

Chapter 7

Continuing the Ripple:

Bringing the Community Together to Accomplish Change

People are always looking for the single magic bullet that will totally change everything. There is no single magic bullet.
~ Temple Grandin (Autism Research Institute, 1996, para. 26).

The *IMPACT* document provides suggestions for improving the teaching and learning of mathematics for the primary purpose of increasing students' mathematical PROWESS in the first two years of college. One component of *IMPACT* is to help faculty seek continuous improvement for better ways to meet the needs of their students. Change can happen at many different levels: classroom, department, college, state, and national. For example, an instructor may seek to employ active learning in a classroom. A department may create major-specific mathematics pathways, revise its curricular philosophy, or adopt a process to establish quality instructional materials. A college may choose to rethink its placement policies and at the same time consider alternative models for delivering mathematics content and pedagogy. A multi-campus institution or system may define and solve problems collaboratively and rethink articulations between K-12, two-year colleges, and four-year institutions. A state may choose to help meet the needs of more students with greater efficiency and more appropriate enabling policies. Lastly, national initiatives that promote STEM learning and enhance state standards, such as the Common Core movement, can elevate the teaching and learning of mathematics. In all of these instances, the work involves multiple stakeholders working together to make meaningful change.

For effective implementation of change, faculty can benefit from the support of college administration and their department. In parallel, the department benefits from faculty ownership and support of the administration to enact such changes. Changes at the college level also require faculty and administration working together to review and update local policies and procedures that foster campus support for reform. Such changes are not easy, but there are now many examples of institutions and groups working to influence the types of changes that this document advocates.

Change, especially educational change, often requires periods of disruption, discomfort, and inconvenience on the part of faculty, administrators, and students. It is important, though, that such temporary issues not stand in the way of actions that will help students succeed and better meet their academic goals. One model for success in accomplishing educational change is to consider and involve stakeholders as change is envisioned and implemented. Those who seek to initiate change in the first

two years of mathematics at the college level should never lose sight of the following five key elements for effective change: (1) student-centered, (2) policy-enabled, (3) administratively-supported, and (4) culturally-reinforced, (5) educator-driven. These elements are based on the work of the Charles A. Dana Center at the University of Texas at Austin. The Dana Center has been working for many years to improve student success in mathematics and has a track record for successfully impacting change. The organization is working with statewide systems and individual institutions to build mathematics pathways. It believes that *all* students in higher education should enroll in pathways that will

- prepare them to use mathematical and quantitative reasoning skills in their careers and personal lives
- enable them to make timely progress towards completion of a certificate or degree
- empower them as mathematical learners (The Charles A. Dana Center, n.d.-a).

A key outcome of their work is the development of alternatives to the traditional algebra-for-all pathway, based on the needs and goals of students in a changing world. They encourage local educational leaders to develop their own structures and strategies so that mathematics pathways are built as follows:

1. **Institutions implement structural and policy changes quickly and at scale.** Mathematics pathways are structured so that all students, regardless of college readiness, enter directly into mathematics pathways aligned to their program of study. In addition, students complete their first college-level mathematics requirement in their first year of college.
2. **Institutions and departments engage in a deliberate and thoughtful process of continuous improvement to ensure high-quality and effective instruction.** Students engage in high-quality learning experiences in mathematics pathways designed so that strategies to support students as learners are integrated into courses and are aligned across the institution and that instruction incorporates evidence-based curriculum and pedagogy (The Charles A. Dana Center, n.d.-b).

The Dana Center has developed resources to help stakeholders engage in thoughtful planning, knowing that the logistics of working on the transfer and applicability of pathways to programs can be daunting. This work takes time and commitment and needs someone to manage the process to make sure that important details that might negatively impact students are anticipated and avoided. Amy Getz (personal communication, May 9, 2017) from the Dana Center suggested a number of takeaways from their work:

- Local work at the institutional and classroom levels is critical, but simultaneous work across all levels of the system is necessary for change to be taken to scale.
- Standardization evolves to “coherence without conformity.” That is, there is both structure and flexibility.
- Development of a model for engagement across a system requires a strategy for working with all of the institutions. Some institutions are more ready for change than others.
- Policy is complex and important. The Dana Center stresses the importance of being proactive on policy issues and prioritizing advocating for change as part of the process.

- Transfer and applicability to program requirements and pathways are issues for both two-year and four-year colleges. Two- and four-year transfer partners need to establish memoranda of understanding for mathematics requirements.
- Statewide-level change is possible but requires a strategy.

As faculty, when our frame of reference is just one institution it is easy to lose sight of what shifts are happening in college-level mathematics around the country. To provide a national perspective, every five years the Conference Board of the Mathematical Sciences (CBMS) surveys a sample of two-year and four-year college mathematics departments and publishes a statistical abstract of undergraduate programs in the mathematical sciences in the United States. For the first time, the 2015 CBMS survey addressed the implementation of mathematics pathways. The survey reported that in the fall 2015, fifty-eight percent (58%) of two-year colleges indicated having implemented a pathways course sequence, enrolling a total of 192,000 students (Blair, Kirkman, & Maxwell, 2018). Some colleges reported implementing not one, but multiple pathway courses such as Foundations (often non-algebraically intensive courses designed to prepare students for college-level gateway courses), Quantitative Reasoning/Literacy, and Statistics. In addition, significant changes occurred between 2010 and 2015 with respect to course content, delivery methods, and instructional strategies.

Another organization, The Carnegie Foundation for the Advancement of Teaching, has a national presence in working on solutions to low transfer-level mathematics completion rates through their Carnegie Math Pathways program utilizing Networked Improvement Communities (NIC). The work of the NICs is leveraged to promote change in institutions and systems through their “Change Package”, which pushes beyond the traditional curriculum adoption reform to include the needed supports for both students and faculty. The “Change Package” includes

- accelerated pathways coursework
- ambitious, relevant, problem-centered curriculum
- student-focused, collaborative pedagogy
- productive persistence (socio-emotional) interventions/practices
- language and literacy supports embedded in materials and training
- comprehensive and sustained professional learning opportunities
- network engagement to support adoption and ongoing improvement.

Although this work initially focused on non-STEM pathways, additional units were developed to allow students to move into algebra intensive pathways (C. Thorn, personal communication, July 13, 2017).

In the rest of this chapter, we provide examples of change, the challenges encountered, the solutions employed, and results experienced. We share how faculty, administration, policy, and culture interacted to improve outcomes for students. The intent of this chapter is not to say that such changes are appropriate for all, but to illustrate the types of large-scale changes that have been made in mathematics in the first two years of college and how such changes occurred.

Changing a State

Building a Community of Two-Year and Four-Year Faculty: The Ohio Mathematics Initiative

In May 2013 the Ohio Department of Higher Education (ODHE) (at the time called the Ohio Board of Regents) convened the Ohio Mathematics Summit, a meeting of mathematics faculty from all 36 two- and four-year public institutions of higher education in Ohio. The Summit was organized to explore

- policies that were impacting mathematics education in the state's two- and four-year postsecondary institutions
- student retention issues confronting institutions across the state
- concerns about the Ohio Transfer Module guidelines for mathematics, statistics, and logic
- effectiveness of quantitative pathways for STEM and non-STEM postsecondary majors.

This meeting resulted in the creation of the Ohio Mathematics Steering Committee with the goal to develop expectations and processes that result in each campus offering pathways in mathematics. These pathways will yield (1) increased success for students in the study of mathematics, (2) a higher percentage of students completing degree programs, and (3) effective transferability of credits for students moving from one institution to another (ODHE, 2014, p. 2).

The Steering Committee was chaired by Joan Leitzel, Professor Emeritus of Mathematics at The Ohio State University. Uri Treisman and the Dana Center provided assistance to the Committee. The final report released in March 2014 included an action plan, *Rethinking Post-Secondary Mathematics* (ODHE, 2014). The recommendations of this report resulted in the creation of the state-wide Chairs and Leads Network, consisting of mathematics chairs and leads from each of Ohio's public institutions of higher education. This network has enabled timely, meaningful, and cross-institutional communication. Some of the accomplishments of the Network include

- the development of a framework for mathematics pathways
- the development of a quantitative reasoning course that is transferable statewide
- a revision of the Ohio Transfer Module Mathematics, Statistics, and Logic Guidelines
- the development of Fast Fact sheets about the work to maintain communication (Ohio Mathematics Initiative)
- bringing together college and high school mathematics faculty, advisors, and counselors

Mathematics faculty play a central role in this project which has helped to develop an influential statewide "mathematics community." The Chairs and Leads Network collaborate with administrators on their own campuses and the ODHE to implement ideas. Communication is an important component of this project where subgroups work to revise, revamp, or replace state-level policies that hinder or prevent innovative course offerings and non-traditional approaches to remediation and mathematics education. In addition, individual institutions engage mathematics faculty in revisions to course offerings, remediation, student support services, and mathematics pathways aligned with programs of study. Another facet of the project is state-level work with K-12 partners that explores 12th grade transition courses along with other pathways from secondary to postsecondary institutions. Finally, professional development activities and regional workshops provide training to faculty. Paula Compton, Associate Vice Chancellor, Articulation and Transfer for the ODHE (personal communication, April 22, 2017) sums up what they have learned: "When there are overarching goals

that will help students with their mathematics education, faculty will come together to pursue those goals with the support of the state and teams of faculty meetings and professional development opportunities.”

The work in Ohio centered on concerns about what is best for students in a world of changing demands. Key players worked to enable the necessary policies to allow change to happen. Administrators understood and supported the endeavors, communication was robust to support a culture that reinforced the work, and faculty played a central role throughout.

Changing Policy to Multiple Pathways

The Maryland Mathematics Reform Initiative (MMRI)

Shortly before Brit Kirwan retired as Chancellor of the University System of Maryland in 2015, he made a commitment to facilitate multiple mathematics pathways for students in public two-year and four-year institutions in Maryland to better meet the needs of students. The University System of Maryland received a First in the World grant from the U. S. Department of Education to “develop, implement, and evaluate a statistics pathway in order to accelerate developmental students’ progress into credit-bearing postsecondary courses and help more of those students reach certificate or degree completion effectively and efficiently” (The University System of Maryland, 2016).

Twelve schools, seven community colleges, and five University System of Maryland institutions chose to participate in the grant although all public and private institutions in Maryland may participate in the meetings and professional development activities. The grant supports faculty to experiment with and collect data on student success when innovative pedagogy and placement strategies are used to create the goal of having better mathematics pathways for students. According to Nancy Shapiro, Principal Investigator and Associate Vice Chancellor for Education and Outreach of University System of Maryland, a high priority of the project was to revise the Code of Maryland Regulations regarding the general education mathematics requirement that applies to all public institutions of higher education in Maryland, since the existing regulatory language was interpreted to be discouraging to the implementation of mathematics pathways. A new Code of Maryland Regulations general education mathematics requirement was approved in July 2016 with new courses that can be applied to a student’s program of study to be in place by July 2018.

Each institution participating in the grant is developing a new pathway to the first college-level statistics or quantitative literacy course. According to John Hamman, Dean of Mathematics and Statistics (personal communication, April 17, 2017), Montgomery College chose to use the Dana Center Mathematics Pathways Foundations of Mathematical Reasoning course to prepare students for a college-level statistics course. Initially, the biggest challenge for Montgomery College was the short time to select and develop a new foundation course and have it through the college’s curriculum approval process so that a limited pilot could be conducted the following fall. The Foundations of Mathematical Reasoning course has some study skills built in, but faculty will embed study skills videos in the course as well. There are issues that will be studied carefully, such as whether the course will be appropriate for students who enroll in Survey of College Mathematics rather than Statistics, and if the new course provides students with an adequate mathematics background for other subjects that have an intermediate algebra prerequisite.

The College of Southern Maryland also based their Foundations of Mathematical Reasoning course on the Dana Center. Rob Farinelli, Associate Vice President of Academic Affairs and Professor of Mathematics at College of Southern Maryland (personal communication, July 21, 2017), said that their college’s students, following successful completion of this course, will be able to enroll in either

a college level Statistics course or a new Quantitative Literacy and Reasoning course. Some colleges participating in the project have selected other curricular options to prepare students, reinforcing the Dana Center's (A. Getz, personal communication, May 9, 2017) concept of "coherence without uniformity." Many of the colleges in the project report challenges with helping advisors understand the rationale for the pathways and why they should advise students to take the new foundation course.

With the help of leaders, who took on the role to enable the policy changes required to shift practice, the work focused first on what was best for Maryland students. Supported by campus administrators, the new opportunity for change triggered a culture that reinforced innovation, bringing together two-year and four-year college faculty in the state to lead the work on new mathematics pathways for students.

Changing a System

Mathematics Pathways: Ivy Tech Math Pathways Project, Indiana

Ivy Tech Community College is Indiana's public, statewide, singly accredited community college with 14 regions and over 40 sites throughout the state. In just four semesters, a number of teams composed of faculty, staff, and administrators overhauled its assessment and placement process; established three pathways of gateway mathematics courses aligned with different programs, majors, degrees, or career programs at the college (Tech Math, Quantitative Reasoning (QR) with developmental mathematics corequisite, and STEM); and eliminated standalone developmental mathematics courses in the Quantitative Literacy pathway. Rob Jeffs, Professor of Mathematics at Ivy Tech Wabash Valley and Carrie McCammon, Math Pathways Project Director at Ivy Tech Wabash Valley Region, stated (personal communication, April 24, 2017) that college faculty and academic leaders worked in partnership with the Dana Center to achieve

- validating the mathematics competencies that students in each program needed to be successful in the curriculum, seek employment in the field, or transfer to a university
- grouping the necessary competencies into a minimum number of gateway courses and work with program faculty to assure that the courses students select for their program meet the respective program's quantitative requirements
- convening four teams (Tech Math, QR, STEM, and Skills Development) to work with mathematics and program faculty to implement coursework and materials for pilots; evaluate content and pedagogy; and provide professional development for faculty who teach the new courses
- reviewing and aligning all of the questions in the 14 strands of test questions for the ACCUPLACER to courses in order to have more meaningful cut scores
- implementing multiple measures for placement
- implementing professional development in support of the QR, corequisite, and Tech Math courses
- surveying and identifying faculty who needed additional coursework to teach the QR course
- collecting and reporting on data on student success in the new Math Pathways courses

Faculty were central to this project and took on leadership and supporting roles. Jeffs and McCammon reported (personal communication, April 24, 2017) that "... the focus was on student success. ... The cooperative work of math faculty and program faculty in the development of the QR and Tech Math pathways facilitated meaningful progress."

Previously, small numbers of students in technology programs passed the developmental and gateway course sequence. Jeffs and McCammon reported that as of 2017, after two years, 64% earn a C or better and 73% earn a D or better, which is leading to increased graduation rates for technology programs. With the co-requisite model with the QR course, Ivy Tech has seen over 60% of students who enrolled in the QR course successfully pass in one semester. Previously, if students had to start in the first of four developmental courses, fewer than 10% completed the gateway course in multiple semesters.

Major initiatives, such as the Ivy Tech Math Project, always have challenges. In addition to the four semesters needed to develop the new courses, new assessments, and placement procedures, an implementation timeline was established for phasing in and phasing out courses since community college students typically attend part-time. Resources were essential for training, stipends, faculty offloads, and money for materials for the Tech Math course. With changing demands, more faculty were needed for the QR courses and fewer for the STEM mathematics courses. Some faculty were required to take a few courses and participate in professional development in order to teach the QR course. An ongoing challenge is transferability. Work is underway to look at degree outcomes rather than courses so that the outcomes of the QR course can be evaluated. Collaborations through the Indiana Transfer Single Articulation Pathway and the Indiana Math Innovations Council will help with transferability of the new courses.

The Ivy Tech Math Project transformed mathematics in the Ivy Tech system with its unwavering focus on student success through the creation of mathematics pathways and the improvement of assessment and placement. Faculty, staff, and administrators participated in the statewide teams and helped to develop a culture of high expectations.

Changing an Institution

Shortening the Pipeline through Collaboration: Harper College High School Course Alignment Project, Illinois

Often, student success is achieved when all stakeholders work together to find solutions to critical issues. One of the important aspects of the Harper College High School Course Alignment Project was that administrators brought key players together early for difficult conversations as the project needed to garner support of a larger group of faculty. Kimberley Polly, Professor of Mathematics at Harper College, (personal communication, May 1, 2017) noted “No one likes change and this project required high school and college faculty to think differently about a seamless transition from high school to college.

In 2009, administrators from Harper College’s three feeder school districts met to look at data on where their graduates placed in mathematics courses when they arrived at Harper. After reviewing the data, it was clear that it was important to increase the percentage of high school students who placed into college level mathematics courses at Harper, and to shorten the time it took to get to college level courses for those students who placed into developmental courses. Polly described the outcome of years of meetings and discussion as a comprehensive plan to move students towards college readiness in mathematics. The first part of the plan was the alignment of high school and college curricula which then led to the development of a high school final exam written collaboratively by high school and Harper faculty. Next came discussion of alternative methods of placement into college level courses using the results on the high school final exam. When this final exam was given in May 2012, the scores were lower than expected. As a result, the high school faculty and Harper faculty got together to discuss new alternatives for senior year mathematics. They proposed a “catch up” course for a

subgroup of students so that they might be college ready in math by the end of senior year. If the students had done poorly on a final exam written entirely by Harper faculty, the success of the partnership might have been in doubt. The dual credit Quantitative Literacy course became a senior-year option; high school seniors were also allowed to take Harper's highest level developmental math course, Intermediate Algebra.

Polly's response to what they learned that would benefit others is that "building trust takes time and a lot of commitment from both sides. Strong partnerships require compromise and compromise makes both systems better Having high school faculty teach dual credit courses helps to smooth the transition from high school to college . . . , strengthens the prerequisite high school courses which makes students more prepared for our courses as they move forward."

Administrators brought a small group of high school and college teachers together to address issues of student success and began to develop the culture for change. The data on placement and student success highlighted the need to better address the challenges facing incoming students. Faculty set goals to decrease the number of students placing into developmental mathematics, shorten the time required to get to college level mathematics, and align high school and college courses. Over time, a culture of collaboration has been built that serves students.

Meeting the Needs of Liberal Arts and Humanities Students: Tarrant County College and The University of Texas at Arlington Redesign Projects

Two colleges in Texas, Tarrant County College and The University of Texas at Arlington, each undertook similar reform projects to get students into appropriate mathematics pathways based on their majors. After reviewing data on student success and researching various mathematics pathways, Tarrant County College formed an exploratory team to propose some changes. The team consisted of mathematics faculty members, an advisor who was also a mathematics adjunct, the Student Success chair, and the Math and Science Division Dean. Working from the Dana Center's Guiding Principles and after careful research and communication with intentional transparency, the team recommended modifying the Developmental Math I course and eliminating Intermediate Algebra as a prerequisite for the two most common, non-STEM oriented college level mathematics courses taken by students, Statistics and Contemporary Math (Quantitative Reasoning). This reform started as a pilot on two of the campuses and has been implemented districtwide.

Tommy Awtry, Dean of Mathematics and Science on the Southeast campus of Tarrant County College, described replacing the Intermediate Algebra prerequisite for the Statistics and Contemporary Math courses as a significant change that required the engagement and ownership of mathematics faculty at the district level since Tarrant County College is a large, multi-campus, one-district college. Key challenges for this change first involved conducting research and then sharing this information with a broad number of key players throughout the six campuses in the district. Awtry felt it was important to focus on what is best for the students, rather than instituting an initiative because others are doing so or simply for the sake of implementing something new. Awtry (personal communication, May 2, 2017) also noted that "Reform works when the movement is faculty and data driven, and when the implementation team is given enough time to research, pilot, and gather data. Reform often fails when it is administratively driven or when not enough time is given for research and data gathering. Choosing well-respected and positive individuals for the implementation team is also a critical element for successful reform."

Shanna Banda, Learning Resource Director at the University of Texas at Arlington, along with faculty redesigned all of the entry-level mathematics courses, developed appropriate pathways for students based on their degree plan, and created two new developmental courses. She noted (personal communication, May 10, 2017) that the Fundamentals of Contemporary Mathematics course "serves students entering Contemporary Mathematics or Elementary Statistics along with a Fundamentals of

Algebra course that serves students entering College Algebra or Business Algebra.” In addition, they updated all other courses, added lab components and technology, and worked with other disciplines to change the required mathematics course when appropriate. This work, driven by the need to place students in the appropriate course for their degree plan, yielded higher course success and retention rates.

Once both institutions had created new mathematics pathways along with new foundations courses, a memorandum of understanding was written to ensure transferability of the mathematics courses from Tarrant County College to University of Texas at Arlington. Banda reminds us that projects such as theirs take several years to implement completely. She says, “Change is never easy, but fortunately people were quick to realize the importance of the efforts.”

These data-driven projects began with a focus on student success while administrators supported the changes. Faculty played a key role in determining how best to meet student needs and policy modifications eventually required bringing two schools together. While the culture reinforced the changes, those changes took significant time.

Improving Student Success through Equity Mentoring: The Equity Mentoring Project at the Community College of Aurora, Colorado

Improving student success is not always just a matter of changing mathematics pathways, revising courses or creating new ones. Sometimes, it is necessary to change what goes on in individual faculty classrooms. The Equity Mentoring Project at the Community College of Aurora, Aurora, CO, focuses on increasing student success by applying the University of Southern California’s Center for Urban Education Equity Scorecard to identify and change practices and beliefs that lead to inequitable outcomes for students in terms of race or ethnicity. An important part of this was to develop an understanding of how higher performing faculty were obtaining student success results.

A team of mathematics faculty used the Equity Scorecard to collect information about faculty classroom practices in developmental mathematics courses and College Algebra at the Community College of Aurora. As the team gathered evidence and reviewed data, they found that some faculty had success rates that the department sought for all instructors. According to James Gray (personal communication, May 15, 2017), then the mathematics Department Chair at the Community College of Aurora, this provided the project team “an anchor to inquire how those faculty were able to get such good results.” He reported that the team was “asked to reflect upon the findings from a race-conscious point of view and develop recommendations for changes designed to positively impact inequitable outcomes. They were assisted by Center for Urban Education Equity who helped them navigate through the process of looking at the evidence in new ways. As a result, the Mathematics Department developed and implemented the Equity Mentoring program at the college.

Faculty learned a number of lessons about themselves and their students. One important lesson had to do with the idea that communication is cultural. It was easier for the faculty to understand this concept in regards to international students. Faculty learned how different subcultures can communicate in very different ways, and how these ways impact the students’ expectations. Another lesson was that although information was usually communicated verbally, there was nonverbal communication when faculty ignored things that they had previously verbalized such as students coming in late or texting in class. The nonverbal message to students was that the faculty were not really concerned with their rules. By listening to the experiences of students and faculty of color about what they experienced in their education histories, they learned that from a very early age, students of color are exposed to powerful and pervasive race-based messages about whether they will be successful in mathematics. These messages come from society as a whole but also from individual teachers and faculty who expect less of their students of color. These students often learn that it is important for faculty to understand the narratives that they have heard about themselves and their

capabilities, and to intentionally and purposefully disrupt these narratives. Finally, the process confirmed the basic principle that every faculty member has taught a student who had legitimate skill preparation issues who overcame them through persistence. Likewise, every faculty member has taught a student who appeared to have all the talent and ability necessary to succeed in their mathematics class yet did not pass. Through action research into their own practices, they learned how their own actions and beliefs impact whether or not they create an environment in which students exhibit the persistence needed for success regardless of skill level.

The chair mentored the full-time faculty and each of them was asked to mentor two part-time faculty. Mentors reviewed individual faculty data that compared their success rates to the course average, class observations, syllabi, and they reviewed the tasks each faculty asked their students to do between the first day of class and the first exam. They found that the lowest level developmental mathematics class had the highest level of inequities. Since part-time faculty taught the majority of these sections there was a focus on including part-time faculty who taught this course.

Gray reported that there were challenges to overcome during this project since faculty did not know of any other examples of equity work being done in this way. A few of them were concerned that by addressing inequities they would also necessarily reduce rigor. Some faculty wanted to do this work but did not know where to begin. Other instructors were fearful that they would say the wrong thing and be labeled as culturally insensitive. As a result of this work, one of the criteria the department uses in hiring new faculty is to hire people who have an interest in, and talent for, doing equity work.

In addition to the Equity Mentoring Project, the Aurora Math Department also engaged in redesigning their developmental mathematics courses and implementing a co-requisite remediation model for College Algebra. They collected significant data about student success and compared success in their new, accelerated developmental course to that in the developmental mathematics courses it replaced. In addition, they compared student success in the new course with traditional instruction versus mastery learning. They also broke down student achievement by ethnicity and gender and generated the same data for their Intermediate Algebra course. They looked at ethnicity and gender data for individual instructors and examined their students' success rates when they went on to College Algebra. Over time, faculty who participated in the Equity Mentoring Project increased success rates for their students. The higher student success rates in Intermediate Algebra resulted in higher success rates in College Algebra. The combined reforms at the Community College of Aurora yielded high success rates across most ethnic groups. For example, Gray noted that in 2015-2016 and 2016-2017 78% to 82% of students passed both the traditional College Algebra and a College Algebra modeling course with no gaps for Black and Hispanic students. In fact, Black and Hispanic students sometimes slightly outperformed Caucasian students.

The impact of the project went beyond the Math Department. The lessons learned led to the creation of the college's Equity Leadership Academy. Each semester, five to six faculty go through a similar process in which they do action research about one another's practices. The work of the Equity Leadership Academy is done in a community of practitioners who help each other learn and grow. Faculty led this project with the support of administrators (and assistance from the Center for Urban Education Equity) to better understand and meet the needs of their students. They intentionally developed the culture of a community of practitioners to help one another through this work.

Increasing Student Access to College through Open Education Resources: The Maricopa Millions Project at the Maricopa County Community College District, Arizona

In 2012, the Maricopa County Community Colleges tasked a small group of faculty and staff to research open educational resources (OER) and develop a vision for how Maricopa should engage in this effort. Given the name Maricopa Millions Project, the primary goal from the beginning was to remove cost and access barriers associated with traditional textbooks and publisher subscription codes

by supporting faculty adoption and development of OER. The commitment of district administration to fund the program was based on the goal that the project would save Maricopa students \$5 million over five years in course materials, while providing students with immediate and permanent access to learning. This administrative support was vital for involving passionate faculty in the process, many of whom were already interested and invested in OER before the outset of the initiative. Cost saving was not the only focus, however. As the project unfolded, Maricopa Millions expanded its efforts to include event to bring broader awareness to faculty and students in order to maximize the impact of OER where it is most needed, in the classroom.

Lisa Young, Faculty Director, Center for Teaching & Learning at Scottsdale Community College, served as a leader on the Maricopa Millions project. Young reported that “Due to the desire to reduce the cost of education to students and ensure they have access to critical learning materials, faculty adoption of OER was an important focus” (personal communication, April 9, 2018). Maricopa Millions has used funds committed by the district’s leadership to offer incentives to faculty through grant funding to develop, revise, remix, and adopt OER by calling for proposals to create content for courses with the highest enrollment. This developed content has been publicly shared via Canvas Commons (with the search tag MMOER) and promoted within Maricopa at faculty-focused dialogue days and other OER events, such as Open Education Week. Young also stated that “Students have benefited from increasing adoptions, and some have even been directly engaged by way of student-focused awareness events designed to teach them how to use the ‘low-cost/no-cost’ filter when searching for classes.”

While Maricopa Millions set out to save students \$5 million over five years, the project surpassed its goal and resulted in a savings of over \$11 million. This is directly attributable to the nearly 30 courses funded and adopted through the nine phases of the grant process, and it also reflects the wider campaign for promoting open resources led by the steering committee and chairs. For example, to boost enrollment in OER courses (and to raise student awareness in general), Maricopa Millions also adopted the #textbookbroke campaign and faculty engaged directly with students at different campuses. Faculty participants set up event tables outside of the student center and interacted with passing students about textbook costs and how to search for courses with “low-cost/no-cost” materials. These events were not only informative for students but rewarding as unique student-faculty interactions outside of the classroom. The great success of Maricopa Millions was possible because of active engagement on all levels – from students and faculty in the classroom to administrative support.

Due to the immense success, the Maricopa County Community Colleges has decided to institutionalize Maricopa Millions by creating a Faculty-in-Residence OER Coordinator assignment, wherein a faculty OER champion would receive full reassigned time for 2-3 years to focus on growing OER initiatives throughout the colleges. The project continues to evolve by focusing now on student engagement and pedagogical innovation in that its grant funding model will encourage faculty to develop, revise, remix, and adopt OER according to one or more of the following focus areas: improving accessibility, incorporating culturally-sustaining pedagogies, developing renewable assignments, and enhancing courses with multimedia and interactives.

Working Together for Accomplishing Change

The projects that are profiled in this chapter are just a sample of projects that are underway to help students succeed by reaching college level mathematics as quickly as possible. Institutions are looking at creating mathematics pathways that are relevant to students’ program of study. Administrators are eager to support projects that will increase student success. Although each of these

projects have had challenges, it is much easier to navigate the challenges when you are part of a community of practitioners whose culture reinforces the work. There are now examples of positive outcomes when leaders are willing to question long held beliefs about what mathematics students need and how students are assessed and placed. The work continues and we hope that your institution's story of change will be shared within our mathematics community.

Are you frustrated with decisions being made about mathematics education at the institutional, state, or national level? Would you like to collaborate with others to effect change? Do you already have great information or ideas on how to work with stakeholders? Head to AMATYC.org/IMPACTLive and find innovations your colleagues are using or contribute innovations and ideas of your own.

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