



Creating Structural Change for Student Success: State Mathematics Task Force Accomplishments and Progress

INTRODUCTION

The Charles A. Dana Center at The University of Texas at Austin has set out a vision in which all students in higher education have the opportunity to succeed in rigorous and relevant mathematics courses. Ultimately, this effort to modernize entry-level college mathematics programs seeks to increase student success by reducing equity gaps, decreasing time to completion, and creating better learning opportunities. While many people might assume this work would be focused solely on the classroom, the Dana Center understands that classroom practice cannot change at large scale unless it is promoted and sustained by systemic structures and processes.

The necessity for effective systemic change led the Dana Center to partner with states and regions to re-envision mathematics programs across institutions and across the two-year and four-year sectors (Charles A. Dana Center, 2015). Through its collaborative work with key state stakeholders, including faculty, administrators, and agency representatives, the Dana Center Mathematics Pathways (DCMP) created a purposeful process to develop, implement, scale, and sustain multiple mathematics pathways. Since the publication of the Dana Center's *Momentum for Improving Undergraduate Mathematics* (Charles A. Dana Center, 2015), a number of states—including Ohio, Georgia, and those that participated in the Building Math Pathways to Programs of Study initiative—have

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made progress towards the goals laid out in their initial task force recommendations. Other states that are currently a part of the Dana Center's Mathematics Pathways to Completion cohort also developed their own recommendations and advanced towards those goals.

Institutions of higher education face a number of challenges related to entry-level mathematics including state policy, transfer and applicability of mathematics credits across institutions, support for underprepared students, misalignment of math content to student needs, and structures and practices based on tradition rather than evidence. While some of these challenges can be addressed within a single institution, most require coordination with other institutions and state policy agencies. Building a strong network of practitioners and policymakers to collaborate, share resources, and create momentum for change is crucial to the implementation, scaling, and sustainability of multiple mathematics pathways. To this end, the Dana Center designed an intentional process that empowers faculty to lead at the state level, engages multiple stakeholders, and is coordinated and aligned across institutions and systems.

This report provides an update of state efforts and progress towards increased student persistence and success as a result of implementing multiple mathematics pathways.

MATHEMATICS AS BARRIER AND OPPORTUNITY

The Dana Center identifies four major issues that negatively impact student success and completion and require structural reform across institutions.

- General misalignment of developmental and gateway mathematics courses with the needs of students and programs, particularly the use of College Algebra as the default gateway math course for most students
- Long developmental education course sequences
- Poor placement practices
- Inconsistent and incoherent applicability of gateway mathematics courses to programs of study across institutions

For additional background and context about why mathematics is a barrier to degree completion, please see *The Case for Mathematics Pathways* (Charles A. Dana Center, 2016).

While course design and classroom practice also impact student success, the Dana Center recognizes that these areas fall more under the purview of faculty at individual institutions and therefore are not a main focus of the systemic, cross-institutional work described in this report.

In 2015, the Dana Center developed a systemic approach to the development and implementation of multiple mathematics pathways with the understanding that far too many students either fail



math courses or pass courses that fail to prepare them for their current academic and future career interests. The DCMP model, which is currently employed in numerous states, is rooted in the concept of “the right math at the right time for all students.” Four principles of the DCMP can guide reform of college mathematics programs at the state, institutional, and classroom levels.

The Dana Center Mathematics Pathways (DCMP) model is structured so that:

Institutions implement structural and policy changes quickly and at scale.

PRINCIPLE 1: All students, regardless of college readiness, enter directly into mathematics pathways aligned to their programs of study.

PRINCIPLE 2: Students complete their first college-level math requirement in their first year of college.

Institutions and departments engage in a deliberate and thoughtful process of continuous improvement to ensure high-quality, effective instruction.

Students receive a high-quality learning experience in math pathways designed so that:

PRINCIPLE 3: Strategies to support students as learners are integrated into courses and are aligned across the institution.

PRINCIPLE 4: Instruction incorporates evidence-based curriculum and pedagogy.

While the DCMP principles ultimately have to be implemented at an institutional level, it is unlikely that a single institution, or even a group of institutions, can fully implement DCMP in isolation. Early studies have demonstrated that institutions can see improvement in student outcomes through implementation of the DCMP principles (Rutschow & Diamond, 2015). However, institutions do not operate in a vacuum. Full implementation of these principles requires addressing a number of cross-institutional challenges. At minimum, these challenges include ensuring the consistent and predictable transfer and applicability of mathematics courses to increase student mobility and persistence and, depending on the state, may also include issues such as placement and how college readiness is specifically defined. Recognizing that these challenges are best answered through a faculty-led and facilitated conversation across institutions and systems, the Dana Center concluded that statewide action is required for effective implementation.



BUILDING AND MAINTAINING MOMENTUM: STATE TASK FORCE PROCESS AND PLANNING

The Dana Center first set out to address these issues across institutions in Texas. That work helped to inform the Center's strategy in Georgia to empower faculty to lead a state-level process for implementation at scale. As work expanded to include more states, the Dana Center developed a theory of scale based on four phases.

- Phase 1** Build momentum for change through the establishment of the task force, utilizing an intentional process to guide meaningful discussions and planning.
- Phase 2** Create enabling conditions through addressing policy issues, and provide resources and technical assistance for implementation.
- Phase 3** Enact the DCMP principles at institutions by building faculty and institutional capacity and aligning institutional structures and policies. Provide supports at the institutional, regional, and state levels.
- Phase 4** Support institutional implementation based on a process of continuous improvement until the mathematics pathways are part of the normative practice of the institution.

This report describes the first three phases of the DCMP theory of scale.

The DCMP theory of scale was put into practice in 12 states through two major national initiatives: Building Math Pathways to Programs of Study (BMPPS) and the Mathematics Pathways to Completion (MPC). BMPPS, in collaboration with Complete College America from 2014 to 2016, included six states: Colorado, Indiana, Missouri, Montana, Nevada, and Ohio. Through this initiative, each state convened mathematics faculty leaders from two-year and four-year institutions to work with policy representatives through a state-level mathematics task force. Each task force established a vision for mathematics pathways in the state, published recommendations, and facilitated activities to support implementation. MPC, which began in 2016, aimed to dramatically improve the success of students in developmental and gateway mathematics courses by implementing math pathways at scale. This initiative supports six states—Arkansas, Massachusetts, Michigan, Missouri, Oklahoma, and Washington—in moving from a broad vision for mathematics pathways to institutional implementation of the DCMP model over three years.

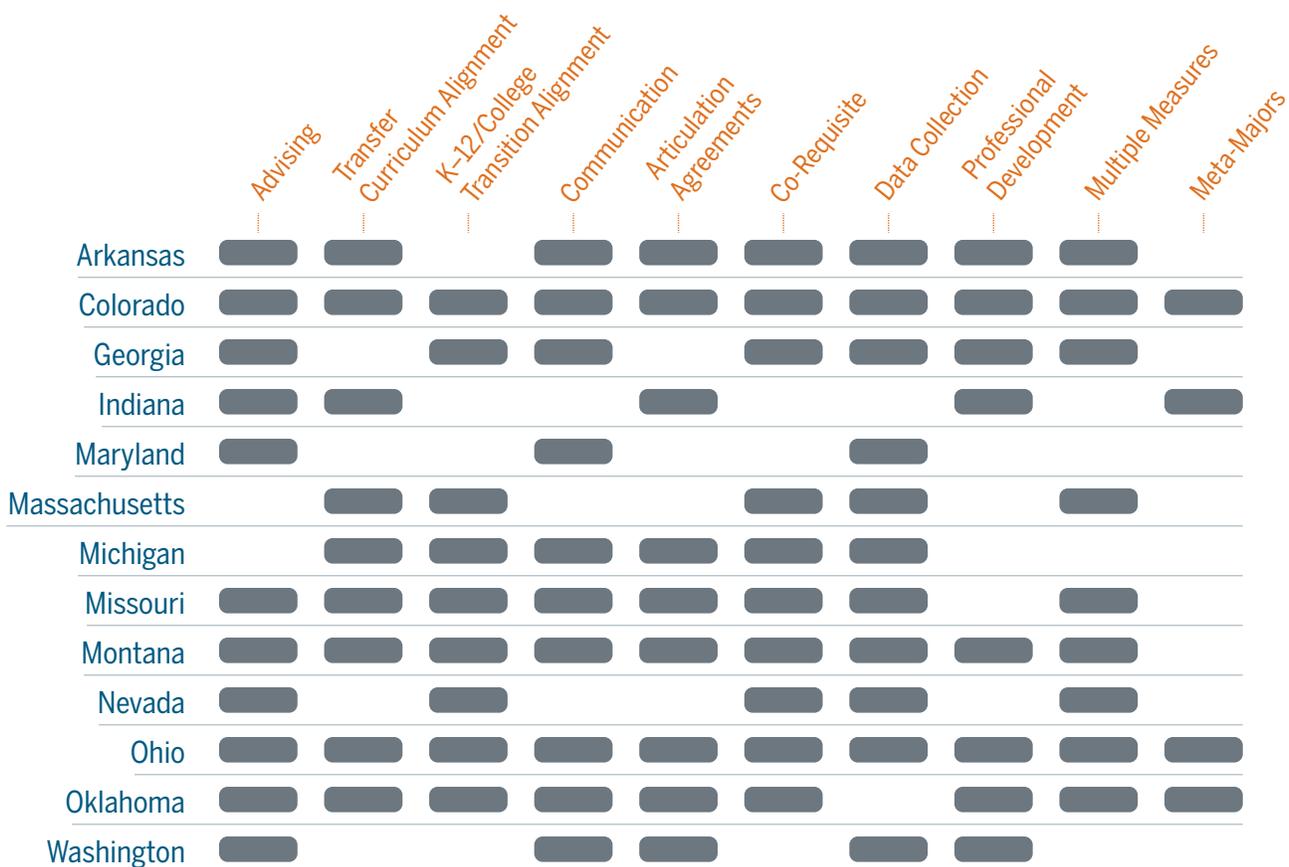
In Phase 1 of the DCMP theory of scale, the Dana Center works closely with a state partner, such as a state agency or student success center, that acts as the convener and hub for the work. Together, the Center and its local partners identify key stakeholders from across institutions and from relevant state-level organizations to serve on the task force. While having “the right people in the room” is necessary for success, process also matters. It is important to establish a process that builds trust, reveals hidden issues, and allows all stakeholders to contribute. For this reason, the Dana Center provides a Leadership Academy for task force chairs and co-chairs, a complete toolkit of resources, and ongoing, customized support.

A vital element of the process is collecting the relevant data and information to inform productive task force conversations and help create a common understanding of mathematics pathways. Understanding data on student success in different mathematics sequences, student transfer, existing math requirements in the curriculum, and other matters is critical to successful

implementation. Additionally, understanding the institutional and state policies that govern advising, curriculum, and transfer provides much-needed context as task force members work to develop and implement alternative math pathways.

Each task force is charged with creating a set of recommendations to guide the implementation of DCMP in their respective states. The recommendations revolve around two central themes: (1) the appropriate pathways for each state, and (2) the factors that would aid or impede successful implementation of DCMP. Although the DCMP model describes a deliberate process to align mathematics requirements to programs of study, it does not dictate specific pathways to be adopted by each state. For example, the 12 states that used the DCMP principles as a framework each found the mathematics pathways that worked best for their particular context. Although there are commonalities across all of the recommendations, states reached their conclusions independently. Their final recommendations and areas of focus are summarized below.

Figure 1. Summary of State Task Force Recommendations



WHERE PRACTICE MEETS POLICY AND PARTNERSHIPS: THE PROGRESS OF MATHEMATICS PATHWAYS IN THE STATES

A key challenge to this work is moving beyond recommendations from Phase 1 and creating conditions that allow for full and sustainable implementation of mathematics pathways through Phases 2 and 3. States support this transition by customizing strategies that address their specific needs, but are still informed by regular support from a consultant and Dana Center staff, tools and resources that address specific challenges, and technical assistance services such as workshops and leadership development.

In their recommendations, the state task forces identified issues and types of actions that fell under multiple categories, including but not limited to: advising, co-requisites, and policy; postsecondary transfer, alignment, and applicability; voluntary partnerships and connection to other reforms; and communication strategies. These and other approaches are summarized in Figure 1, and examples of best practices and progress are summarized below.

One of the lessons learned from BMPPS was the importance of actively engaging the stakeholders at the institutional level—without that engagement, full implementation and scaling of mathematics pathways are not possible. Consequently, the MPC states worked diligently to turn plans into tangible institutional commitments. Missouri, Arkansas, Michigan, Oklahoma, and Washington made significant strides in securing formal commitments from a large number of institutions in their respective states to implement DCMP. Arkansas, for example, secured commitments from 31 out of 33 two-year and four-year institutions in the state, while Oklahoma secured 26 out of its 27 two- and four-year institutions.



Another lesson learned early on in the MPC initiative is that without the consistent and predictable transfer and applicability of mathematics credits to a student's chosen program of study, mathematics pathways cannot truly succeed. To address this issue, the Dana Center is leading intentional and focused efforts related to transfer and applicability in the MPC states. Five of those states (Arkansas, Massachusetts, Missouri, Oklahoma, and Washington) have made progress towards determining whether mathematics is a barrier to student persistence and degree completion, and if the math that students are taking at the two-year level aligns with their academic and career interests at the four-year level. While each approach is unique and designed to address each state's specific context and concerns, the work underway in these five states includes a focus on transfer data and state transfer policy issues, examination of transfer inventory guides, and facilitated discussions and collaboration among regional stakeholders.

The transfer and applicability work in the MPC states is ongoing with clear signs of action and progress. Missouri and Massachusetts are taking regional approaches: Two-year and four-year institutions participated in Dana Center-facilitated transfer convenings in order to develop a shared understanding of how math course requirements align to degree programs across

institutions and to work towards regional, cross-sector, and cross-institutional agreement to support the transfer and applicability of mathematics pathways. Arkansas is taking a policy-based approach to address the transfer and applicability issue by releasing a set of recommendations that align certain programs to quantitative literacy requirements as part of its Arkansas Course Transfer System (ACTS) revision. Similar recommendations for other pathways will follow. Additionally, Arkansas, with the support of the Dana Center, will convene institutions regionally to determine if the recommendations are being properly implemented and degree programs are predictably aligned.

In Michigan, the math task force leaders have strategized how to leverage legislative support and funding for the Michigan Transfer Network to support the mathematics pathways work through faculty professional development, mathematics course alignment to programs of study, and improved access to data across Michigan's institutions. Working groups in Oklahoma and Washington have collected and analyzed comprehensive data in order to create questions and frameworks that can generate student transfer reports capable of identifying barriers to student retention and completion, in addition to highlighting successful programs of study. Washington has also developed a set of recommendations for its statewide Joint Transfer Council, while Oklahoma will explore how to address the applicability issue at the regional level.

As noted above, the institutions implementing DCMP are not functioning in a vacuum. The Dana Center recognizes that DCMP is a partner initiative that pairs well with many of the other student success initiatives under development and implementation in these states. A number of the states (Arkansas, Colorado, Indiana, Missouri, Montana, Nevada, Ohio, and Oklahoma) were intentional in their task force recommendations to connect DCMP implementation to other student success initiatives. Arkansas, Michigan, and Washington specifically connected DCMP work with their student success centers. Examples of complementary student success initiatives include guided pathways and developmental education reform, the use of multiple measures for student placement in developmental education, and co-requisite coursework as an alternative to traditional developmental education.

States in the BMPPS and MPC initiatives have made great progress based on task force recommendations. Figure 2 lists different approaches that states have taken to accomplish several of their goals and strategies.

Figure 2. Examples of Progress in BMPPS and MPC States

APPROACH	STATE EXAMPLES
<p>Policy Changes</p>	<p>Colorado:</p> <ul style="list-style-type: none"> Updated placement policy to allow institutions to differentiate placement for multiple math pathways, and revised statewide transfer agreements to better align math requirements for programs of study. <p>Michigan:</p> <ul style="list-style-type: none"> Secured \$1 million in legislative appropriations in 2018 to support multiple mathematics pathways work by expanding the Michigan Transfer Network, which is tasked with aligning mathematics courses to programs of study. <p>Missouri:</p> <ul style="list-style-type: none"> Passed legislation that created "the CORE 42," a core transfer curriculum that allows students to "seamlessly" transfer a block of general education credits, including credits earned in multiple mathematics pathways, to all public four-year institutions in the state.

APPROACH	STATE EXAMPLES
<p>Transfer and Alignment</p>	<p>Arkansas:</p> <ul style="list-style-type: none"> As part of its Arkansas Course Transfer System (ACTS) revision, released a set of recommendations for programs aligning to quantitative literacy, and plans to release similar recommendations for other pathways. <p>Indiana:</p> <ul style="list-style-type: none"> Integrated math pathways work into statewide guided pathways development, and established recommendations for aligning math pathways to meta-majors. <p>Missouri:</p> <ul style="list-style-type: none"> Finalized entry-level mathematics course student learning outcomes for Mathematical Reasoning and Modeling, Precalculus Algebra and Precalculus, and Statistical Reasoning. <p>Oklahoma:</p> <ul style="list-style-type: none"> Established four student learning outcome working groups for each entry-level mathematics course: College Algebra, Mathematical Modeling, Statistics, and Quantitative Reasoning. These outcomes were finalized for each pathway and included in Oklahoma’s statewide transfer matrix in February 2018.
<p>Voluntary Commitments</p>	<p>Arkansas:</p> <ul style="list-style-type: none"> Secured commitments from 31 out of 33 two- and four-year institutions to adopt multiple math pathways, align math course requirements with programs of study, and adopt co-requisite approaches to support underprepared students. <p>Oklahoma:</p> <ul style="list-style-type: none"> Secured commitments from 26 out of 27 two- and four-year institutions to offer an entry-level math course for at least one alternate math pathway, in addition to College Algebra, by Fall 2018. <p>Washington:</p> <ul style="list-style-type: none"> Hosted a “Pathway to Calculus” meeting with action steps involving all research and baccalaureate institutions in curricular, pedagogical, and structural changes across all public higher education for transfer and articulation.
<p>Communication Strategies</p>	<p>Missouri:</p> <ul style="list-style-type: none"> Hosted five Math Pathways Regional Symposiums to inform stakeholders across the secondary and postsecondary sectors of which math pathways community colleges and universities had implemented thus far, and how to appropriately advise students into each pathway. <p>Nevada:</p> <ul style="list-style-type: none"> Hosted a convening where every college presented their math pathways plans and recommendations to one another in order to foster a common understanding and solicit feedback. <p>Ohio:</p> <ul style="list-style-type: none"> Developed a statewide communications hub for multiple mathematics pathways, in addition to preparing and supporting faculty leaders to serve as math pathway champions and promote the new pathways across the state.

CONCLUSION

With support from the Dana Center, state partners in the Building Math Pathways to Programs of Study and the Mathematics Pathways to Completion initiatives are making strides in improving opportunities for students. These states had identified key policies and issues and are enacting a number of the recommendations from their respective task forces. While each state is responding to its particular characteristics, all of the partner states can be viewed as leaders in the implementation of mathematics pathways.

The catalyst for these state efforts is the Dana Center's recognition that mathematics can pose a barrier to student success. To address this issue, the Dana Center developed an intentional process for implementing multiple mathematics pathways capable of creating structural change and fostering student success. The Dana Center's work first in Texas and then with Georgia, and later with the BMPPS and MPC states, led to the development of an innovative practice regarding student persistence and success—an approach that is unique from any other reform effort in higher education. Recognizing the achievements and great progress in these partner states, the Charles A. Dana Center continues to seek new state and system partners in an ongoing effort to improve mathematics outcomes for all students.

REFERENCES

Charles A. Dana Center at The University of Texas at Austin. (2015). *Momentum for improving undergraduate mathematics: Progress from state mathematics task forces*. Austin, TX: Author. Retrieved from https://dcmathpathways.org/sites/default/files/resources/2017-05/Momentum%20for%20Improving%20Undergraduate%20Mathematics_%20Progress%20from%20State%20Mathematics%20Task%20Forces_2017.pdf

Charles A. Dana Center at The University of Texas at Austin. (2016). *The case for mathematics pathways: Progress from state mathematics task forces*. Austin, TX: Author. Retrieved from <http://dcmathpathways.org/resources/case-mathematics-pathways>

Rutschow, E. & Diamond, J. (2015). *Laying the foundations: Early findings from the New Mathways Project*. Retrieved from https://www.mdrc.org/sites/default/files/New_Mathways_ES.pdf

About the Dana Center

The Dana Center develops and scales math and science education innovations to support educators, administrators, and policy makers in creating seamless transitions throughout the K–16 system for all students, especially those who have historically been underserved. We focus in particular on strategies for improving student engagement, motivation, persistence, and achievement.

The Center was founded in 1991 at The University of Texas at Austin. Our staff members have expertise in leadership, literacy, research, program evaluation, mathematics and science education, policy and systemic reform, and services to high-need populations.

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