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Charles A. Dana Center

K–12 and Postsecondary Collaboration to Improve Mathematics Course Alignment: Recommended Process and Case Studies

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ABOUT THIS RESOURCE

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ABOUT THE DANA CENTER

The Dana Center develops and scales mathematics 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. For more information about the Dana Center Mathematics Pathways (DCMP), see **www.dcmathpathways.org**.

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The Mathematics Launch Years Toolkit consists of briefs intended to support districts and higher education systems in streamlining the transition for students from high school to college. The "Mathematics Launch Years" in high school refer to the content that follows the foundational algebraic and geometric thinking usually located in Algebra I, Geometry, and parts of Algebra II courses. In Launch Years courses, students can explore mathematics pathways aligned to their postsecondary programs of study and career aspirations.

K–12 and Postsecondary Collaboration to Improve Mathematics Course Alignment: Recommended Process and Case Studies

BACKGROUND

Improving students' readiness for college is a critical issue to ensure that all students have equitable opportunities to succeed in higher education. Historically underserved students are far more likely to be identified as "not college ready," a designation that strongly correlates with lower rates of postsecondary course completion, retention, and completion of a certificate or degree (ACT, 2017, p. 20). In particular, mathematics has been shown to be a major barrier to college completion and thus merits special attention (Complete College America, 2016). K–12 districts and institutions of higher education share the responsibility of preparing all students for postsecondary education.

The definition of college readiness in mathematics has evolved in recent years with the advent of mathematics pathways (Charles A. Dana Center, 2016). The mathematics pathways movement seeks to ensure students take the course or sequence of courses relevant for their programs of study. For many students, their college mathematics requirement is part of a mathematics pathway other than the legacy sequence that leads to College Algebra or Calculus. Therefore, K–12 districts need to evaluate whether their course offerings are aligned to this changing higher education landscape. For more information on the implications of the mathematics pathways movement on K–12 mathematics, see the first brief in the Launch Years toolkit, ***The Case for Mathematics Pathways from the Launch Years in High School through Postsecondary Education*** **(Charles A. Dana Center, 2017b)**.

Promoting a productive and effective process for aligning K–12 and higher education mathematics is a challenge because structures are not typically in place to foster ongoing and deep collaboration between higher education and K–12 faculty. Achieving full alignment of high school and college expectations requires ongoing communication between both levels. This brief draws on lessons learned from the Charles A. Dana Center's many collaborations with the K–12 and higher education sectors on mathematics education, sharing recommendations and presenting two case studies from Ohio and Texas to demonstrate this work in practice. It is intended for K–12 and higher education system-level and policy leaders and mathematics faculty leaders to support their efforts to improve K–16 alignment.

RECOMMENDED PROCESS TO FOSTER K–12 AND POSTSECONDARY COLLABORATION FOR MATHEMATICS ALIGNMENT

The goal of K–12 and higher education collaboration is to ensure that the course offerings in high school and the guidance given to students create opportunities for success in college and beyond. After students successfully complete courses that provide a foundation of algebraic, geometric, probabilistic, and statistical content in their first three years of high school, they would be academically prepared for AP or IB Statistics, a dual-credit Quantitative Reasoning course, or Pre-Calculus. In order to achieve better success for students in college mathematics, high school mathematics departments need to vertically align their course offerings with mathematics requirements for programs of study at colleges and universities.

Additionally, a shift in advising students on which mathematics courses to take is essential. Often students are advised into a course based on their perceived readiness for particular mathematics content. Instead, advising for fourth-year mathematics courses should begin with students' career aspirations so advisors can make course recommendations based on the mathematics knowledge and skills students will need in their postsecondary programs of study. All fourth-year options should be rigorous enough to allow students to move between mathematics pathways in their postsecondary education if they ultimately choose a different program of study that has different mathematics requirements.

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From its extensive work supporting states in implementing mathematics pathways, the Charles A. Dana Center identified effective practices for collaborating with a range of education entities. We offer three broad recommendations for a process that cultivates a successful, meaningful collaboration between the K–12 and higher education sectors. The mathematics alignment process requires that leaders consider the policy environment, identify K–12 and higher education leaders and structures needed to make changes to mathematics sequences, and use data to determine one galvanizing charge to begin mathematics alignment work.

Consider the policy environment.

One of the first steps to foster mathematics alignment is to be aware of and to understand current state policies about mathematics alignment as well as policies within districts and in higher education institutions. Policies that can affect mathematics alignment include high school graduation requirements, college readiness measures, college placement exams and practices, and interventions such as mathematics transition courses. It is important to identify relevant policies and determine whether they can be leveraged—or need to be changed—in order to enable alignment. While it is important to understand current policies, it is equally crucial to understand misperceptions or confusion about policy that may need to be addressed within systems.

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The following policies support strong alignment and create the conditions for a more seamless transition to college mathematics. Determine which

of these policies are already in place and which ones a region, state, or institution may need to adopt to fully align K–12 and higher education mathematics.

- States require four years of mathematics for high school graduation.
- Districts offer courses in the launch years that are aligned to the entry-level mathematics courses in college. Students can take college preparatory courses that teach statistics, probability, quantitative reasoning, and information science, in addition to the legacy, algebraically intensive sequence designed to prepare students for Calculus.
- Districts work with higher education institutions to offer a mathematics transition course for students who are not yet deemed college ready in mathematics in the twelfth grade that prepares them for all entry-level mathematics pathways. Upon successful completion of this course, students can take an entry-level college mathematics course without further testing or remedial coursework.
- Institutions of higher education use a range of measures, including GPA—rather than a single test—to determine college readiness and consider readiness for different mathematics pathways.

Form a working group of key K–12 and higher education leaders.

Typically, staff from the higher education and K–12 agencies in the state would establish this type of working group. State and regional contexts should be considered to identify the appropriate leaders and structures that will encourage communication and mutually beneficial collaboration. Defining the right geographic area is also a significant and early decision. Analysis of the common feeder patterns for students from high school to college can help determine which districts and colleges should work together in planning the K–12 to postsecondary mathematics alignment. Additionally, how districts and higher education institutions are organized in a particular state should be considered. In many states, higher education institutions or systems are broken into regions while in other states, college or university systems may be statewide. Each of these different options for organization will affect alignment efforts.

Once working group leaders have determined the geographic area, there are various stakeholders who may be involved in collaborative efforts. Consider if the following groups should be represented and if there are particular influential leaders or institutions that are important to include.

- ***K–12 and higher education mathematics faculty*** have the content expertise and will ultimately realize any alignment efforts. Their leadership and investment in implementing any changes to mathematics courses or curriculum with fidelity are integral to any collaboration about mathematics alignment such as vertically aligning student learning objectives.
- ***K–12 and higher education administrators*** may play a significant role in shaping mathematics changes and need to understand the reasons for the changes in the mathematics sequence. Curriculum directors will know how to navigate system bureaucracies and need to be invested in any reforms so that competing priorities do not ultimately diminish the changes in mathematics.

- ***State-level leaders*** (e.g., representatives from student success centers, the K–12 and higher education agencies, the governor's office, legislative bodies) may be important to include in the discussions about mathematics alignment. Determine whether these groups have influence over the desired changes, and if their input and support would produce a better result for systems and students.
- ***Non-profit organizations and business leaders*** may also play a role in mathematics alignment efforts. They may contribute convening power, be able to deliver messages to a large audience, or help in other ways to promote collaboration between K–12 districts and higher education institutions. Research which non-profit organizations and business leaders may be important and helpful to include in collaboration efforts.

Use data to identify one galvanizing charge.

Once the working group members have been identified, the next step is to analyze relevant data to help define the problems that the group is trying to address and to set common goals for the work. For example, the working group may examine data on low percentage rates of students graduating from high school who are college ready in mathematics, racial disparity in college readiness rates, or fourth-year courses offered in K–12 districts that are not aligned with entry-level postsecondary mathematics courses. After the group has reviewed data and determined the challenge to address, it should focus efforts on one galvanizing charge that will be a first step in aligning K–12 and higher education mathematics. This focus on one issue provides an opportunity for stakeholders in the working group to simultaneously make tangible progress towards their common goals and solidify how best to collaborate effectively.

Examples of Data for Analysis

- Feeder and transfer patterns of students from K–12 to two-year and four-year institutions
- Student success rates across the full sequence of mathematics courses
- College readiness rates upon high school graduation
- Advanced or fourth-year mathematics course offerings in K–12 districts
- Percentage of students enrolled in developmental mathematics education courses and subsequent outcomes for those students
- Entry-level college mathematics course-taking rates compared to the percentage of students in programs of study broken down by entry-level mathematics requirements
- Achievement gaps between student groups based on ethnicity

CASE STUDIES OF SUCCESSFUL K–12 AND POSTSECONDARY COLLABORATION

Efforts in Ohio and Texas to align K–12 and higher education mathematics are showcased here to demonstrate how these states actualized similar reforms in two different environments. Ohio and Texas followed the recommended process while working within their specific contexts. For example, Ohio took on the work of mathematics alignment between K–12 and higher education voluntarily as an extension of efforts in higher education to improve success in college mathematics. In the case for Texas, state legislation prompted higher education and K–12 districts to collaborate on the implementation of a mathematics transition course.

Ohio Mathematics Steering Committee prioritizes K–12 and postsecondary alignment in implementing mathematics pathways.

In 2013, the Ohio Department of Higher Education, supported by the Dana Center, launched the **Ohio Mathematics Steering Committee** to mobilize mathematics faculty from across two-year

and four-year institutions of higher education to dramatically increase the percentage of students who pass gateway mathematics courses and enter programs of study within one academic year. The steering committee launched the Ohio Mathematics Initiative to develop and implement recommendations and formed several working groups to address specific issues. In 2017, the Ohio Mathematics Initiative assigned the K–12 and Higher Education Alignment Committee to work on implementing a mathematics transition course for twelfth graders who are not college ready.

Policy environment

Several factors compelled leaders to collaborate to implement a mathematics transition course. One contributing factor is that Ohio is a state where the Ohio Department of Education and the Ohio Department of Higher Education work collaboratively. The two departments are in the same building, and the State Superintendent's and Chancellor's offices are down the hall from one another. Both the K–12 and higher education agencies agreed to contribute internal funding to support the mathematics transition course initiative. The participation of staff and financial commitments from both agencies demonstrate their investment in working together.

Additionally, Ohio has clear "remediation thresholds" in which students can earn a remediation-free designation. If students enter college remediation-free, they are much more likely to earn a certificate or degree. Students can demonstrate college readiness by achieving a given threshold on assessments such as the Accuplacer, Accuplacer Next Gen, SAT, ACT, GED, PlaceU, NMaple Soft T.A., and Aleks. The percentage of students who graduate remediation-free is part of a district's annual report card and accessible on the Ohio Department of Education website. These district annual report cards are publicly available, which creates a culture of transparency and public pressure to address challenges. Another important policy factor is that higher education institutions are funded based on their performance, including completion rates. Higher education institutions have a financial incentive, in addition to their deep commitment to students, to improve degree completion rates and see college readiness in mathematics as a promising strategy towards this end.

> **"The participation of staff and financial commitments from both agencies demonstrate their investment in collaborating with one another."**

Collaboration between the K–12 and higher education agencies, the state policy of creating a clear remediation threshold, the public reporting of college readiness rates, and postsecondary funding incentives focused attention on increasing the number of remediation-free students. A promising strategy to increase the number of students who are ready to enroll directly into college-level mathematics upon high school graduation is a mathematics transition course for twelfth grade students.

K–12 and higher education leaders and structures

After the K–12 and Higher Education Alignment Committee on the Ohio Mathematics Initiative identified the charge of implementing a mathematics transition course, the committee formed two working groups to lead the development and implementation of the mathematics transition course. The Advisory Working Group is charged with policy and logistical issues related to implementation. It comprises staff from the Ohio Department of Education and the Ohio Department of Higher Education, administrators and staff from higher education institutions and K–12 districts, and mathematics associations in the state. The Development Working Group, consists of K–12 and higher education mathematics faculty who will determine the content taught in the course and make any decisions related to the content and teaching of the transition course.

Essential to a successful alignment initiative is a strong communication plan. The initiative's Communications Committee is charged with encouraging K–12 districts and higher education institutions to implement the recommendations and work of the Ohio Mathematics Initiative, including the mathematics transition course. Because there was no state legislation mandating that districts offer a mathematics transition course—and the over 650 districts in the state would need to decide whether to offer the course—the Communications Committee represents and explains the work of the Ohio Math Task Force to local institutions and districts.

Key learnings

The ability of Ohio to create a statewide coalition across multiple stakeholders and educational sectors is noteworthy. The Ohio Mathematics Initiative was able to build this coalition through a thoughtful process that respected different perspectives and allowed for input and, at the same time, set ambitious, shared goals for improvement. The Ohio Department of Education and Department of Higher Education empowered faculty leaders, invested in the process, and supported extensive communications efforts. The K-12 and Higher Education Alignment Committee built on the Ohio Mathematics Initiative's efforts and identified the challenge of mathematics college readiness and a promising solution in a mathematics transition course.

Texas legislation requires K–12 and postsecondary collaboration to implement a mathematics transition course.

Implementing the College Prep Mathematics course in Texas is a useful case study of how policy can shape collaboration and how a focal point for initiating K–12 and postsecondary collaboration can urge swift and thoughtful action.

Policy environment and relevant data

The Texas legislature in 2013 passed legislation, House Bill 5, which requires that all districts partner with at least one higher education institution to implement a College Prep Mathematics course for students who are not yet ready for college mathematics at the end of eleventh grade. Students who successfully complete the course are deemed exempt from other college readiness measures or exams, as long as they enroll in the partnering institution within two years and enroll in an entry-level, credit-bearing college mathematics course within one year of enrolling in the college. This mandate to implement a College Prep Mathematics course requires higher education and K–12 collaboration around a specific task with a goal that is important to both groups of educators.

In this case, state policy is driving the specific charge on which districts and higher education institutions would work together. The policy presents an opportunity for K–12 and higher education to collaborate on an issue that requires aligning mathematics content in the College Prep mathematics course with the content of entry-level college mathematics courses. Although it was not a higher education and K–12 working group that looked at data to choose this alignment issue, the legislature certainly considered data before writing the College Prep Mathematics course into the legislation. In 2012, 43% of students in Texas community colleges were not ready for college mathematics and were required to take developmental education courses. Of those students who took developmental mathematics in the 2012 cohort, only 48% returned to school the following fall, compared with 65% of students who were prepared in mathematics. From the same cohort of students who had to take developmental mathematics courses, only 33% had been deemed college ready in math or earned a college math credit two years later (Texas Higher Education Coordinating Board, 2015, pp. 5-6). State education leaders

were concerned about readiness for college mathematics and legislatively mandated the College Prep Mathematics course to address this challenge.

The Dana Center encourages districts and higher education institutions to gather data through students' matriculation to postsecondary institutions. The measure of ultimate success for the student is attainment of a postsecondary certificate or degree. Shown below is a continuum of data that would be useful to collect from high school through postsecondary education.

K–12 and higher education leaders and structures

Since the legislation allows each K–12 district and its higher education partner to determine the content of the College Prep Mathematics course, there are many different versions of this course with a range of content. Based on work with districts across the state, the Dana Center learned that some colleges were asking districts to offer old models of developmental courses, typically Intermediate Algebra, for the College Prep Mathematics course at the high school. Intermediate Algebra developmental education courses have very low student success rates in colleges and do not include the range of content necessary to prepare for the all mathematics pathways in higher education. In some districts, students were not enrolled in the College Prep Mathematics course. The Texas Success Center, the Dana Center, and K–12 and higher education leaders recognized the need to involve mathematics faculty in the effort to develop the learning objectives to ensure alignment between the course and higher education mathematics. Learn more about the Texas Success Center's efforts to develop student learning objectives for the College Prep Mathematics course aligned to the multiple gateway college mathematics courses in the second Launch Years brief, ***Defining Content in a Transition to College Mathematics Course at the State or Regional Level*** **(Charles A. Dana Center, 2017a)**.

A few regions in the state decided to take a region-wide approach to implementation to improve the quality of instruction and support materials. Multiple higher education institutions within these regions created reciprocity agreements. These reciprocity agreements allow students to use the college readiness exemption from success in the College Prep Mathematics course at all of the colleges in the region.

Currently, the Dana Center works with three regions that are interested in offering a multiple mathematics pathways approach to the course. In each of the participating regions, different entities served as the catalyzing leader for regional implementation. The following examples illustrate the importance of understanding the local context and how a variety of levers can spur change. In Central Texas, an influential, local non-profit organization facilitated meetings between the Dana Center, the main two-year college in the region, and K–12 districts. The organization's convening power and endorsement were pivotal in recruiting the necessary entities to join the regional effort to establish a common mathematics transition course.

In both the Houston and Corpus Christi areas, mathematics professors were instrumental in encouraging colleges and districts to collaborate. Leaders in Houston were also engaged in a complementary STEM initiative with staff who saw the College Prep Mathematics course as an essential part of meeting the outcomes of the initiative. Leaders of this initiative in Houston

encouraged colleges and districts in the area to work with the Dana Center to implement a high-quality College Prep Mathematics course.

The Dana Center also played a role in enabling implementation by developing materials for a transition course that high schools could adopt or use as a model. The Center also secured grant funding to support professional learning that further fostered collaboration between both levels of education systems and made it easier for faculty to teach the courses effectively.

Through collaborating to implement the College Prep Mathematics course, key leaders in districts, colleges, and universities have built relationships. In an effort to implement the transition course, college mathematics faculty and administrators are bringing together K–12 district mathematics leaders to focus on instructional and logistical issues. Leaders from both levels communicate a minimum of once a year to review the memorandum of understanding for the transition course. Colleges and districts also examine the data from the course and adjust final assessments and instructional materials based on their findings.

Key learnings

Legislative mandates are often met with resistance or are implemented in such a way to meet the letter of the law without fulfilling the true intent. The combination of mathematics faculty, K–12 liaisons at colleges, and trusted partner organizations proved successful in avoiding negative and unproductive backlash and instead fostered K–12 and higher education collaboration. Collaborating to implement the transition course was a tangible way to address mathematics alignment across the two levels of education. Further, the Dana Center's role in providing materials and training underscore the importance of offering essential tools and services that help educators to implement high-quality programs.

GOING FORWARD

There is not one prescriptive formula for achieving mathematics alignment across the K–12 and higher education systems, as exemplified in the case studies of Ohio and Texas. In fact, there is great opportunity for all states and regions to make meaningful progress in improving student success and expanding our skilled workforce by ensuring students have the mathematical training they need for success in postsecondary education and their careers.

Examining the policy environment, identifying and including influential K–12 and higher education leaders, and grounding collaborative work in data to determine a meaningful starting point for the work is a process for beginning thoughtful and concrete work to address the mathematics alignment issues between K–12 and higher education. Improved alignment in the Mathematics Launch Years courses with gateway postsecondary courses will improve students' readiness for college, students' facility with the key mathematical concepts that will serve them throughout their careers, and help students achieve success on a path towards upward social and economic mobility.

REFERENCES

ACT. (2017). *ACT profile report–National: Graduating class 2017*. Retrieved from https://www.act.org/content/dam/act/unsecured/documents/cccr2017/P_99_999999_N_S_N00_ACT-GCPR_National.pdf

Charles A. Dana Center. (2016). *The case for mathematics pathways*. Austin, TX: Author.

Charles A. Dana Center. (2017a). *Defining content in a transition to college mathematics course at the state or regional level*. Austin, TX: Author.

Charles A. Dana Center. (2017b). *The case for mathematics pathways from the launch years in high school through postsecondary education*. Austin, TX: Author.

Complete College America (2016). Data collection. Retrieved from https://ccacollection.sheeo.org/cca/

Texas Higher Education Coordinating Board (THECB). (2015). Developmental education accountability measured data: Community colleges statewide totals (Fall 2012 cohort). Retrieved from http://www.txhighereddata.org/reports/performance/deved/inst.cfm?inst=778877&report_type=2&report_yr=2013.