, is that

it allows students to directly enter college-level math, removing the obstacles of developmental sequencing and making it possible for students to earn college-level math credits in their first semester of college.

Still, not all studies of corequisite remediation have found impacts on longer-term outcomes. A study of a statewide intervention in Tennessee that instituted corequisite remediation with math pathways found that students on the margin of the college-readiness threshold who were placed into corequisite remediation were 15 percentage points more likely to pass their first college-level math course. But, similar to this DCMP study, the Tennessee study did not find significant impacts on enrollment persistence, transfer to a four-year college, or degree completion.[viii] While pairing math pathways with corequisite remediation may lead to stronger impacts, the impact of corequisite remediation on longer-term outcomes, even with math pathways, may be dependent on other important factors, such as the student sample, the setting, or the particular design of the intervention.

A movement toward corequisite remediation is underway. Since the start of this study, the state of Texas has moved its colleges toward corequisite remediation. The state legislature voted Texas House Bill 2223 into law in 2017 requiring colleges to offer 100 percent of developmental sections as corequisite courses starting in the 2021–2022 academic year, and about nine out of ten institutions met the goal that year.[ix] More research is needed to fully assess the effectiveness of the corequisite model combined with the math pathways model.

Another option to help boost graduation rates might be to pair accelerated or corequisite math pathways with multifaceted support programs that extend past the first year of college. These programs use multiple components such as academic advising, tutoring, individual career and employment services, and tuition assistance over multiple years to address an assortment of barriers to students' college success. One notable example, the Accelerated Study in Associate Programs (ASAP) model, has been shown to nearly double graduation rates in multiple colleges across two states with different student populations.[x] While programs such as DCMP can make an important contribution, colleges may want to consider integrating math reforms with multifaceted services to meet the needs of a diverse set of students. A synthesis of experimental studies of community college reforms found that the effects tend to be larger for interventions that are more comprehensive (those that have more components).[xi] While math pathways is an effective tool for supporting students through college-level math completion, pairing it with other services could help students overcome other obstacles they may face to college success.

Notes and References

[i]Xianglei Chen, *Remedial Coursetaking at US Public 2- and 4-Year Institutions: Scope, Experiences, and Outcomes. Statistical Analysis Report.* NCES 2016-405 (Washington, DC: National Center for Education Statistics, 2016), website: https://nces.ed.gov/pubs2016/2016405.pdf.

[ii]Thomas Bailey, Dong Wook Jeong, and Sung-Woo Cho, "Referral, Enrollment, and Completion in Developmental Education Sequences in Community Colleges," *Economics of Education Review* 29, 2 (2010): 255–270, website: https://doi.org/10.1016/j.econedurev.2009.09.002.

[iii]RCTs measure the effectiveness of an intervention by randomly assigning participants to receive the intervention or not and then comparing the outcomes of the two groups. The randomness of the assignment creates two groups that are similar, on average, in all ways except their receipt of the intervention.

[iv]Elizabeth Zachry Rutschow, Susan Sepanik, Victoria Deitch, Julia Raufman, Dominique Chevelle Dukes, and Adnan Moussa, *Gaining Ground: Findings from the Dana Center Mathematics Pathways Impact Study* (New York: Center for the Analysis of Postsecondary Readiness, 2019), website: https://ccrc.tc.columbia.edu/publications/gaining-ground-dana-center-mathematics-pathways.html.

[v]When an impact is not statistically significant it cannot be proven that the impact is different from zero—that is, it is possible that the impact was due to chance alone rather than the program.

[vi]Connie Richardson, "Corequisite Mathematics Toolkit: Tools and Resources for the Design and Implementation of Equitable and Effective Support Courses," (Austin, TX: Charles A. Dana Center, 2021), website: https://strongstart.org/wp-content/uploads/2021/08/SSTFToolkit_DanaCenter_Final-1.pdf.

[vii]Daniel Douglas, Alexandra W. Logue, and Mari Watanabe-Rose, "The Long-Term Impacts of Corequisite Mathematics Remediation with Statistics: Degree Completion and Wage Outcomes," *Educational Researcher* 52, 1 (2023): 7–15, website: https://doi.org/10.3102/0013189x221138848. Alexandra W. Logue, Mari Watanabe-Rose, and Daniel Douglas, "Should Students Assessed as Needing Remedial Mathematics Take College-level Quantitative Courses Instead? A Randomized Controlled Trial," *Educational Evaluation and Policy Analysis* 38, 3 (2016): 578–598, website: https://doi.org/10.3102/0162373716649056.

[viii]Florence Xiaotao Ran and Yuxin Lin, "The Effects of Corequisite Remediation: Evidence from a Statewide Reform in Tennessee," *Educational Evaluation and Policy Analysis* 44, 3 (2022): 458-484, website: https://doi.org/10.3102/01623737211070836.

[ix]Christine G. Mokher and Toby J. Park-Gaghan, "Taking Developmental Education Reform to Scale: How Texas Institutions Responded to Statewide Corequisite Implementation," *Innovative Higher Education* 48, 5 (2023): 861-878, website: https://doi.org/10.1007/s10755-023-09656-7.

[x]Cynthia Miller and Michael J. Weiss, "Increasing Community College Graduation Rates: A Synthesis of Findings on the ASAP Model from Six Colleges Across Two States," *Educational Evaluation and Policy Analysis* 44, 2 (2022): 210–233, website: https://doi.org/10.3102/01623737211036726.

[xi]Michael J. Weiss, Howard S. Bloom, and Kriti Singh, "What 20 Years of MDRC RCTs Suggest about Predictive Relationships Between Intervention Features and Intervention Impacts for Community College Students," *Educational Evaluation and Policy Analysis* 0, 0 (2022), website: https://doi.org/10.3102/01623737221139493.