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SUCCESS STORY

How Effective Redesign Can **Improve Development Math Outcomes**

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Abstract

From 2007 to 2009, Rock Valley College's developmental math coordinator, Kathleen Almy, led a complete redesign of her college's traditional developmental math sequence. While doing so, she discovered that although traditional algebra courses were working more efficiently than before the redesign, it wasn't solving bigger problems students were facing.

In 2009, the American Mathematical Association of Two-Year Colleges (AMATYC) began working on a new national project to reimagine what developmental math could be both in terms of content as well as instruction. As a representative of Illinois, Kathleen was one of 15 faculty members who developed the reimagined developmental math course called Math Literacy for College Students. It created pathways in developmental math based on whether a student was heading to College Algebra or Statistics/Quantitative Reasoning.

Without materials for the chosen pilot schools, Kathleen and her colleague, Heather Foes, decided to create their own. Joining forces with Pearson, Kathleen and Heather created Math Lit, the first pathways textbook from the faculty's perspective, offering an accelerated pathway to college readiness through developmental math. The text allowed the course to be implemented with the modernized instructional and content approach.

We invite you to review our findings below, where you'll see:

- A large-scale redesign involving content, instruction, and assessment modernization in action
- Evidence that pathways courses have no statistically significant difference in outcomes from students starting in beginning algebra (while also saving the student an additional semester).

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Challenge

> With developmental math courses having the highest failure and non-completion rates of any developmental subject, college educators consistently look for ways to improve their developmental math programs.

From 2007 to 2009, as the developmental math coordinator for Rock Valley College, Kathleen led a comprehensive redesign of her college's traditional developmental math sequence. That work involved significant changes in the number and length of courses, their pace, the content development, and the policies used throughout the department. While the changes made the traditional algebra courses work well, it was still just a band-aid on a fundamental problem. The underlying assumption was that this was the correct content for all students underprepared for college-level math. In actuality, this was untrue.

Traditional developmental math was built on the theory that all students are headed towards calculus when in reality, only a small percentage actually do. In developmental courses, students are treated as though they have never seen the content before. Those who get through it and need to take a statistics class will learn material they won't use. Instead of proper preparation for their next chosen course, developmental math courses can become an unintentional barrier to college math and an impetus for leaving college altogether.

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Solution

After Kathleen led the redesign at Rock Valley College, she realized that the algebra courses were working really well, but the content was never touched. Although the pass rates increased by over 20 percentage points on average, improving traditional algebra courses was only a temporary solution.

In 2009, the American Mathematical Association of Two-Year Colleges (AMATYC) began working on a new national project that would reimagine what developmental math could be. The project, which was spearheaded by the Carnegie Foundation and the Dana Center at The University of Texas was funded by the Lumina and Gates foundations. Kathleen, representing the state of Illinois, was one out of 15 faculty members who developed the reimagined developmental math course Math Literacy for College Students, also known as Quantway, using authentic problems and active learning for students heading to non-STEM math courses like statistics and quantitative reasoning.

From a faculty perspective, Kathleen knew that if the course didn't have well-constructed and vetted materials to accompany it, it wouldn't come to full fruition.

> "Materials and professional development are key to implementing a new course and instructional approach. Without them, no change really happens."

Without any materials for the colleges not chosen as one of the colleges in a nationwide pilot, Kathleen and her colleague, Heather Foes, began creating content. It quickly became apparent that cobbling together existing materials wouldn't work since the topics needed, their order, and the pedagogy used was so different. They began writing their own materials and approached Pearson to publish them. **In 2011**, they signed a book deal and started working on what would be known as *Math Lit*, a textbook from the faculty's perspective. It was the first developmental pathways textbook published and the leader in its genre.

Math Lit, a one-semester alternative to the traditional two-semester developmental algebra sequence for non-STEM students, offers an accelerated pathway to college readiness through developmental math. It prepares non-STEM students to move directly into liberal arts math or introductory statistics while also including enough algebra to prepare STEM students for intermediate algebra. *Math Lit* emphasizes contextual problem-solving and approaches each topic with the questions "how does it work?" and "how can I use it?" Not only do students work through activities and explorations to gain a greater conceptual understanding of the four thematic strands: numeracy, proportional reasoning, algebraic reasoning, and functions, but faculty can use the text as a step-by-step guide for instruction.

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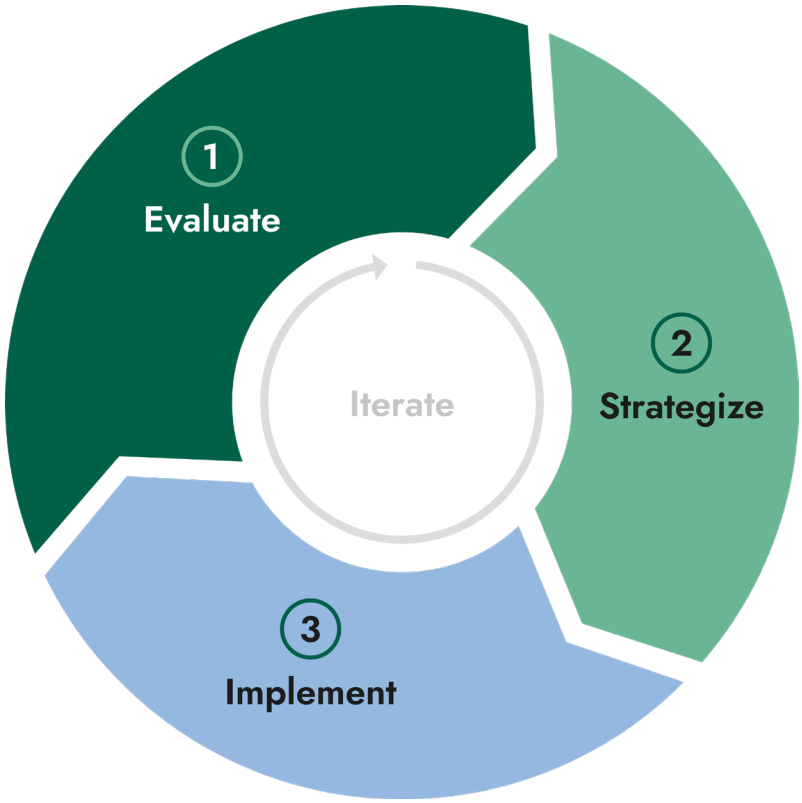
Bringing Pathways to Life

Redesigning the curriculum is one of the first steps to modernizing developmental math. Bringing a new vision of developmental math to life requires substantial work at many levels (classroom, departmental, college, state). A college must move through multiple phases just to get a pilot offering.

First, they must strategize how to incorporate a new course and its pathway into their existing approach. This phase involves educating anyone affected on a new course and building buy-in for change. This may even involve policy at a higher level so that the course can be used as a prerequisite. That leads to the need for a plan for implementation including scheduling, staffing, course approvals, a syllabus, and materials. Then implementation begins.

Faculty have to feel comfortable teaching with new materials in a new instructional style, which involves training. After all of those phases have been completed and the course is in use, tweaks will need to be made after data is collected. This last stage of iteration closes the loop and leads to another cycle of change if needed. Over time, the activities, topics, topic order, and assessment approaches are refined.



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Findings

Quantway and its accompanying developed course for statistics-bound students, Statway, were piloted at select U.S. colleges with support from the Carnegie Foundation and the Dana Center's Math Pathways (DCMP) program. The groups conducted research throughout the development and implementation of the new courses.

Here's what was found:

- Rigorous analysis indicates that students in the Statway program are three times more likely to complete college-level mathematics in one year and to earn more college-level mathematics credits in subsequent years than similar students in traditional algebra-based course sequences (Yamada & Bryk, 2016).
- Preliminary analyses of longer-term outcomes suggest that Quantway students are more likely to earn a two-year degree or credential, and Quantway and Statway students are more likely to transfer to a four-year college, as compared to a general population of community college students (Huang, 2018; Norman, 2017).
- Subgroup analyses have shown that the program's benefits are strong for students with a range of prior proficiency levels in mathematics, including those who placed one and two levels below college-ready. Using a propensity score matching approach, Yamada, Bohannon, Grunow, and Thorn (2018) found that Black and Latino men experienced the strongest gains in rates of passing remedial courses and entering college-level math as a result of taking Quantway courses.

- A large-scale random assignment study of DCMP is underway, and early results have shown stronger pass rates for students enrolled in the DCMP version of the developmental course. DCMP students are also more likely to attempt and pass college-level mathematics. Further, the impacts of DCMP appear to be greater for part-time students as well as for students who placed into multiple developmental areas (Rutschow, 2018; Rutschow, Sepanik, et al., 2019). This research has not examined outcomes by race/ethnicity.
- Colleges using Math Lit had similar results with no statistically significant difference in outcomes in gateway math courses between students in traditional algebra courses and those in pathways courses like Math Literacy. The focus on using algebraic concepts and reasoning over simply learning the mechanics of algebra and a modernized instructional design helped prepare students for the rigor and expectations of college-level math courses. Students were regularly asked to communicate verbally and in writing with their classmates to make sense of concepts, which were more challenging than a traditional developmental algebra curriculum.

For example, students were investigating loans and how viral growth works, not just solving equations like 3x - 2 = 15. Relevant contexts and timely problems, like analyzing the impact of the opioid crisis, engage students in the content. The mathematical development also used proven best practices of moving from concrete to abstract situations instead of beginning and focusing on abstraction, which is the approach common to developmental algebra.

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Classroom Impacts for Students and Faculty

Community colleges and universities throughout the U.S. have adopted developmental math pathways to augment their traditional developmental algebra and sometimes replace it. Even with the growing use of corequisite remediation, there's a population of students that won't benefit from a corequisite.

Developmental math pathways like Math Literacy provide a one-semester option that is effective and modernized. It allows students to gain the skills and readiness for math and college to succeed in a college-level math course. Math Literacy's use continues to evolve to implementations. **It is a developmental math option used in high schools as a senior course that prepares students for college-level math (as soon as they graduate), satisfying some state mandates.**

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Demonstrated Results

"Stagg High School is currently using the Math Lit curriculum for our Senior Applied Math Course [a transitional math course].

The curriculum is perfect for applying math concepts in real-life situations. Students constantly comment on how they see the importance of what they learned in their first 3 years in high school as it is applied in a context that they see each day. The projects and course work allow you as an educator to make a connection with your students through great discussions and applications."

John Daniels, Math Teacher | Stagg High School

"The approach in this text where the content is highly contextualized and the class sessions involve active learning are what makes this class unique. The choice of book was critical to the success of this class [Math Literacy for College Students].

Students tell me that for the first time in their lives they actually feel like they understand the math they are learning."

Donna Carlson, Professor of Mathematics | College of Lake County
Transitional Mathematics Liaison | Lake County High Schools

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Getting Started With **Your Gateway Redesign**

If your institution is exploring how to redesign gateway courses or ready to lead broader transformation, Almy Education is here to help. Our expert-led sessions prioritize faculty engagement and momentum, paving the way for collaborative redesign that drives student completion and institutional success. Whether launching your first initiative or scaling existing reforms, you'll leave with a strategic blueprint for advancing your gateway course redesign and sustaining positive impact even after our engagement ends.

almyeducation.com/getstarted