

Dana Center Mathematics Pathways

Intervention Report | Developmental Education

WHAT WORKS CLEARINGHOUSE™

June 2021

WWC 2021-014
U.S. DEPARTMENT OF EDUCATION

A Publication of the National Center for Education Evaluation at IES

Not all students enroll in college prepared for college-level coursework. In response, many colleges attempt to identify students who are underprepared for college-level courses and then place them into developmental courses intended to help them succeed. These courses are usually offered on a non-credit basis and do not count toward graduation. As a result, students enrolled in developmental education can take longer to graduate than peers who enroll in credit-bearing college courses from the outset.

Several interventions have been designed to accelerate students' transition from developmental to credit-bearing college courses, including the *Charles A. Dana Center Mathematics Pathways*, hereafter referred to as *Dana Center Mathematics Pathways* or *DCMP*.¹ *DCMP* offers multiple

math pathways aligned to programs of study, accelerated enrollment in credit-bearing college math courses, integrated student supports, and math instruction that incorporates evidence-based curricula and pedagogy.

This What Works Clearinghouse (WWC) report, part of the WWC's Developmental Education topic area, explores the effects of *DCMP* on student progression in developmental education and progression in college. The WWC identified seven studies of *DCMP*. Three of these studies meet WWC standards.² The evidence presented in this report is from studies of the impact of *DCMP* on community college students—including Asian, Black, White, and Hispanic students—in urban, suburban, and rural settings.

What Happens When Students Participate in *DCMP*?³

The evidence indicates that implementing *DCMP*:

- is likely to increase progression in developmental education
- is likely to increase progression in college

Findings on *DCMP* from three studies that meet WWC standards are shown in Table 1. The table reports an

effectiveness rating, the improvement index, and the number of studies and students that contributed to the findings. The improvement index is a measure of the intervention's effect on an outcome. It can be interpreted as the expected change in percentile rank for an average comparison group student if that student had received the intervention.

Table 1. Summary of findings on *DCMP* from studies that meet WWC standards

Outcome domain	Effectiveness rating	Study findings	Evidence meeting WWC standards (version 4.0)	
		Improvement index (percentile points)	Number of studies	Number of students
Progressing in developmental education	Positive effects	+21	3	46,012
Progressing in college	Positive effects	+8	2	11,163

Note: The improvement index can be interpreted as the expected change in percentile rank for an average comparison group student if that student had received the intervention. For example, an improvement index of +21 means that the expected percentile rank of the average comparison group student would increase by 21 points if the student received *DCMP*. The improvement index values are generated by averaging findings from the outcome analyses that meet WWC standards, as reported by Rutschow et al. (2019), Schudde & Keisler (2019), and Schudde & Meiselman (2019). A positive improvement index does not necessarily mean the estimated effect is statistically significant. Progressing in developmental education outcomes reported in these studies include ever passed a college-level math class and completed the developmental math sequence. Progressing in college outcomes reported in these studies include college-level math credits earned and college-level credits earned. The effects of *DCMP* are not known for other outcomes within the Developmental Education topic area protocol, including college enrollment, academic achievement, postsecondary degree attainment, credential attainment, employment, and earnings.

BOX 1. HOW THE WWC REVIEWS AND DESCRIBES EVIDENCE

The WWC evaluates evidence based on the quality and results of reviewed studies. The criteria the WWC uses for evaluating evidence are defined in the [Procedures and Standards Handbooks](#) and the [Review Protocols](#). The studies summarized in this report were reviewed under WWC Standards (version 4.0) and the Developmental Education topic area protocol (version 4.0).

To determine the effectiveness rating, the WWC considers what methods each study used, the direction of the effects, and the number of studies that tested the intervention. The higher the effectiveness rating, the more certain the WWC is about the reported results and about what will happen if the same intervention is implemented again. The following key explains the relationship between effectiveness ratings and the statements used in this report:

Effectiveness rating	Rating interpretation	Description of the evidence
Positive (or negative) effects	The intervention is <i>likely</i> to change an outcome	Strong evidence of a positive (or negative) effect, with no overriding contrary evidence
Potentially positive (or negative) effects	The intervention <i>may</i> change an outcome	Evidence of a positive (or negative) effect with no overriding contrary evidence
No discernible effects	The intervention <i>may result in little to no change</i> in an outcome	No affirmative evidence of effects
Mixed effects	The intervention <i>has inconsistent effects</i> on an outcome	Evidence includes studies in at least two of these categories: studies with positive effects, studies with negative effects, or more studies with indeterminate effects than with positive or negative effects

How is DCMP Implemented?

The following section provides details of how *DCMP* is implemented. This information can help educators identify the requirements for implementing *DCMP* and determine whether implementing this intervention would be feasible at their institutions. Information on *DCMP* presented in this section comes from correspondence with the developer and from the studies that meet WWC standards (Rutschow et al., 2019; Schudde & Keisler, 2019; and Schudde & Meiselman, 2019). Since the *DCMP* model has evolved since these studies were conducted, we describe the current components of *DCMP* and note where those components differ from the model studied in Table 2.

- **Goal:** *DCMP* aims to ensure all students in higher education are prepared to use mathematical skills in their careers and personal lives, enabled to make timely progress towards completion of a certificate or degree, and empowered as mathematical learners.
- **Target population:** *DCMP* is designed to accelerate the progression of college students who may not be ready for college-level math coursework and have been disadvantaged by the traditional system of standardized test placement and multiple semesters of developmental math courses.
- **Method of delivery:** Math instruction in *DCMP* courses is delivered using evidence-based curricula and pedagogy. Students also receive individual advising from their college to help them align their math course selection with their program of study. Students continue to receive integrated supports from their college throughout their college experience.

Comparison group: In the three studies that contribute to this intervention report, students in the comparison group enrolled in the colleges' traditional developmental math courses, and typically spent two or more semesters to complete the colleges' math requirement. Courses are typically lecture-based and focus on algebraic skills leading to college-level algebra.

- **Frequency and duration of service:** Students are placed directly into college-level math courses with appropriate supports in one of three math pathways—statistical reasoning, quantitative reasoning, or path to calculus—based on their program of study. With the exception of students in science, technology, engineering, and math (STEM) programs of study, most students complete their college-level math requirement in one semester. Students in STEM programs of study complete their first college-level calculus math requirement in the first year.
- **Intervention components:** *DCMP* is comprised of several components, including math course sequences aligned to students' programs of study; first-semester co-requisite model; instruction using evidence-based curricula and pedagogy; enhanced coordination between college faculty, advisors, and student support staff; and alignment of math pathways between two- and four-year colleges. Refer to Table 2 for additional details.

Table 2. Components of *DCMP*

Key component	Description
Math course sequences aligned to students' programs of study	<i>DCMP</i> offers math pathways options to fit the needs of students in various programs of study. Specifically, <i>DCMP</i> developed curricula for three math pathways: (1) a statistical reasoning pathway for students in the social sciences and health professions; (2) a quantitative reasoning pathway for students in the humanities and liberal arts; and (3) a path to calculus pathway for students in STEM.
First semester co-requisite model	In the first semester of <i>DCMP</i> , students are enrolled directly into the appropriate college-level math course aligned to their program of study. Co-requisite support courses are provided to help students engage and succeed in the college-level courses. It is important to note that the Dana Center revised the <i>DCMP</i> model to a first semester co-requisite model after the studies that meet WWC standards were conducted. The three studies featured in this report (Rutschow et al., 2019; Schudde & Keisler, 2019; and Schudde & Meiselman, 2019) investigated the effects of the original <i>DCMP</i> model where students completed an accelerated developmental math course in the first semester and immediately enrolled in a credit-bearing introductory college-level math course aligned to their program of study in the second semester. In Schudde & Meiselman, 2019, six out of the 27 community colleges also implemented the co-requisite model.
Evidence-based curricula and pedagogy	In the <i>DCMP</i> courses, curricula are organized around broad mathematical concepts. The curricula are contextualized around real-world problems and incorporate the use of real datasets. Instruction uses a variety of strategies, such as small group work, class discussions, and interactive lectures, and students actively engage in analyzing data and problem-solving. Students are challenged to apply learned skills to unfamiliar and non-routine problems and develop multiple strategies and solutions to each problem.
Enhanced coordination between college faculty, advising, and student supports	Students receive college advising to help them make informed decisions about their program of study based on their career and life goals. College faculty, advisors, and student support staff enhance collaboration to provide consistent support across the students' entire college experience and to build student self-efficacy through instructional strategies, ongoing check-ins, tutoring, and other supports.
Alignment of math pathways with four-year colleges (community colleges only)	Community college leadership arranges written articulation agreements with four-year colleges to provide credit for students' math courses upon transfer from the community college to the four-year college.

What Does *DCMP* Cost?

This preliminary list of costs is not designed to be exhaustive; rather, it provides educators an overview of the major resources needed to implement *DCMP*. The program costs described in Table 3 are based on the information available as of December 2020.

As reported in Rutschow et al. (2019), the average *DCMP* start-up cost for each college was about \$140,450 over two years. Start-up costs included administrative costs to plan and align courses and conduct meetings with college leadership, training for faculty and advisors, and time

spent revising curricula and preparing to teach the new courses. The ongoing costs of implementing *DCMP* beyond the existing costs to deliver traditional developmental math courses were, on average, \$19,340 per year at each college or \$132 per student. The Dana Center contributed an additional \$295,057 in estimated start-up costs toward aligning math pathways at each college and statewide, developing math curricula, and hosting initial and ongoing faculty professional development.

Table 3. Cost ingredients for *DCMP*

Cost ingredients	Description	Source of funding
Personnel	Faculty, advisors, and other support staff receive initial training and ongoing professional development on how to implement <i>DCMP</i> .	Colleges
Facilities	No additional facility costs are required beyond the standard costs for faculty and advisor office space and classroom space to deliver instruction.	Colleges
Equipment and materials	The Dana Center has developed curricula to include full lessons and lesson guides for implementing <i>DCMP</i> . Using the curricula is not a requirement for implementing <i>DCMP</i> . However, the Dana Center offers the curricula for free with a technology-based homework platform that costs a one-time fee of approximately \$40 per student. Students may be required to purchase calculators and textbooks.	The Dana Center or colleges (curricula); Students or parents (calculators, textbooks, and homework platform fee)
Other	Start-up costs can include aligning math pathways at the college and statewide, establishing an online learning community for instructors to share instructional practices, and facilitating written transfer agreements with four-year colleges. The Dana Center offers a free implementation guide online: https://dcmathpathways.org/implementation-guide and is available to provide professional development in these areas at a cost.	The Dana Center (implementation guide); Colleges (professional development)

For More Information:

About *DCMP*

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About the cost of the intervention

Rutschow, E. Z., Sepanik, S., Deitch, V., Raufman, J., Dukes, D., & Moussa, A. (2019). Gaining ground: Findings from the Dana Center Mathematics Pathways impact study. New York, NY: Community College Research Center at Teachers College, Columbia University, and MDRC. <https://eric.ed.gov/?id=ED600649>

Research Summary

The WWC identified seven studies that investigated the effectiveness of *DCMP* (Figure 1):

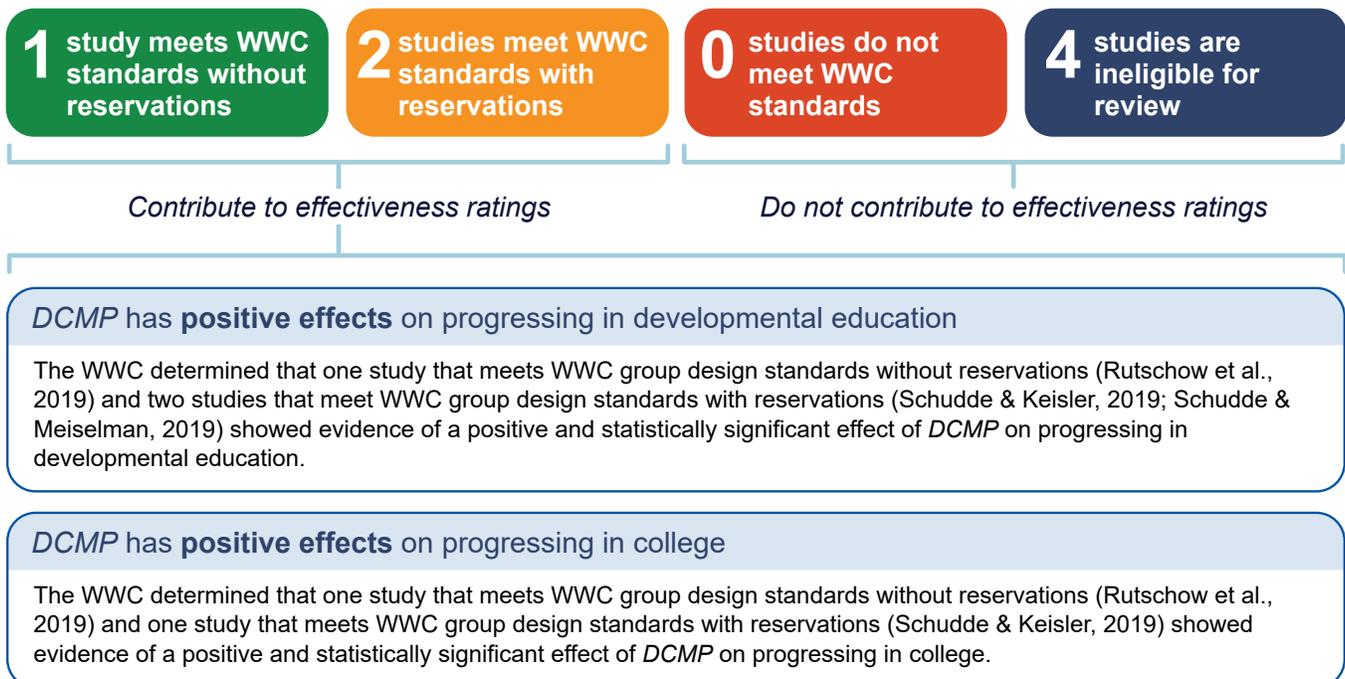
- 1 study meets WWC group design standards without reservations
- 2 studies meet WWC group design standards with reservations
- 4 studies are ineligible for review

The WWC reviews findings on the intervention's effects on eligible outcome domains from studies that meet standards, either with or without reservations. Based on this review, the WWC generates an effectiveness rating, which summarizes how the intervention impacts, or changes, a particular outcome domain. The WWC reports additional supplemental findings, such as for subsamples of Black or Hispanic students, on the WWC website (<https://whatworks.ed.gov>).

These supplemental findings and findings from studies that either do not meet WWC standards or are ineligible for review do not contribute to the effectiveness ratings.

The three studies of *DCMP* that meet WWC group design standards reported findings on progressing in developmental education and progressing in college. No other findings in the studies meet WWC group design standards within any outcome domain included in the Developmental Education topic area.⁴ Citations for the three studies reviewed for this report are listed in the References section, which is on page 11. Citations for the four studies that are ineligible for review and the reasons the WWC determined they were ineligible are also listed in the References section.

Figure 1. Effectiveness ratings for *DCMP*



Main Findings

Table 4 shows the findings from the three *DCMP* studies that meet WWC standards. The table includes WWC calculations of the mean difference, effect size, and performance of the intervention group relative to the comparison group. Based on findings from the three studies that meet WWC standards, the effectiveness rating for progressing in developmental education is *positive effects*, indicating strong

evidence of a positive effect with no overriding contrary evidence. These findings are based on 46,012 students. The effectiveness rating for progressing in college is *positive effects*, indicating strong evidence of a positive effect with no overriding contrary evidence. These findings are based on 11,163 students.

Table 4. Findings by outcome domain from three studies of *DCMP* that meet WWC standards

Measure (study)	Study sample	Sample size	Mean (standard deviation)		WWC calculations			p-value
			Intervention group	Comparison group	Mean difference	Effect size	Improvement index	
Ever passed college-level math class (%) (Rutschow et al., 2019) ^a	Full sample	1,411	25.30	18.50	6.80	0.24	+10	<.01
Completed developmental math sequence (%) (Rutschow et al., 2019) ^a	Full sample	1,411	57.00	33.50	23.50	0.59	+22	<.01
Ever passed college-level math class (%) (Schudde & Keisler, 2019) ^b	DCMP vs. Two-to-three semester sequence	9,752	70.20	34.20	36.00	0.92	+32	<.01
Ever passed college-level math class (%) (Schudde & Meiselman, 2019) ^c	Full sample: 2 cohorts	34,849	22.00	14.00	8.00	0.33	+13	<.01
Outcome average for progressing in developmental education						0.55	+21	
Math credits earned (college-level) (Rutschow et al., 2019) ^a	Full sample	1,411	0.90 (1.60)	0.60 (1.40)	0.30	0.20	+8	<.01
College credits earned (Rutschow et al., 2019) ^a	Full sample	1,411	11.90 (12.40)	11.10 (11.90)	0.80	0.07	+3	0.23
College-level credits earned: Cumulative (after 3 years) (Schudde & Keisler, 2019) ^b	DCMP vs. Two-to-three semester sequence	9,752	32.75 (24.34)	26.88 (23.03)	5.87	0.25	+10	<.01
Outcome average for progressing in college						0.19	+8	

Notes: For mean difference and effect size values reported in the table, a positive number favors the intervention group and a negative number favors the comparison group. The effect size is a standardized measure of the effect of an intervention on outcomes, representing the average change expected for all individuals who are given the intervention (measured in standard deviations of the outcome measure). An indicator of the effect of the intervention, the improvement index can be interpreted as the expected change in percentile rank for an average comparison group student if that student had received the intervention. For example, an improvement index of +21 means that the expected percentile rank of the average comparison group student would increase by 21 points if the student received *DCMP*. A positive or negative improvement index does not necessarily mean the estimated effect is statistically significant. Some statistics may not sum as expected due to rounding.

^a Rutschow, et al. (2019) required corrections for multiple comparisons which were applied to measures in the same domain. Outcome standard deviations were provided in response to an author query. This study is characterized as having a statistically significant positive effect on progressing in developmental education and progressing in college because the estimated effect is positive and statistically significant.

^b Schudde & Keisler (2019) did not require corrections for clustering or multiple comparisons nor difference-in-differences adjustments. This study is characterized as having a statistically significant positive effect on progressing in developmental education and progressing in college because the estimated effect is positive and statistically significant.

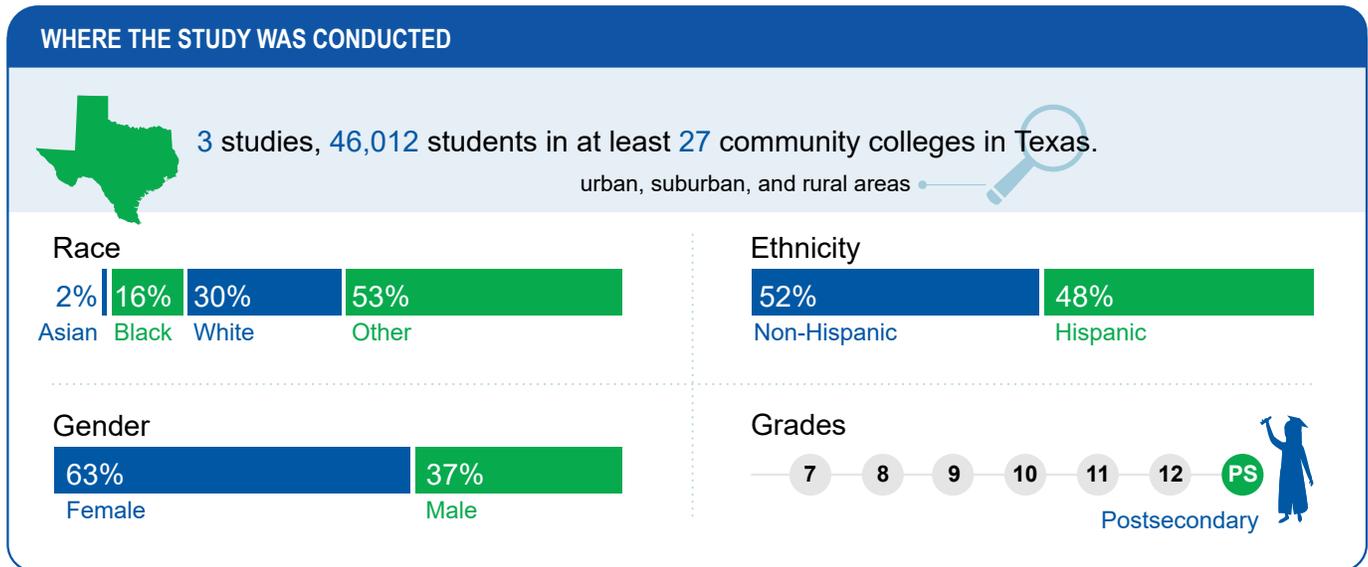
^c Schudde & Meiselman (2019) did not require corrections for clustering or multiple comparisons nor difference-in-differences adjustments. This study is characterized as having a statistically significant positive effect on progressing in developmental education because the estimated effect is positive and statistically significant.

For more information, please refer to the WWC Procedures Handbook, version 4.0, page 22.

In What Context Was *DCMP* Studied?

The following section provides information on the setting of the three studies of *DCMP* that meet WWC standards, and a description of the participants in the research.

This information can help educators understand the context in which the studies of *DCMP* were conducted, and determine whether the program might be suitable for their setting.



Details of Each Study that Meets WWC Standards

This section presents details for the studies of *DCMP* that meet WWC standards. These details include the full study reference, findings description, findings summary, and description of study characteristics. A summary of domain findings for each study is presented below, followed by a description of the study characteristics. These study-level details include contextual information about the study setting, methods, sample, intervention group, comparison group, outcomes, and implementation details. For additional information, readers should refer to the original studies.

Research details for Rutschow et al. (2019)

Rutschow, E. Z., Sepanik, S., Deitch, V., Raufman, J., Dukes, D., & Moussa, A. (2019). Gaining ground: Findings

from the Dana Center Mathematics Pathways impact study. New York, NY: Community College Research Center at Teachers College, Columbia University, and MDRC. <https://eric.ed.gov/?id=ED600649>

Findings from Rutschow et al. (2019) show evidence of a statistically significant positive effect of *DCMP* on progressing in developmental education (Table 5). This finding is based on an outcome analysis that includes 1,411 students. The finding on progressing in college, which shows evidence of a statistically significant positive effect, is based on an outcome analysis that includes 1,411 students. The findings and research details summarized for this study come from four related citations, including the primary study listed. See the References section, which is on page 11, for a list of all related publications.

Table 5. Summary of findings from Rutschow et al. (2019)

Outcome domain	Sample size	Meets WWC Group Design Standards Without Reservations		
		Study findings		
		Average effect size	Improvement index	Statistically significant
Progressing in developmental education	1,411 students	0.41	+16	Yes
Progressing in college	1,411 students	0.13	+5	Yes

Table 6. Description of study characteristics for Rutschow et al. (2019)

WWC evidence rating	Meets WWC Group Design Standards Without Reservations. This is a randomized controlled trial (RCT) with low attrition. For more information on how the WWC assigns study ratings, please see the WWC Procedures and Standards Handbooks (version 4.0) and WWC Standards Briefs , available on the WWC website.
Setting	The study was conducted in four community colleges in Texas. Two of the community colleges, Brookhaven and Eastfield, are single-campus schools located in suburban Dallas. El Paso Community College is a large, five-campus community college located in El Paso, a large city. Trinity Valley Community College is a small, rural community college serving five counties with three campuses. These colleges were selected in part because they had prior experience with <i>DCMP</i> , they could scale their <i>DCMP</i> program, and they also had a “business as usual” developmental math program that provided a strong contrast to <i>DCMP</i> .
Methods	<p>Students were eligible to participate in the study if they (a) were required to take one or two developmental math courses and (b) were planning on majoring in fields eligible for <i>DCMP</i>'s statistics or quantitative reasoning math pathways. This includes students who were planning to major in social science, social services, or nursing and health professions who were eligible for <i>DCMP</i>'s statistics math pathway, as well as students who were planning on majoring in liberal arts, fine arts, and humanities who were eligible for <i>DCMP</i>'s quantitative reasoning math pathway. Students who were planning on majoring in science, technology, engineering, or math (STEM) were not eligible for the study. These students would be eligible for <i>DCMP</i>'s reasoning with functions math pathway, which was not included in the study.</p> <p>Altogether, 1,411 students were recruited across four cohorts, with a new cohort introduced each semester (fall 2015, spring 2016, fall 2016, and spring 2017). Of these 1,411 students, 856 students were randomly assigned to <i>DCMP</i> and 555 were randomly assigned to their college's standard developmental math sequence. There was no attrition, as the study used administrative records to report outcomes.</p>
Study sample	The study sample included 1,411 students who enrolled in the study over four semesters—fall 2015, spring 2016, fall 2016, and spring 2017. The intervention group included 856 students and the comparison group included 555 students. Students were 23 years old on average. The majority of students were Hispanic (54%) and female (61%). About 14% were White, 13% were Black, and race was not specified for 74% of students. Sixty-nine percent of students had enrolled in college within a year of high school graduation. Thirty-one percent had failed at least one math class in high school, and 84% of sample members placed two or more levels below college-ready in math.
Intervention group	The <i>DCMP</i> math sequence began with an accelerated developmental math course, Foundations of Mathematical Reasoning, which combined two developmental math courses into one semester-long course. This course was centered on introductory algebraic, statistics, and quantitative literacy concepts, and content was delivered in a student-centered approach where larger mathematical concepts were presented in narrative form. Moreover, course materials incorporated themes from other academic disciplines such as science and literacy. Upon successful completion of the course, students entered either a one-semester course on (1) college statistics for students majoring in social and health sciences, (2) quantitative reasoning for students majoring in the humanities or liberal arts, or (3) a two-semester path to calculus for students majoring in STEM.
Comparison group	Students enrolled in the comparison group completed their college's standard developmental math sequence, which typically began with Beginning Algebra in Semester 1, followed by Intermediate Algebra in Semester 2. These courses were typically taught in a lecture style, where a higher emphasis was placed on the memorization of formulas and algorithms with little to no real-world application or problem-solving.
Outcomes and measurement	<p>Study authors reported findings on four outcome measures that are eligible for review under the Developmental Education topic area. These outcomes include college-level math credits earned after three semesters (progressing in college domain), college credits earned after three semesters (progressing in college domain), ever passed a college-level math class (progressing in developmental education domain), and completed the developmental math sequence (progressing in developmental education domain).</p> <p>The study also reported supplemental findings for a subsample of students for both the progressing in college and progressing in developmental education domains. Subsamples included students with placement tests indicating math proficiency at college-level or 1 level below, students with placement tests indicating math proficiency at 2 or 3 levels below college-level, Black students, and Hispanic or Latino students. For the completed developmental math sequence outcome, the study reported findings for the full sample after the first semester and after the second semester. For the ever passed college-level math class outcome, the study reported findings for the full sample after the second semester. A summary of these findings are available on the WWC website (https://whatworks.ed.gov). The supplemental findings do not factor into the intervention's rating of effectiveness.</p> <p>Persistence into the next school year was also reported but is ineligible for review, and thus is not included in the intervention report, because this outcome combined receipt of any degree and enrollment in a four-year college.</p>
Additional implementation details	All of the colleges had prior experience implementing <i>DCMP</i> . The Dana Center offered a three-day training on the <i>DCMP</i> curricula in three consecutive years (2013, 2014, and 2015). Nearly all of the <i>DCMP</i> faculty in the study had attended this training. Faculty may have attended this training well before the start of this study in fall of 2015. The Dana Center set up an online community for <i>DCMP</i> instructors where instructors could support one another. The Dana Center also organized in-person and virtual meetings where colleges with experience implementing <i>DCMP</i> could mentor and support others. Dana Center staff members visited each college to provide implementation support at least once. Faculty members had access to a mentor who was available for individual meetings.

Research details for Schudde & Keisler (2019)

Schudde, L., & Keisler, K. (2019). The relationship between accelerated dev-ed coursework and early college milestones: Examining college momentum in a reformed mathematics pathway. *AERA Open*, 5(1). <https://eric.ed.gov/?id=EJ1210499>

Findings from Schudde & Keisler (2019) show evidence of a statistically significant positive effect of *DCMP* on

progressing in developmental education (Table 7). This finding is based on an outcome analysis that includes 9,752 students. The finding on progressing in college, which shows evidence of a statistically significant positive effect, is based on an outcome analysis that includes 9,752 students.

Table 7. Summary of findings from Schudde & Keisler (2019)

		Meets WWC Group Design Standards With Reservations		
		Study findings		
Outcome domain	Sample size	Average effect size	Improvement index	Statistically significant
Progressing in developmental education	9,752 students	0.92	+32	Yes
Progressing in college	9,752 students	0.25	+10	Yes

Table 8. Description of study characteristics for Schudde & Keisler (2019)

WWC evidence rating	Meets WWC Group Design Standards With Reservations. This is a quasi-experimental design (QED) with baseline equivalence established on the analytic sample.
Setting	The study was conducted in 20 community colleges in Texas implementing <i>DCMP</i> in fall 2014. This sample includes all community colleges that were implementing <i>DCMP</i> at that time in the state.
Methods	The study is a QED that used propensity score matching to create two comparison groups. The first comparison group included students enrolled in a one-semester developmental math sequence and the second comparison group included students enrolled in a two-to-three semester developmental math sequence. The study assessed student rates of passing developmental math at the end of the fall 2014 semester (Semester 1), at the end of the spring 2015 semester (Year 1), and at the end of the spring 2017 semester (Year 3).
Study sample	<p>After matching, the main analytic sample—which compared students in <i>DCMP</i> with students in the two-to-three semester developmental math sequence group—included 484 students in the intervention group and 9,268 students in the comparison group. The main analytic sample was comprised of 15% Black students, 34% White students, and race was not specified for 52% of students. Forty-six percent of students in the main analytic sample were Hispanic and 71% were female.</p> <p>In the analysis that compared <i>DCMP</i> students to the one-semester developmental math sequence group, there were 563 students in the intervention group and 5,947 students in the comparison group after matching. This sample was comprised of 19% Black students, 40% White students, and race was not specified for 41% of students. Thirty-five percent of students in the one-semester developmental math sequence group were Hispanic and 71% were female.</p>
Intervention group	The <i>DCMP</i> math sequence began with an accelerated developmental math course designed to prepare students for entry-level college math in one semester. Colleges either used a <i>DCMP</i> -developed math curriculum, Foundations of Mathematical Reasoning, or their own curriculum that aligned with <i>DCMP</i> recommendations. Content was delivered using a student-centered approach and students learned to apply and interpret concepts by solving real-life math problems. <i>DCMP</i> recommended that the accelerated developmental math course be accompanied by a student success course aimed at helping students use the resources available on the college campus while building study skills and learning strategies that supported academic success. Once students successfully completed the accelerated developmental math course, they were encouraged to immediately enroll in credit-bearing college-level math courses specific to their program of study, including non-algebra options such as statistics or quantitative reasoning. <i>DCMP</i> courses applied a student-centered approach, featuring real-life problem solving and conceptual learning rather than rote memorization.
Comparison group	For the main analyses, comparison group students were enrolled in a two- or three-semester-long sequence of developmental math courses. After completing these courses, students were required to take college algebra. In the supplemental analyses, comparison group students were enrolled in a one-semester-long developmental math course. After completing this single course, students were required to take college algebra.
Outcomes and measurement	<p>Study authors reported findings on two outcome measures that are eligible for review under the Developmental Education topic area. These outcomes include college-level credits earned (progressing in college domain) and ever passed a college-level math class (progressing in developmental education domain), measured after five semesters.</p> <p>The study also reported supplemental findings for the one-semester-long comparison group and a shorter follow-up time period which included outcomes measured after one semester. A summary of these findings are available on the WWC website (https://whatworks.ed.gov). The supplemental findings do not factor into the intervention’s rating of effectiveness.</p> <p>Study authors reported findings on two outcome measures that do not meet WWC standards, and thus are not included in the intervention report. The findings for earned an associate degree for both the one-semester and two-to-three-semester-long comparison groups do not meet WWC group design standards because baseline equivalence of the analytic intervention and comparison groups is necessary but the requirement was not satisfied.</p>
Additional implementation details	No additional information provided.

Research details for Schudde & Meiselman (2019)

Schudde, L., & Meiselman, A. Y. (2019). Early outcomes of Texas community college students enrolled in Dana Center Mathematics Pathways prerequisite developmental courses. New York: NY: Center for the Analysis of Postsecondary Readiness. <https://eric.ed.gov/?id=ED597974>

Findings from Schudde & Meiselman (2019) show evidence of a statistically significant positive effect of *DCMP* on progressing in developmental education (Table 9). This finding is based on an outcome analysis that includes 34,849 students.

Table 9. Summary of findings from Schudde & Meiselman (2019)

		Meets WWC Group Design Standards With Reservations		
		Study findings		
Outcome domain	Sample size	Average effect size	Improvement index	Statistically significant
Progressing in developmental education	34,849 students	0.33	+13	Yes

Table 10. Description of study characteristics for Schudde & Meiselman (2019)

WWC evidence rating	Meets WWC Group Design Standards With Reservations. This is a cluster quasi-experimental design (QED) with baseline equivalence established on the analytic sample.
Setting	The study was conducted in 24 community colleges in Texas in the fall of 2015 and in 27 community colleges in Texas in the fall of 2016.
Methods	The study is a cluster QED that includes two cohorts of community college students who took developmental math courses in fall 2015 or fall 2016. The authors were able to use a list of course and section numbers provided by the Dana Center to identify students enrolled in <i>DCMP</i> courses. Students who were enrolled in both a <i>DCMP</i> and non- <i>DCMP</i> developmental math course were counted as <i>DCMP</i> students.
Study sample	There were 34,849 unique students in the sample. Across both cohorts, 30% were White, 16% were Black, 2% were Asian, and race was not specified for 52% of students. Forty-nine percent of students were Hispanic and 61% were female.
Intervention group	Students in the intervention group enrolled in <i>DCMP</i> which provided an accelerated developmental course that was delivered in one semester instead of two. Students who took the accelerated developmental course were typically in non-STEM majors. The authors noted that six community colleges implemented a co-requisite <i>DCMP</i> model, where students took their developmental coursework at the same time as a credit-bearing math course. Advisors and faculty had autonomy in determining students' placement into <i>DCMP</i> .
Comparison group	Students in the business-as-usual comparison group typically took the two-semester developmental math sequence, but the authors noted that other colleges may have been experimenting with accelerated developmental sequences.
Outcomes and measurement	<p>Study authors reported findings on one outcome measures that is eligible for review under the Developmental Education topic area: ever passed a college-level math class by the end of the second semester.</p> <p>The study also reported supplemental findings for an outcome measuring whether students ever passed a college-level math class after two years. A summary of these findings is available on the WWC website (https://whatworks.ed.gov). The supplemental findings do not factor into the intervention's rating of effectiveness.</p> <p>Study authors reported findings on two outcome measures that do not meet standards, and thus are not included in the intervention report. The finding for college credits earned does not meet WWC group design standards because the analysis does not provide a credible measure of the effectiveness of the intervention. The finding for enrolled in college does not meet WWC standards because the equivalence of the clusters in the analytic intervention and comparison groups is necessary but the requirement was not satisfied.</p>
Additional implementation details	No additional information provided.

References

Study that meets WWC group design standards

Rutschow, E. Z., Sepanik, S., Deitch, V., Raufman, J., Dukes, D., & Moussa, A. (2019). *Gaining ground: Findings from the Dana Center Mathematics Pathways impact study*. New York, NY: Community College Research Center at Teachers College, Columbia University, and MDRC. <https://eric.ed.gov/?id=ED600649>

Additional sources:

Rutschow, E.Z. & Diamond, J. (2015). *Laying the foundations: Early findings from the New Mathways Project*. New York, NY: MDRC. <https://eric.ed.gov/?id=ED558504>

Rutschow, E.Z., Diamond, J. & Serna-Wallender, E. (2017). *Math in the real world: Early findings from a study of the Dana Center Mathematics Pathways*. New York, NY: Center for the Analysis of Postsecondary Readiness and MDRC. <https://eric.ed.gov/?id=ED583571>

Rutschow, E.Z. (2018). *Making it through: Interim findings on developmental students' progress to college math with the Dana Center Mathematics Pathways*. New York, NY: Center for the Analysis of Postsecondary Readiness and MDRC. <https://eric.ed.gov/?id=ED586095>

Studies that meet WWC group design standards with reservations

Schudde, L., & Keisler, K. (2019). The relationship between accelerated dev-ed coursework and early college milestones: Examining college momentum in a reformed mathematics pathway. *AERA Open*, 5(1). <https://eric.ed.gov/?id=EJ1210499>

Schudde, L., & Meiselman, A. Y. (2019). Early outcomes of Texas community college students enrolled in Dana Center Mathematics Pathways prerequisite developmental courses. New York, NY: Center for the Analysis of Postsecondary Readiness. <https://eric.ed.gov/?id=ED597974>

Studies that do not meet WWC group design standards

None

Studies that are ineligible for review using the Developmental Education Protocol

Bickerstaff, S. E., Chavarín, O., & Raufman, J. (2018). *Mathematics Pathways to Completion: Setting the conditions for statewide reform in higher education*. New York, NY: Community College Research Center. <https://eric.ed.gov/?id=ED590685> The study is ineligible for review because it does not use an eligible design.

Ganga, E., & Mazzariello, A. (2018). *Math pathways: Expanding options for success in college math*. Denver, CO: Education Commission of the States. <https://eric.ed.gov/?id=ED590584> The study is ineligible for review because it does not use an eligible design.

Moussa, A. & Bickerstaff, S. (2019). *Creating accelerated pathways for student success in mathematics: A snapshot of courses offered at the launch of the Mathematics Pathways to Completion Project*. New York, NY: Community College Research Center. <https://eric.ed.gov/?id=ED600419> The study is ineligible for review because it does not use an eligible design.

Solis, S.M. (2018). *The impact of a new mathematics curriculum model and selected demographic factors on the academic performance of community college students* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI: 10980931) The study is ineligible for review because it does not include an eligible outcome.

Endnotes

¹Between 2011 and 2016 *DCMP* was known as the *New Mathways Project (NMP)*. Some of the older studies in this report refer to the intervention as *NMP*. The developer reports the name was changed to *DCMP* to better describe the intervention as a transformational change across higher education.

²There may be overlap among the samples in two of the studies (Rutschow et al., 2019 and Schudde & Meiselman, 2019), but study characteristics are sufficiently different to consider them separate studies under version 4.0 of the WWC standards.

³The literature search reflects documents publicly available by October 2020. Reviews of the studies in this report used the standards from the WWC Procedures and Standards Handbook (version 4.0) and the Developmental Education topic area protocol (version 4.0). The evidence presented in this report is based on available research. Findings and conclusions could change as new research becomes available.

⁴The effects of *DCMP* are not known for other outcome domains within the Developmental Education topic area, including college enrollment, academic achievement, postsecondary degree attainment, credential attainment, employment, and earnings.

Recommended Citation

What Works Clearinghouse, Institute of Education Sciences, U.S. Department of Education. (2021, June). *Dana Center Mathematics Pathways*. <https://whatworks.ed.gov>.