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POLICY BRIEF

Accelerating Success: A Multi-College Investigation of the Dana Center Mathways Project

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What We Studied

Every year, colleges refer more than a million students they deem underprepared for college-level mathematics coursework to sequences of one or more developmental math courses. Most of these students linger in developmental math courses for years, either because they are placed into longer sequences of courses, struggle to pass these courses, or both. Developmental and college-level math requirements are both significant barriers for many students, regardless of major (Bailey, Jeong, & Cho, 2010; Chen, 2016).

In this study, we examined one strategy for dev-ed math reform, the Dana Center Math Pathways (DCMP) model. The DCMP model encouraged students to enroll in a college-level math course best suited to their field of interest and, at the time of inquiry, used a compression approach, condensing sequences of two or more developmental courses into a shorter, accelerated prerequisite course that covers the same content in a single semester. Among two cohorts of students who enrolled in developmental math courses in fall 2015 and fall 2016, we compared key early outcomes of those enrolled in DCMP developmental courses with peers enrolled primarily in traditional developmental math courses. We find evidence of greater enrollment and pass rates in introductory college-level math courses among the DCMP enrollees as early as one semester after developmental enrollment.

How We Analyzed the Data

We used student data collected by the Texas Higher Education Coordinating Board (THECB), including demographic information, enrollment records, placement test scores and exemptions, credits, grades, and degree outcomes, along with financial aid application (FAFSA) information. Using a list of course and section numbers provided by the Dana Center, we identified students enrolled in DCMP developmental courses at each of the implementing colleges in fall 2015 and 2016. The comparison group was primarily composed of students in traditional developmental math sequences (identified based on course number), but at least some colleges were experimenting with alternative developmental math reforms. We ran descriptive statistics to compare the two groups and understand sorting into DCMP vs. non-DCMP dev-ed math courses. We then used a linear probability model to estimate the relationship between enrollment in DCMP developmental math and several important milestones for student success, such as passing introductory college-level math within two years (or within one year, for specifications performed on students from the fall 2016 cohort). We control for demographics, including gender, race/ethnicity, age, whether the student was FTIC, and TSI score.

What We Discovered

To examine differences between students in DCMP courses and other developmental math courses, we present summary statistics for all students who enrolled in developmental math at Texas community colleges offering DCMP

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in fall 2015 and fall 2016 (see Table 1 below). The first three columns of Table 1 include all students enrolled in developmental math in fall 2015, broken into those enrolled in DCMP developmental courses and those enrolled in non-DCMP developmental courses at colleges that offered DCMP, and the differences between these two groups. The second three columns include all students enrolled in developmental math in fall 2016, broken into the same categories.

Table 1. Description of Students in DCMP vs. non-DCMP Developmental Math: Fall 2015 & 2016

	Fall 2015			Fall 2016		
	DCMP Courses	Non-DCMP Courses	Difference	DCMP Courses	Non-DCMP Courses	Difference
Campuses	24	23		27	27	
Students	4,857	23,837		6,653	25,206	
Dev-Math Course Enrollments	4,974	26,714		8,107	27,915	
Pass Rate	66.6%	61.3%	5.3%***	66.8%	59.9%	6.9%***
Demographics						
Female	64.1%	60.5%	3.6%***	60.4%	65.0%	58.9%
Race/Ethnicity						
White	43.5%	25.3%	18.2%***	40.1%	28.7%	11.5%***
Asian	1.1%	1.4%	-0.3%*	1.5%	2.9%	-1.4%***
Black	20.6%	16.1%	4.5%***	15.3%	15.6%	-0.3%
Hispanic	31.7%	54.1%	-22.4%***	39.6%	50.6%	-11.0%***
Other	3.1%	3.1%	0.0%	3.4%	2.3%	1.2%***
Age						
0-19	52.2%	47.6%	4.5%***	53.8%	50.2%	3.6%***
20-24	20.7%	23.1%	-2.4%***	20.0%	22.6%	-2.6%***
25+	25.5%	25.0%	0.6%	21.9%	23.2%	-1.2%**
Placement Test						
Has TSI Score	67.1%	52.5%	14.6%***	67.1%	63.4%	3.7%***
Mean TSI Score	334.1	331.2	2.9***	334.0	332.8	1.2***
Has Any Test Score	69.0%	56.5%	12.5%***	68.9%	65.3%	3.6%***
Mean Z-Score (Any Test)	-0.55	-0.74	0.19***	-0.64	-0.71	0.08***
Financial Aid						
Has FADS Record	30.3%	29.7%	0.6%	25.9%	28.0%	-2.1%***
Average Student Income	$10,843	$10,092	$751	$9,851	$9,355	$496
Average Family Income	$17,652	$16,778	$874	$20,486	$21,538	-$1,051
Average Family Contribution	$2,658	$2,157	$500**	$3,055	$2,863	$192
Average Unmet Need	$8,200	$9,252	-$1,052***	$7,176	$7,893	-$717***

Notes: The Dev-Math Course Enrollments counts the course enrollments in the given category of developmental math, which may be more than one per student. Other than that row, students are counted only once per column. The Placement Test section is based on Texas Success Initiative (TSI) Report. If a student has a TSI Report record with a score from the math TSI test within the past 5 years, they are counted as having a TSI score; "any test score" captures those with either a TSI math score or any other math placement test score within 5 years. For an overview of the TSI placement test, see THECB (2017). Despite mandates for placement tests and reporting, there are non-negligible rates of missing test score data (see Schudde & Meiselman, 2019)
***$p < .01$, **$p < .05$, *$p < .1$

Table 1 illustrates that students enrolled in DCMP courses were more likely to be White and female than students enrolled in non-DCMP courses. Although DCMP courses included more Black students than non-DCMP courses, the disparities in White and Hispanic student enrollments—in which White students appear to be strongly overrepresented and Hispanic students strongly underrepresented in DCMP courses—are striking. Students enrolled in DCMP courses were also somewhat more likely to have test score records from the Texas Success Initiative (TSI) assessment (the mandated placement test in Texas), and conditional on having scores, their scores tended to be significantly higher. There also appear to be some differences in financial measures across students enrolled in DCMP and non-DCMP courses, though the differences are only statistically significant for the average family contribution and unmet financial need measures. However, most students did not have financial aid records containing this information—among all the students, under a third filed for financial aid.

Our main takeaway from the descriptive patterns in both cohorts is that there appear to be systematic differences between students enrolled in DCMP and non-DCMP developmental math courses. Compared with non-DCMP courses, DCMP courses included more White students, fewer Hispanic students, and fewer male students than we would expect to see based on the distribution of students at the colleges. The observed selection—particularly the variation in participation across race/ethnicity—signals inequality in subgroup access to reformed developmental math pathways (we elaborate on this in the policy recommendation section). Without more information about how students were selected for enrollment in DCMP courses, we cannot ascertain the drivers of these patterns. However, it implies colleges must be careful in considering how reforms are implemented to ensure equal access to reformed courses.

Next, we examine the outcomes of students who participated in DCMP courses using regression models. The systematic differences across DCMP and non-DCMP students at DCMP-offering colleges motivate our inclusion of various controls in the regression analysis.

In Table 2, we present coefficient estimates from our regressions. Column 1 shows that, after controlling for a host of background characteristics and TSI scores, fall 2015 DCMP students were around 2 percentage points more likely to pass developmental math that term than their non-DCMP peers. DCMP students were slightly less likely to persist to the next semester than non-DCMP students, but they were much more likely to enroll in a college-level math course in that next term (driven by higher enrollment in college-level math among DCMP students who persisted). Participating in DCMP in fall 2015 is associated with a 17-percentage-point increase in the probability of enrolling in college-level math in the next term. Within two years, DCMP students were 9 percentage points more likely to enroll in college-level math and 5 percentage points more likely to pass college-level math than their peers who enrolled in non-DCMP courses. The positive relationship between DCMP developmental course enrollment and short-term outcomes is expected, as students in DCMP should take fewer developmental math courses overall and should enroll in college-level math earlier than students in traditional developmental math sequences.

Column 2 shows results for the fall 2016 cohort, but due to a shorter follow-up period, the longer term dependent variables capture the probability of each respective outcome within one year rather than two years. While there are some differences in short-term results across cohorts, the patterns generally hold across cohorts with one exception: next-semester persistence. The estimate for enrolling in college in the next semester is positive for DCMP students in the fall 2016 cohort but negative for those in the fall 2015 cohort. Other short-term estimates also differ, but less dramatically; for example, the estimate for passing developmental math is larger in magnitude and the estimates for the next-semester outcomes are smaller in magnitude among the fall 2016 than among the fall 2015 DCMP students. Column 3 pools the fall 2015 and fall 2016 cohorts to show the combined DCMP results within one year (we use these estimates in our final discussion below). The point estimates from the combined cohorts are a higher for the passing of developmental math (an increased likelihood of 4 versus 2 percentage points among DCMP students) and somewhat lower for most other outcomes than our preferred specification from the 2015 cohort.

Overall, DCMP appears to have offered students an immediate boost in college-level math enrollment and completion. The results from our regression analysis suggest that the advantage gained in the first term after enrollment in developmental math was maintained over time—there was still a 5-percentage-point improvement in passing college-level math two years later among those in the fall 2015 cohort, which has a longer follow-up period than the 2016

cohort. The acceleration in meeting the milestone of college-level math completion represents time and effort saved for DCMP students. Conditional on eventually passing college-level math, completing the requirement a semester or two earlier may be a substantial benefit, as it could allow students to graduate earlier. Further, some DCMP students pass college-level math who may not pass otherwise.

Table 2. Estimated Differences in Outcomes of Students Enrolled in DCMP and Non-DCMP Developmental Math

Outcome	Fall 2015 Cohort	Fall 2016 Cohort	Combined
Passed Developmental Math	0.02** (0.01)	0.06*** (0.01)	0.04*** (0.01)
Next Semester:			
Enrolled in College	-0.02** (0.01)	0.02*** (0.01)	0.00 (0.01)
Enrolled in College-Level Math	0.17*** (0.01)	0.11*** (0.01)	0.13*** (0.01)
Passed College-Level Math	0.10*** (0.01)	0.07*** (0.01)	0.08*** (0.00)
College Credits Attempted	2.46*** (0.24)	1.11*** (0.21)	1.64*** (0.16)
College Credits Earned	1.47*** (0.22)	0.65*** (0.20)	0.95*** (0.15)
Subsequent Years:	Within 2 Years	Within 1 Year	
Enrolled in College	-0.03*** (0.01)	-0.01 (0.01)	-0.01** (0.01)
Enrolled in College-Level Math	0.09*** (0.01)	0.07*** (0.01)	0.09*** (0.01)
Passed College-Level Math	0.05*** (0.01)	0.05*** (0.01)	0.06*** (0.01)
College Credits Attempted	3.00*** (0.42)	1.41*** (0.26)	2.02*** (0.19)
College Credits Earned	1.64*** (0.40)	0.77*** (0.24)	1.13*** (0.18)
N	15,180	19,669	34,849

Notes: In all columns, the treatment group is comprised of students enrolled in DCMP developmental math courses, while the comparison group is comprised of students enrolled in other developmental math courses at the same set of colleges. All regressions include controls for gender, race/ethnicity, age, FTIC status, and TSI math placement test scores. We exclude students without TSI score records. ***p < .01, **p < .05, *p < .1

Policy Recommendations

The positive relationships between enrolling in DCMP developmental courses and important college outcomes bolster support for expanding access to accelerated developmental education options. Math reforms like compressed prerequisite and corequisite developmental coursework are opportunities for students to gain momentum through their college requirements. Since the onset of this study, the state passed House Bill 2223, which mandated that colleges increasingly enroll students into corequisite coursework (pairing developmental-education courses with college-level courses). The patterns of results from our work suggest that allowing students to more quickly enter college-level math courses will improve student outcomes, though our focus was on compressed prerequisite courses and not corequisite courses.

Given the positive relationships between enrolling in DCMP developmental courses and important college outcomes, the systematic sorting of students into DCMP—and particularly the differences in participation across race/ethnicity—is a concern. DCMP-implementing colleges tend to enroll a disproportionate number of White students in DCMP developmental courses relative to students from other racial/ethnic groups and especially relative to Hispanic students. Math reforms like compressed prerequisite and corequisite developmental coursework are opportunities for students to gain momentum through their college requirements. For that reason, colleges' placement practices have important implications for equity—decisions about placement by college personnel that serve to accelerate some students through developmental and college requirements and leave others with the status quo could exacerbate educational inequalities.

The patterns we observe in DCMP versus non-DCMP developmental course enrollment—based on decisions made at the college level—may be useful to educators across the country as they think about student access to innovations in developmental math, including ongoing corequisite reforms like those now being implemented in Texas. Understanding selection into reformed pathways is crucial to improving equity and student success. College personnel make important decisions about which students have access to new opportunities in developmental math and which are left behind in traditional developmental pathways. If reforms are not implemented at scale (i.e., not offered to all students), then policymakers and college leaders seeking to improve on their reform efforts should work to ensure that students have equal access to opportunities to advance to and through college-level coursework. If reforms prove successful for large numbers of students, they should be scaled broadly.

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