

Symposium Title: Developmental Education Reform to Improve Student Outcomes: Findings from four Evaluations

Organizer: James Benson, Institute of Education Sciences

Discussant: Christopher M. Mullin (Education Commission of the States)

A confluence of initiatives by researchers, policymakers, legislators and student advocacy groups currently combine to generate an extraordinary level of attention to developmental education (DE) reform. For over 10 years, researchers have pointed to lengthy sequences of non-credit developmental courses as impediments to student progression (Bailey 2009) and searched for strategies to assist students in DE (e.g. Visser et al. 2012). More recently, researchers have begun to identify promising strategies for organizing and delivering DE (e.g. Edgecombe et al. 2014, Gardenhire et al. 2016). Since 2011, policymakers have drawn on the emerging research base to implement a host of research-driven reform strategies (see Figure 1). In the last 5 years, legislators in large states have accelerated the pace of reform by enacting sweeping reform legislation (e.g. Senate Bill 1720 in Florida), and student advocacy groups have made DE reforms central to their college completion agendas. The swift pace of reform initiatives combined with the immense task of overhauling DE systems surpasses the scope and pace of research aimed at identifying effective reform strategies.

This symposium strives to expand the DE research base by featuring findings from four evaluations. Because research teams are carrying out the evaluations in close coordination with policymakers, each has the potential to inform future policy decisions, and two are already influencing policy implementation at the state level. The symposium addresses these issues:

1. How can colleges accurately assess students for placement into (and out of) DE in order to promote academic success?
2. Which DE reform strategies are effective in facilitating students' success in subsequent coursework and completion of college?
3. What are the impacts of DE reform for historically-underrepresented student groups?

Researchers have found that a significant proportion of students are under-matched to entry-level math and reading/writing courses, with some being capable of immediately succeeding in credit-bearing courses and many others being capable of succeeding with appropriate academic supports (Scott-Clayton, Crosta & Belfield 2014). **Paper #1** addresses this topic by evaluating a set of alternate placement algorithms designed by instructors within the SUNY system. Although the alternate English algorithms place a much larger proportion of students into credit bearing courses than the alternate math algorithms, evaluation of both sets of algorithms provides a clear test of the under-matching hypothesis. For over 10 years, researchers have pointed to the slow progress of students through DE (Bailey, Jeong & Cho 2010). **Paper #2** evaluates corequisite remediation, an increasingly popular strategy of accelerating student progression by providing

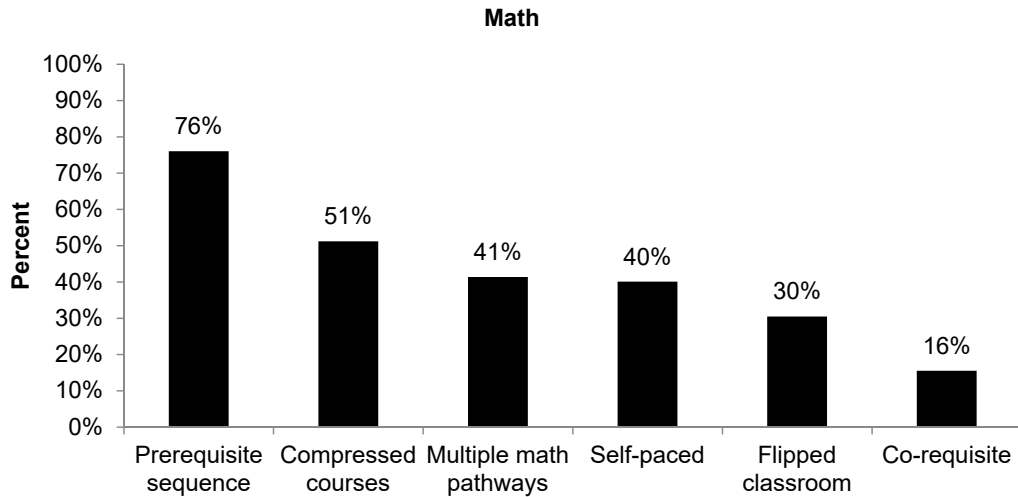
them assistance concurrent with their enrollment in credit-bearing courses. As noted above, researchers have pointed to the need for improvements to the delivery of DE, and **Paper #3** addresses this issue by evaluating and studying implementation of the DCMP, a career-relevant curriculum built around real-world math problems. While each paper addresses moderation of impacts by student sub-groups, **Paper #4** focuses specifically on the differential effects of the broad statewide DE reform in Florida for traditionally-underrepresented student groups.

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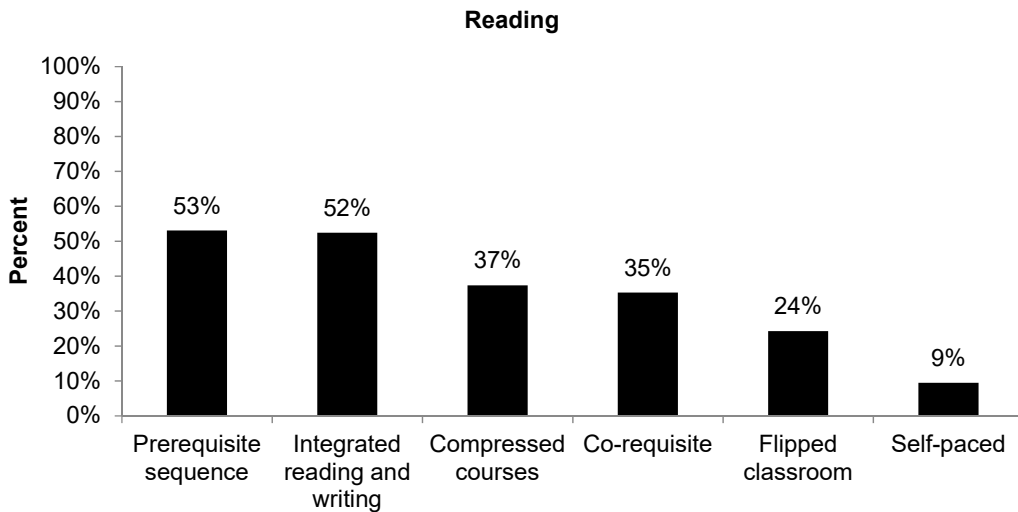
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Figure 1
Prevalence of Developmental Education Instructional Methods
Among Public 2-Year Colleges (2016)

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SOURCE: Data from the Center for the Analysis of Postsecondary Readiness' institutional survey.
 NOTES: Percentages among 2-year public colleges that reported offering developmental courses.
 Colleges were counted as using an instructional method if they used it in more than two course sections.

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Distributions may not sum to 100 percent because categories are not mutually exclusive.
 Categories are defined as following: prerequisite sequence courses follow a traditional multi-semester developmental sequence; compressed courses allow students to complete two developmental courses in one semester; multiple math pathways are sets of linked courses that are designed to give students math skills relevant to their degree requirements and program of study; self-paced courses allow students to work through course content independently; in the flipped classroom model, students are exposed to content outside of class often through online materials, while most in-class time is devoted to activities, projects, and discussions; co-requisite courses are those in which students are placed directly into a college-level course while concurrently enrolling in a developmental course that serves as a learning support; and integrated reading and writing courses are those where reading and writing skills are taught together in a developmental English course.

Paper #1: Evaluation of a Multiple Measures Placement System Using Data Analytics: Early Impact Findings

Authors: Elisabeth Barnett* (CCRC), Peter Bergman (CCRC), Elizabeth Kopko* (CCRC), Vikash Reddy (CCRC), Clive Belfield (Queens College, CUNY), and Susha Roy (CCRC)

Background/Context: Two thirds of students who attend community colleges and two fifths of students who attend public four-year colleges enroll in one or more remedial courses (Chen, 2016). Remedial courses require students to invest time and money that could be applied to college-level coursework, and studies suggest that the effects of remedial courses on student outcomes are at best mixed for students on the cusp of needing additional academic support (Jaggars & Stacey, 2014). Further, students who start college in remediation are less likely to graduate (Attewell, Lavin, Domina, & Levey, 2006).

Most students who participate in remediation in math and/or English are referred to these programs based on scores they earn on standardized placement tests. Research shows that some students assigned to remediation would likely pass a college-level course in the same subject area if given that opportunity; it also suggests that using multiple measures, including high school GPA, may be useful in assessing college readiness (Belfield & Crosta, 2012; Scott-Clayton, 2012). An increasing number of colleges are exploring or beginning to use multiple measures to place incoming students (Rutschow & Mayer, 2018). This study builds on this trend in the field of practice by evaluating a placement system that employs an algorithm with thresholds set by college instructors.

Purpose/Objective/Research Question: To evaluate the impact of a multiple measures placement system on student outcomes, CAPR initiated an experimental study in partnership with the State University of New York (SUNY) system and seven community colleges.

This presentation has three aims: (i) to explain why there is a need to change assessment and placement practices; (ii) to explain how a multiple measures placement system using data analytics is implemented in different college contexts; and (iii) to present early impact findings from a randomized control trial (RCT) comparing the effects on student outcomes of placing students into remedial or college-level courses with either a multiple measures placement system or a status quo system that uses just placement test scores.

Setting: Research was conducted at seven participating SUNY community colleges (see Table 1). While our students were randomly selected, the colleges were not, thus limiting the generalizability of the study.

Population/Participants/Subjects: We will present early impact results from the study’s first cohort of students, which includes all eligible students who went through intake at a participating college in fall 2016 and opted to participate in the study. Our analytic sample consists of 4,729 students who took a placement test, of which 3,865, or about 82%, enrolled in at least one remedial or college-level course of any kind during the fall 2016 term. Table 2 shows baseline descriptive statistics for students enrolled during the first semester of the study.

Intervention/Program/Practice: CAPR researchers and college personnel collaborated to develop the algorithms and alternative system for placement. Given differences among participating colleges, algorithms were created for each college individually, using historical data from 2011–14. Data on multiple measures — including high school GPA, years since high school graduation, and placement test scores — as well as data on outcomes in college-level courses, were used to create algorithms that weight each measure in the most appropriate way for predicting student performance in initial college-level math and English courses. Faculty at each college then created placement rules by choosing the cut points that would be used to place program group students into remedial or college-level courses.

Research Design: The study employs an RCT that meets What Works Clearinghouse evidence standards without reservations. Entering first-year students were informed about the research and afforded the opportunity to seek additional information and/or opt out. Participants took placement tests and were randomly assigned to be placed by either the status quo method (control group students) or the multiple measures algorithm (program group students). Table 3 provides evidence that students are well-balanced across program and control groups, providing assurance that the random assignment was implemented as intended.

Data Collection/Analysis: Implementation findings are based on interviews with college personnel at all seven colleges. Our impact analyses were conducted using ordinary least squares regression analyses, controlling for college fixed effects and a range of student characteristics. For both math and English, we consider three outcome measures constructed from administrative data: the rate of college-level course placement (versus remedial course placement), the rate of college-level course enrollment, and the rate of college-level course completion with grade C or higher, all in the same subject area. To examine whether program assignment led to differential first-term impacts by race/ethnicity, Pell status, or gender, we conducted subgroup analyses and tested the significance of interaction effects for each subgroup.

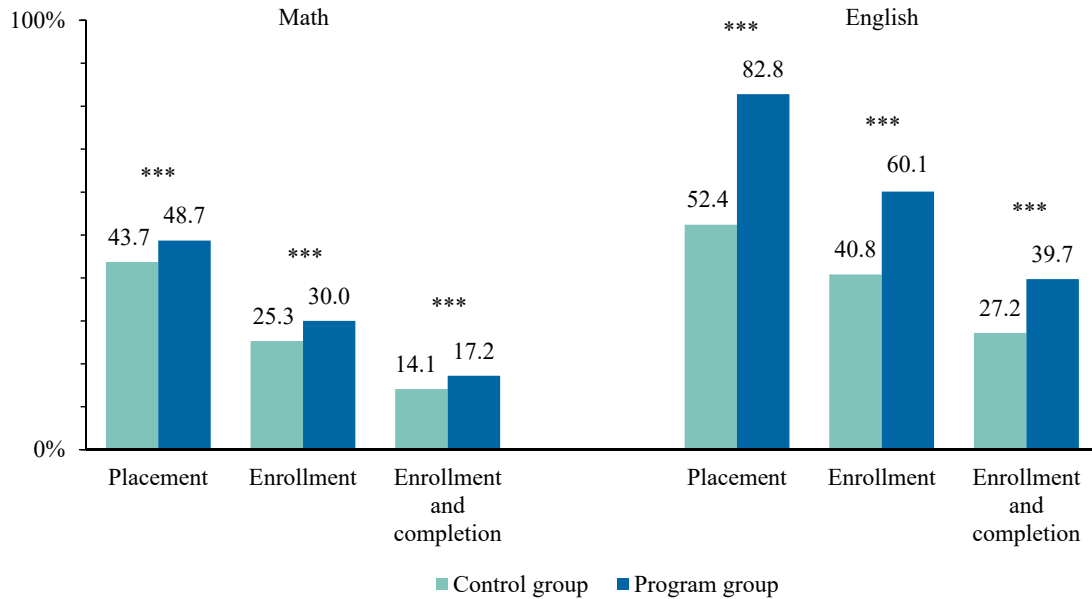
Findings/Results: Our results are consistent with the hypothesis practitioners can design placement systems that lead to greater rates of student progress by employing a relatively small set of measures identified as predictive of college success,.

Impact analyses indicate that many program group students were placed differently than they would otherwise have been. In math, 14% of program group students placed higher than they would have under a test-only system, while 7% placed lower. In English, 41.5% placed higher, while 6.5% placed lower.

Further, program group students were 3.1 and 12.5 percentage points more likely than control group students to both enroll in and complete a college-level math or English course in the first term (Figure 1). Additionally, subgroup analyses produced differential impacts between women and men, as well as among different ethnicities.

Figure 1

College-Level Course Outcomes in Math and English



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*** $p < .01$, ** $p < .05$, * $p < .10$.

Our results concerning implementation suggest that establishing a data analytics placement system is challenging but manageable.

Conclusions: These early results are broadly positive but assess outcomes based on merely one semester of data. Further impact analyses using additional data will include data on persistence and accumulation of college credits over the longer term to fully evaluate the effects of using a multiple measures system to place incoming students. Additional sub-group analyses will also be conducted.

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Table 1
College Characteristics^a

Characteristic	Institution						
	Cayuga	Jefferson	Niagara	Onondaga	Rockland	Schenectady	Westchester
General college information							
Student population	7,001	5,513	7,712	23,984	10,098	8,458	22,093
Full-Time faculty	69	80	151	194	122	79	215
Part-Time faculty	170	177	0	480	409	0	2
Student/faculty ratio	20	18	16	23	23	23	16
% receiving financial aid	92	91	92	92	56	92	70
Demographics							
Race/ethnicity (%)							
American Indian or Alaska Native	0	1	1	1	0	1	1
Asian	1	2	1	3	5	7	4
Black or African American	5	7	11	12	18	14	21
Hispanic/Latino	3	11	3	5	20	6	32
Native Hawaiian or Other	0	0	0	0	0	1	0
White	85	73	80	49	39	67	33
More than one race/ethnicity	2	3	2	3	2	2	2
Race/Ethnicity unknown	3	3	1	27	15	2	5
Non-Resident Alien	1	1	0	0	1	0	1
Gender (%)							
Female	60	58	59	52	54	53	53
Male	40	42	41	48	46	47	47
Age (%)							
Under 18	30	17	19	24	10	37	1
18-24	44	52	60	55	63	40	69
25-65	26	31	21	21	26	23	30
Age unknown	0	0	0	0	0	0	0
Retention/graduation rates (%)							
Full-Time students	56	55	63	57	68	56	64
Part-Time students	28	30	47	34	56	50	53
Three-Year graduation rate	24	27	28	20	29	20	15
Transfer out rate	18	19	18	22	19	22	18

^aBased on fall 2015 Integrated Postsecondary Education Data System (IPEDS) data.

Table 2**Baseline Descriptive Student Characteristics by College (Among Enrolled Students)**

Characteristic	Overall		College 1		College 2		College 3		College 4		College 5	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Female (%)	48	50	58	49	48	50	52	50	50	50	44	50
Race/ethnicity (%)												
White	43	49	83	38	78	42	74	44	38	49	31	46
American Indian/Native Alaskan	1	8	1	10	2	13	4	19	0	6	0	7
Asian	3	18	0	6	2	14	0	0	6	25	3	17
Black	18	39	7	26	17	38	21	41	22	42	18	38
Hispanic	22	41	7	25	0	0	1	9	30	46	25	43
Pacific Islander	0	2	0	0	1	8	0	0	0	0	0	0
More than one race/ethnicity	11	32	1	12	0	0	0	0	3	17	19	39
Non-Resident Alien	0	3	1	9	0	0	0	0	0	3	0	0
Race/ethnicity unknown	2	15	0	0	0	0	0	0	0	0	4	20
Race/ethnicity missing	12	33	0	0	12	33	76	43	5	22	0	0
Age at entry	19.94	5.57	20.10	6.77	22.06	7.70	21.03	6.15	20.43	5.89	18.99	4.25
Age at entry missing (%)	0	0	0	0	0	0	0	0	0	0	0	0
Pell Grant recipient (%)	49	50	64	48	66	47	61	49	36	48	47	50
Pell Grant status missing (%)	5	22	0	0	0	0	37	48	0	0	0	0
Total	3,865		327		408		673		1,002		2,319	

Table 3
Post-Randomization Characteristics by Treatment Assignment

Characteristic	Control Mean	Program Mean	Treatment-Diff	p-value	Observations
Female	47.50%	47.90%	0.40%	0.76	3,865
Gender missing	17.80%	18.70%	0.90%	0.43	4,729
Race/ethnicity					
White	43.50%	41.70%	-1.80%	0.30	3,382
American Indian/Native Alaskan	0.70%	0.70%	0.00%	0.81	3,382
Asian	3.10%	3.70%	0.60%	0.34	3,382
Black	16.90%	19.20%	2.30%	0.09	3,382
Hispanic	21.90%	21.50%	-0.40%	0.77	3,382
Pacific Islander	0.10%	0.10%	0.00%	0.96	3,382
More than one race/ethnicity	11.50%	10.90%	-0.60%	0.57	3,382
Non-Resident Alien	0.10%	0.10%	0.00%	0.61	3,382
Race/ethnicity unknown	2.30%	2.10%	-0.20%	0.76	3,382
Race/ethnicity missing	28.30%	28.70%	0.40%	0.76	4,729
Age at entry	19.9	20	0.10	0.52	3,593
Age at entry missing	17.80%	18.70%	0.90%	0.43	4,729
Pell Grant recipient	50.10%	53.30%	3.20%	0.06	3,672
Missing Pell Grant info	4.40%	3.70%	-0.70%	0.23	4,729
TAP Grant recipient	39.10%	39.60%	0.50%	0.78	3,721
Missing TAP Grant info	3.40%	3.40%	0.00%	0.99	4,729
GED recipient	4.50%	4.20%	-0.30%	0.57	4,600
Missing GED status	2.90%	2.70%	-0.20%	0.79	4,729
HS GPA (100 scale)	78	78	0.00%	0.97	1,862
HS GPA (missing)	59.80%	61.70%	1.90%	0.18	4,729
ACCUPLACER subtest scores					
Arithmetic	45	45.9	0.90	0.26	3,439
Algebra	53.1	53.7	0.60	0.77	4,407
College-level math	35.5	35.4	-0.10	0.89	455
Reading	72.3	71.9	-0.40	0.47	3,696
Sentence skills	76.3	76.1	-0.20	0.12	1,072
Writing	6.1	6.1	0.00	0.11	3,324
Total	2,274	2,455			4,729

Paper #2: The Causal Impact of Corequisite Remediation on Student Outcomes

Authors: Trey Miller* (AIR), Lindsay Daugherty (RAND), Paco Martorell (UC-Davis), and Russell Gerber (THECB)

Background/Context: Faced with troubling evidence on the success of students who take traditional developmental education (DE) courses, states and higher education institutions across the United States are rethinking the way they address college readiness (Community College Research Center, 2014a; Scott-Clayton, Crosta, & Belfield, 2012). One promising reform is corequisite remediation. Students in corequisites skip one or more DE courses and move directly into a college-level course in the first semester with DE support provided alongside the college-level course. While all corequisites are designed to accelerate students through DE sequences, some corequisites also incorporate reforms into curriculum and delivery of instruction. In addition, some institutions pair corequisites with additional advising and/or wraparound supports. One experimental study has demonstrated the effectiveness of a corequisite remediation model for students who are underprepared in mathematics (Logue, Watanabe-Rose, & Douglas, 2016), while several quasi-experimental studies have provided evidence of the effectiveness of particular corequisite models for students who are underprepared in reading and/or writing (Cho, Kopko, Jenkins, & Jagers, 2012).

Purpose/Objective/Research Question: In this study, we investigate the impact of corequisites that pair an integrated reading and writing DE support with a college-level English course. This is the first study to provide experimental evidence of the impact of corequisites for students underprepared in reading and writing, and the first study of corequisites to examine the short and long-term impact of different approaches to combining instruction and supports within a large state (Texas). We also explore whether corequisites have differential impacts on students with different levels of college preparedness and from different backgrounds.

Setting & Sample: The study was conducted at five large community colleges in Texas. All first-time-in-college (FTIC) students scoring within a range on the state's college readiness exam were recruited to participate in the study during orientation or initial advising sessions. Total intake for the study was 2,157 students over four semesters from fall 2016 to fall 2018. We will report two-year outcome data for the 975 students who entered the study in fall 2016, and one-year outcome data for the 1,756 students who entered the study from fall 2016 to fall 2017.

Intervention/Program/Practice: All of the institutions participating in our study implemented a corequisite model that paired a one credit hour integrated reading and writing DE support with a three-credit hour gateway English course (English Composition I). The student learning objectives for the English course and the integrated support were common across study institutions and across the state. However, approaches to corequisites varied in terms of the structure of the support and the coursework and pedagogy used across the course and support. In our sample, two institutions implemented versions of the Accelerated Learning Program (ALP) model, where 10-15 students were included in an English Composition course with college-ready students, and the support consisted of additional classroom time with the same instructor for the students who were not college ready. One institution implemented an Extended Instructional

Time model in which specific sections of the English Composition course were populated entirely by students who were not college ready, and the course was extended with an additional hour of support time that was fully integrated into the course and allowed for scaffolding with the full class of students. Finally, two institutions implemented versions of an Academic Support Service model, where students who were not college ready were integrated into sections of the English Composition course with college-ready students, and supported through required weekly use of existing academic supports including mandatory participation in office hours at one college and mandatory use of tutoring at the writing center in the other.

Research Design: We implemented the investigation using a randomized control trial (RCT) with students randomized within institutions, a design that meets What Works Clearinghouse standards without reservations. All first-time-in-college (FTIC) students scoring within a pre-determined range on the state's college readiness exam at each participating institution were recruited to participate in the study during orientation or initial advising sessions. Students who opted to participate were administered a baseline survey and then randomized to the corequisite model at their institution or to the highest-level developmental education course, which was integrated reading and writing. Our analysis of covariates indicates that randomization resulted in baseline equivalence, meaning that a significant difference in outcomes across treatment and control groups can be interpreted as a causal impact of the DE program.

Data Collection and Analysis: We rely on several sources of data to investigate the implementation and impact of corequisite remediation. We draw on rich administrative records from Texas that allow us to construct a range of measures of student outcomes including pass rates and performance in a first college-level English course, pass rates and performance in other relevant courses, credit accumulation, persistence, degree completion and upward transfer. We conducted a detailed student survey at baseline that included information about student background and motivation for attending college. We also conducted a follow-up survey of 1,340 students during the semester after initial random assignment. The follow-up survey collected rich information about student experiences in the treatment or control condition, their preparation level for that course and subsequent courses, and whether their treatment condition played any role in their decision to remain enrolled or leave the institution. Finally, we collected detailed implementation data including student, faculty, and administrator interviews and focus groups during each semester in which we conducted random assignment, as well as a faculty survey and review of course documentation.

Findings/Results/Conclusions: Early results for the Fall 2016 cohort indicate that corequisite students were 17 percentage points more likely to pass a gateway English course within one year, with positive results across institutions and models. We found no statistically significant differences in one-semester persistence rates. We are currently analyzing data from Year 2 and will be prepared to share one-year experimental results for the students from the Fall 2016 through Fall 2017 cohorts and two-year experimental results for the Fall 2016 cohort.

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Paper #3: Evaluation of the Dana Center Math Pathways

Authors: Elizabeth Zachry Rutschow* (MDRC), Dominique Dukes (MDRC), Julia Raufman (CCRC), Nicole Edgecombe (CCRC), Adnan Moussa (CCRC), Dan Cullinan (MDRC), and Victoria Deitch (MDRC)

Background / Context: In the last decade, researchers, practitioners, and policymakers have argued that passing developmental math is one of the key challenges to community college students' success. Math pathways, which offer developmental students accelerated and differentiated math course sequences aligned with their programs of study, is a highly popular method for combatting this problem (Strother, Van Campen, and Grunow, 2013; Charles A. Dana Center, 2014). Research has demonstrated their promise in both descriptive and experimental studies, with math pathways often seeing notable increases in developmental students' completion of a gateway college-level math course within one year (Logue, Watanabe-Rose, and Douglas, 2016; Hayward and Willett, 2014; Sowers and Yamada, 2015; Zachry Rutschow and Diamond, 2015).

The Charles A. Dana Center at the University of Texas at Austin's has developed a math pathways model, the Dana Center Math Pathways (DCMP) with the goal of improving students' progress in developmental and college-level math and college completion. The DCMP promote the implementation of three math pathways that are aligned with students' career interests. In addition, the Dana Center has developed revised curricula for the DCMP developmental and college-level math courses, which integrate more student-centered, contextualized, and active learning approaches. This presentation will discuss early findings from a random assignment evaluation of the DCMP, which represents one of the only rigorous studies of math pathways to date.

Purpose / Objective / Research Question: The DCMP is a national math pathway model that has been scaled across hundreds of U.S. community colleges and will provide definitive evidence about the effectiveness of math pathways. This study is focused on four research questions:

1. Do DCMP students have better academic outcomes than students in traditional developmental math programs? Are these outcomes mediated through changes in student engagement?
2. To what degree is there fidelity to the DCMP model across colleges? What aspects of DCMP are consistent across sites? What adaptations were made and why?
3. How do the curriculum and pedagogy in the DCMP courses differ from the colleges' traditional developmental math courses?
4. Is DCMP cost effective relative to business as usual?

Setting: This study was conducted at four Texas colleges that are representative of early adopters of the DCMP model: Brookhaven College and Eastfield College (of Dallas County Community College District; El Paso Community College; and Trinity Valley Community

College). They were selected based on the strength of their implementation, ability to meet the sample size requirements, and interest in the research.

From fall 2015 through spring 2017, eligible and interested students were randomly assigned either to the program group, which had the opportunity to enroll in a DCMP sequence starting with an accelerated developmental course followed by a college-level statistics or quantitative reasoning course; or the standard group, which received the colleges' traditional developmental and college-level math course sequences.

Population / Participants: The DCMP were targeted to students who (1) were in need of one or two developmental math courses and (2) were pursuing the humanities and social sciences majors (eligible majors). Around 1500 students from the four Texas Colleges were enrolled into the study over the course of four semesters.

Program: Approximately 60% of the sample was randomly assigned to take DCMP courses and 40% to standard courses. DCMP course content emphasized numeracy, statistics, and algebraic reasoning skills while standard courses focus primarily on algebra. Additionally, the DCMP provides an accelerated model for students with two developmental math course needs, allowing program students to complete these courses more quickly. Approximately 60 percent of the sample was assigned to the program group and 40 percent to the standard group.

Research Design: The evaluation employs a randomized control trial design. Randomization resulted in baseline equivalence across treatment and control students, meaning that changes in program students' outcomes can be attributed with a high level of confidence to the impact of the DCMP. The study is also examining implementation and cost effectiveness of the DCMP.

Data Collection and Analysis: Researchers collected transcript data on the study participants and background information through a baseline survey. Researchers also made multiple visits to the study colleges to conduct interviews, focus groups, and classroom observations with faculty, staff, and students involved in both the DCMP and standard math courses. A student survey was conducted (60% response rate) to assess students' experiences in the courses and attitudes towards math. Finally, researchers collected data on the costs of implementing the DCMP and the costs associated with maintaining the program.

The analysis includes proximal confirmatory measures constructed from administrative data including students' progression in math courses, the percentage of them who complete their first college-level math course, and their average number of math credits earned. Distal confirmatory outcomes include students overall academic progress and degree completion.

Findings/Results: Preliminary results based on analysis of the first two study cohorts are encouraging. 25% of program students completed a college-level math course after three semesters, compared to 17% of standard students (Zachry Rutschow, 2018; Zachry Rutschow, Diamond, & Serna-Wallender, 2017). Students in the program group also completed more math credits.

Conclusions: These early findings suggest that the DCMP are helping students reach a critical college milestone: making it to and through a college-level math course. Additionally, survey

results suggest that students are having a qualitatively different experience learning math, a result that was expected as part of the DCMP theoretical model. Final results from the study will be published in 2019 and will be previewed at the spring 2019 conference.

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Paper #4: Accelerating Success: The Impact of Florida’s Developmental Education Reform on First Year Credit Accumulation

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Background: The Florida legislature passed Senate Bill 1720 in 2013 to initiate a major statewide reform of developmental education. Beginning in fall 2014, developmental education became optional for the majority of community college students in Florida. Additionally, colleges were required to offer optional developmental education courses with flexible instructional modalities, and to develop enhanced advising and academic support services.

Purpose: Now that four years have passed since Senate Bill 1720 passed, we examine whether the reform has made a difference in promoting postsecondary success. The outcome of interest is students’ college-level credit accumulation in the first (fall-spring) year. We hypothesize that with the freedom to enroll directly into college-level courses and enhanced institutional support in place to sustain academic progress, students are making faster progress in the post-reform period. In addition, due to prior empirical studies that find larger negative effects of developmental education on student success for minority students, we hypothesize that minority students benefit more from the reform compared to White students.

Setting: This study focuses on examining the impact of the legislative reform on credit accumulation in the Florida College System (FCS). FCS consists of all 28 public community colleges in Florida.

Population/Subjects: The FCS has an annual fall enrollment between 450,000-480,000 in recent years with an average student age of 25. Approximately 35% of students attend full-time and 65% attend part-time. Both female students and ethnic minority students makeup slightly more than half of the total population. First time in college students (FTIC), which make up our analytic sample, comprise around 16-18% of the total enrollment in each cohort.

The first three cohorts of students entered college in the fall of 2011 to fall 2013 prior to the developmental education reform, and the last three cohorts of students entered in the fall of 2014 to fall 2016 after the reform. Our analytic sample consists of 205,812 students in the pre-reform period and 202,911 students in the post-reform period for a total sample size of 408,723.

Intervention: SB1720 mandates that beginning in fall 2014, students who entered 9th grade in the 2003-04 school year and beyond and had earned a standard high school diploma were considered college-ready and were no longer required to take the placement test or developmental courses. The law also exempted active duty members of the military from developmental education.

Research Design: We apply an interrupted time series design with interaction effects, otherwise known as the difference-in-difference (DID) approach. The DID approach controls for potential sources of selection bias from time invariant factors, such as ability and motivation, by

comparing the difference in average outcomes between groups prior to and after the policy change, and then the difference between the two outcome differences over time. The second differencing process cancels out student characteristics that remain stable overtime that typically bias estimates comparing participants to non-participants. DID thus makes a more convincing claim on the causal relationship between the predictor and the outcome compared to a simple matched-comparison design. For our analyses, we use a balanced panel with three years of data prior to the reform and three years after.

Data Collection and Analysis: Our data source is student-level records from Florida’s Education Data Warehouse (EDW). Our sample includes six cohorts of FTIC students at FCS institutions and is conditional on students enrolling in both the fall and spring semesters. Our outcome of interest is a continuous variable for the number of credit hours earned in the first year of college. We use a balanced panel with three years of data prior to the reform and three years after the reform. In order to capture both the base change and explore differential changes in credit accumulation by student subgroups, we include indicators for Hispanic and Black students relative to the reference group of White students (students of other races/ethnicities are excluded from these models) and interact these indicators with the post reform indicator. We estimate the following model for student i at college j in year (cohort) t :

$$y_{ijt} = \beta_0 + \beta_1(2014) + \beta_2(Black)_{ijt} + \beta_3(Hispanic)_{ijt} + \beta_4(2014*Black)_{ijt} + \beta_5(2014*Hispanic)_{ijt} + \beta_6(S)_{ijt} + \beta_7(HS)_{ijt} + \zeta_j + \lambda_t$$

Under this specification, β_1 captures the change in credit accumulation post-reform, β_2 and β_3 capture the overall difference in the outcome for Black and Hispanic students, respectively, enrolled in developmental education, β_4 and β_5 capture any differential changes in student outcomes for Black and Hispanic students, respectively, post-reform, β_6 is a vector of student background characteristics, β_7 is a vector of high school academic preparation indicators, ζ_j is a college fixed effect to account for unobserved heterogeneity across institutions, and λ_t is a year (cohort) fixed effect. This model captures both the base changes in overall student outcomes and a differential change for Hispanic and Black students between the pre and post-reform period.

Results: Overall, we observe a base increase of 0.992 credits after the reform. Further, while credit accumulation is, on average, lower for Black and Hispanic students, compared to White students in the pre-policy period, we observe greater rates of change for Black and Hispanic students in the post-policy period (1.016 and 0.61 credits for Black and Hispanic students, respectively). Put differently, all students show increases in total credits accumulation over the first year in the post-policy period, but Black and Hispanic students show greater increases than White students.

Conclusions: Overall, the 2014 reform led to significant growth of first year credit accumulation, indicating that the policy change accelerates the academic progress of FTIC students. More noticeably, the reform seems to be helping to mitigate the performance gap between White and minority students, contributing to equalizing postsecondary educational outcomes. Due to recent implementation of the reform, the study is limited in producing

evidence regarding the long-term impacts of the policy change including its impact on credential/degree completion.