Carnegie Foundation
for the Advancement of Teaching

Carnegie Math Pathways™ 2015-2016 Impact Report: A Five-Year Review

CARNEGIE MATH PATHWAYS

TECHNICAL REPORT

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Abstract

College math is a gateway course that has become a constraining gatekeeper for tens of thousands of students annually. Every year, over 500,000 students fail developmental mathematics[1], preventing them from achieving their college and career goals. The Carnegie Math Pathways initiative offers students an alternative. It comprises two Pathways courses, Statway® and Quantway®, that provide post-secondary students with an accelerated method to complete developmental mathematics sequences and attain college-level math credit. Since its launch in classrooms at 29 colleges in 2011, Statway and Quantway have served over 20,000 students. In 2015-2016, the Pathways had achieved remarkable results even while serving over four times as many students as in its initial year. Student success rates in Statway, Quantway 1, and Quantway 2 reached 50%, 64%, and 67% respectively. New impact studies also show that Pathways students have higher completion rates, subsequent math enrollment and success, credit accumulation rates, and transfer rates from two-year to four-year colleges.

This report provides descriptive statistics on the 2015-2016 student outcomes, as well as insights into potential areas for improvement based on data from the Pathways' fifth year of implementation.

The Problem

Nearly 60% of the nation's incoming community college students fail the math placement exam and are required to take at least one, and often more, developmental (also known as remedial) mathematics class(es) as a first step toward earning associate or bachelor's degrees (Bailey, Jeong, & Cho, 2010). However, 80% of the students who place into developmental math do not successfully complete any college-level mathematics courses within three years (Bailey et al., 2010). Many of these students spend long periods of time repeating courses and ultimately leave college without a degree or specialized credential. As a result, many of the over 1.7 million first-time students each year[2] will fail to acquire essential mathematics skills and are thus unable to progress toward their career and life goals.

The Pathways Solution

To address this national problem, the Carnegie Foundation for the Advancement of Teaching formed a network of college faculty, administrators, researchers, and program designers who worked together to create a transformative approach to developmental mathematics education: The Carnegie Math Pathways (previously called Community College Pathways or CCP). We call this type of group, whose members apply their specific expertise to a common aim, a Networked Improvement Community (NIC) (Bryk, Gomez, Grunow, & LeMahieu, 2015).

[1] Bailey, Jeong, and Cho (2010) claim that approximately 60% of first-time community college students are placed into developmental math courses. Of those students, up to 80% never complete their credit-bearing math course (Bailey et al., 2010). According to the data (retrieved on 03/13/2017) from the National Center for Education Statistics - IPEDS Data Center, the average number of first-time community college students from 2011 to 2015 is approximately 1,100,000 annually. Sixty percent of that figure is 660,000, and of this new amount, 80% is 528,000. Thus, approximately half a million students each year do not obtain college math credit.

[2] See National Center for Education Statistics (2010), Table 241.

The Pathways program currently offers two courses: Statway® and Quantway®. Statway is a year-long, college-level statistics course. It integrates developmental and college-level math into the lessons so students who complete the entire course earn their required college math credit. Statway is designed to address specific barriers and challenges, and does so by making problems relevant to students' lives. A lesson on random sampling, for example, is embedded in a word problem about a college seeking to determine what percentage of students would be willing to pay more for a reserved parking place. Faculty also learn new pedagogical techniques that require less lecturing and more student engagement.

Quantway is designed with similarly engaging pedagogy and relevant content, but is delivered as two separate semester-long courses: Quantway 1, which fulfills the requirements for students' developmental mathematics sequence, and Quantway 2, the subsequent semester course through which students receive college mathematics credit in quantitative reasoning. The Pathways join students and faculty in a common, intensive pursuit of a shared goal—for students to achieve college math credit in one year, rather than requiring them to struggle through the typical two-year sequence of courses leading to calculus, which is more advanced mathematics than many students require for their major.

STATWAY

Statway integrates developmental mathematics skills and college-level statistics into a collaborative, problem-focused class.

It is a year-long pathway that replaces the traditional algebra sequence and a statistics course, allowing developmental math students to earn college-level credit for statistics in a single academic year.

QUANTWAY

Quantway 1 is a single-semester quantitative reasoning course that fulfills the requirements for students' developmental mathematics sequence and prepares them for success in subsequent college-level math.

Students who succeed in Quantway 1 are then eligible to enroll in Quantway 2, a college credit-bearing quantitative reasoning course, or another college-level course appropriate for their field of study.

Pathways Enrollment

Since its launch, the Pathways have experienced continual growth, expanding into new campuses and serving more students every year. In 2015-2016, total enrollment was 6,220 (see Table 1)—quadruple the first year of enrollment—with 320 sections taught by 222 faculty members across 36 institutions (see Table A1 in the Appendix).

Remarkably, the Pathways' outcomes have maintained their extraordinary levels of success, even in the context of continued growth. Over the course of five years, the program has maintained successful course completion rates of 55% while serving increasingly larger student populations. (Sowers & Yamada, 2015; Strother, Van Campen, & Grunow, 2013; Van Campen, Sowers & Strother, 2013).

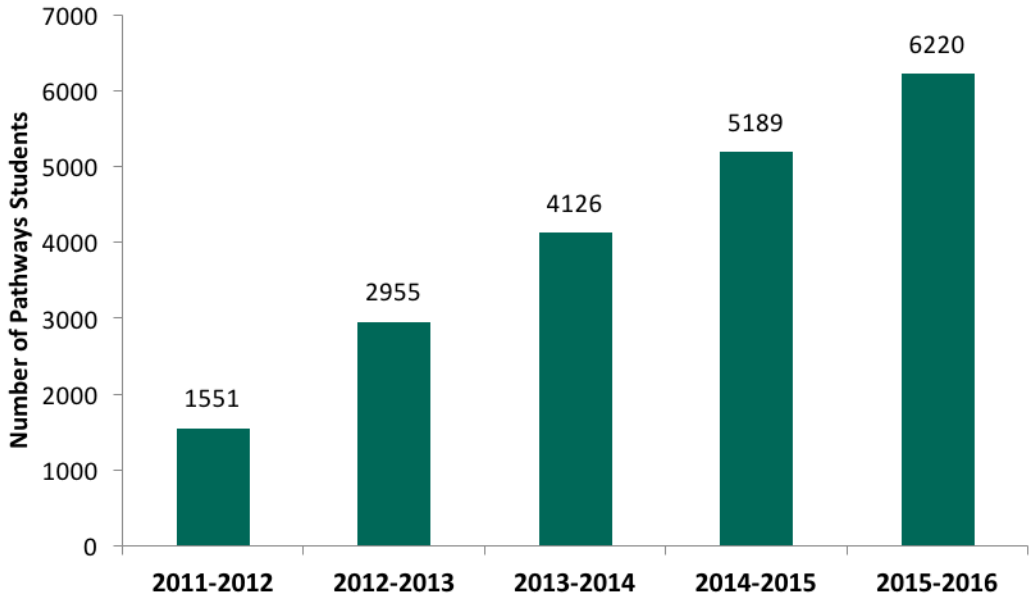

Figure 1. Pathways Enrollment Over Five Years

Table 1. Pathways Enrollment, 2011-2016[3]

		2011-2012	2012-2013	2013-2014	2014-2015	2015-2016
Statway	Students	1,133	1,553	2,283	2,862	3,254
	Institutions	21	22	22	26	21
Quantway	Students	418	1,402	1,843	2,327	2,966
	Institutions	8	8	11	13	16
Total	**Students**	**1,551**	**2,955**	**4,126**	**5,189**	**6,220**
	Institutions	**29**	**30**	**33**	**38**	**36**

Student Performance in Statway

Statway's success rate is defined as the percentage of students who started the course in the fall academic term and completed the full, year-long Pathways with a grade of C or higher (the outcome required on most campuses for college credit to be awarded), or a Pass in a Pass/Fail grading system[4]. Overall, there were a total of 2,531 students enrolled in the fall 2015 cohort, and 1,263 (50%) successfully completed the Statway sequence (see Table 2a).

[3] Data reported in this table (and subsequent tables and figures) may vary slightly from statistics reported in previous issues of the Impact Report. This difference exists because data have been updated to reflect the new and more accurate information from participating colleges. In addition, data used to compute success rates for 2015-2016 and after are reported directly by faculty, whereas data for the previous years are from institutional research data.

[4] If a grading system is used that employs +/-, success in a course is defined as achieving a C- or higher. For the purpose of calculating the success rates, the denominator of the ratio includes those who received W (Withdraw) or I (Incomplete) grades.

Table 2a. Student Success in Statway Across Five Years at Community Colleges and Four-Year Institutions

	Institutions	Size of Analytic Sample[5]	Students Successfully Completing the Full Pathway	Success Rate
Fall 11 Cohort	18	1,120	557	50%
Fall 12 Cohort	22	1,057	598	57%
Fall 13 Cohort	22	1,435	737	51%
Fall 14 Cohort	18	1,485	720	48%
Fall 15 Cohort	21	2,531	1,263	50%
All Fall Cohorts	35	7,628	3,875	51%

Specific to community colleges, there were 2,467 community college students in the fall 2015 cohort, and 1,212 (49%) completed the full pathway with a grade of C or higher and earned college credit (see Table 2b). In conjunction with the first four years' outcomes, overall success rates demonstrate that approximately 49% of community college students successfully completed Statway.

Table 2b. Student Success in Statway Across Five Years at Community Colleges

	Institutions	Size of Analytic Sample	Students Successfully Completing the Full Pathway	Success Rate
Fall 11 Cohort	18	968	468	48%
Fall 12 Cohort	18	853	445	52%
Fall 13 Cohort	19	1,294	620	48%
Fall 14 Cohort	16	1,391	652	47%
Fall 15 Cohort[6]	21	2,467	1,212	49%
All Fall Cohorts	34	6,973	3,397	49%

Though it was designed to serve community college students, Statway has been employed successfully for students at four-year universities as well. In the last five years, Statway has been offered at five California State University (CSU) campuses, where successful completion rates have been higher than usual. In 2015-2016, 51 (80%) of 64 CSU students in our analytic sample successfully completed the full pathway with a success rate of 73% (see Table 2c). Because students at community versus traditional colleges tend to differ in some important ways[7] , we have broken out the community college analyses themselves. Nonetheless, these numbers suggest that Statway can be usefully applied for a range of students in a variety of contexts.

[5] The analytic sample is based on students who begin the Statway sequence in the fall academic term. This allows us to compare one academic year to another based upon comparable conditions. Total enrollment figures include students starting in any academic term within a given year.

[6] One college offering three-term Statway started in Winter 2016; thus, this academic year includes success numbers in summer for that particular college.

[7] For example, CSU campuses have higher admission requirements than community colleges – who must admit all students. CSU students are also required to complete all developmental requirements in the first year.

Table 2c. Student Success in Statway Across Five Years at California State Universities

	Institutions	Size of Analytic Sample	Students Successfully Completing the Full Pathway	Success Rate
Fall 11 Cohort	2	152	89	59%
Fall 12 Cohort	4	204	153	75%
Fall 13 Cohort	3	141	117	83%
Fall 14 Cohort	2	94	68	72%
Fall 15 Cohort	1	64	51	80%
All Fall Cohorts	4	655	478	73%

The above results represent a dramatic improvement on the outcomes for students in traditional developmental math courses. Typically, only 6% of a baseline group of developmental math students successfully earned college-level math credit in one year[8]. Even when allowing a two-year timeframe for the baseline group to fulfill their requirements, only 15% successfully completed the traditional sequence and earned college math credit (see Figure 2). Compared to these outcomes, students in Statway—with the weighted average success rate of 50% across five years—are achieving triple the success in half the time.

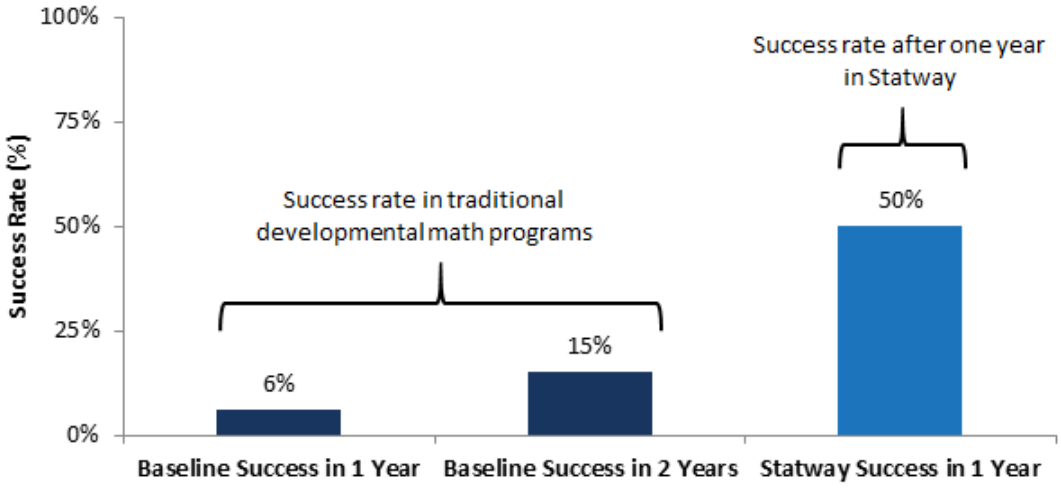

Figure 2. Student Success in Traditional Programs Versus Statway

Student Performance in Quantway

To determine Quantway 1 success, we computed the percent of unique students who enrolled in either the fall or spring terms and completed the course with a C or higher, or a Pass

[8] To compute this baseline success rate, we worked with institutional researchers from 18 Statway colleges in year 1 to collect data on developmental mathematics course-taking prior to Statway implementation. Analyses revealed that only 5.9% of non-Statway developmental math students enrolled at these colleges in 2008 received credit for college-level mathematics in one year. Additionally, only 15.1% had achieved this goal after two years, 20.4% after three years, and 23.5% after four years.

in a Pass/Fail grading system[9]. In 2015-2016, we achieved the highest success rate in the five years since implementing the program is colleges: 1,724 students (64%) out of 2,680 successfully completed Quantway 1 (see Table 3a). Among those who successfully completed Quantway 1, 1,079 took the course in community college (with a success rate of 60%) and 645 enrolled in it at four-year institutions (a success rate of 74%) (see Table 3b[10]).

Table 3a. Student Success in Quantway 1 Across Five Years at Community Colleges and Four-Year Institutions

	Institutions	Size of Analytic Sample	Students Successfully Completing Quantway 1	Success Rate
2011-2012	8	418	234	56%
2012-2013	8	1,402	732	52%
2013-2014	11	1,805	1,062	59%
2014-2015	11	1,936	1,107	57%
2015-2016	16	2,680	1,724	64%
Total	19	8,241	4,859	59%

Student success in Quantway 1 far exceeds that of students in traditional developmental math sequences. Only 21% of a baseline group of developmental math students passed a traditional developmental math course within one year[11] (see Figure 3). Extending that timeframe to two years increased the cumulative pass rate to only 29%. Quantway 1 students, on the other hand, with a 59% weighted average success rate across five years, achieve double the success of the typical approach in a single semester.

Table 3b. Student Success in Quantway 1 in Year Five at Community Colleges and Four-Year Institutions

	Institutions	Size of Analytic Sample	Students Successfully Completing Quantway 1	Success Rate
Community Colleges	13	1,813	1,079	60%
Four-Year Institutions	3	867	645	74%

[9] If a grading system is used that employs +/-, success in a course is defined as achieving a C- or higher. For the purpose of calculating the success rate, the denominator of the ratio includes those who received W (Withdraw) or I (Incomplete).

[10] Because of the dramatic increase in Quantway enrollment, this year we include Table 3b (Quantway 1) and Table 4b (Quantway 2) to separate the success rate of community colleges and four-year institutions.

[11] To compute this baseline success rate, we worked with institutional researchers from six of the first Quantway colleges. Analyses revealed that only 20.6% of students were able to successfully complete their developmental math sequence within a full year. Additionally, 28.5% achieved this goal after two years, 31.6% after three years, and 33.3% after four years.

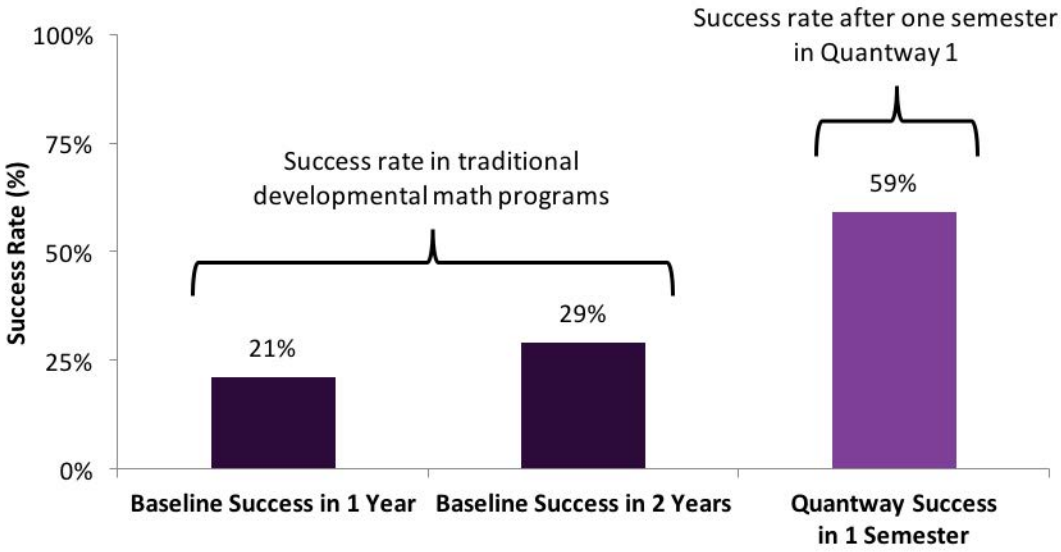

Figure 3. Student Success in Traditional Programs Versus Quantway 1

Quantway 2, the college-level companion course to Quantway 1, also displayed encouraging results in its fourth year of implementation. Of the 286 students enrolled in Quantway 2 in 2015-2016, 193 (67%) successfully completed the course with a grade of C or better and earned college credit[12] (see Table 4a). This, combined with the first three years of Quantway 2 implementation, results in an overall success rate of 65%.

Table 4a. Student Success in Quantway 2 Across Four Years at Community Colleges and Four-Year Institutions

	Institutions	Size of Analytic Sample	Students Successfully Completing Quantway 2	Success Rate
2012-2013	3	44	30	68%
2013-2014	5	217	145	67%
2014-2015	3	168	96	57%
2015-2016	5	286	193	67%
Total	7	715	464	65%

Additionally, the success rate at community colleges (68%) is similar to that of four-year institutions (66%) (see Table 4b). These findings, taken together, suggest that Quantway 2 is an effective college-level mathematics option, and that, similar to Statway, Quantway 2 is applicable to multiple contexts. Quantway 2 can be offered as a stand-alone college-level Quantitative Reasoning course or as part of a coherent Quantway pathway that combine Quantway 1 and 2.

[12] If a +/- grading system is used, success in a course is defined as achieving a C- or higher. The denominator of the success rate includes those who received W (Withdraw) and I (Incomplete).

Table 4b. Student Success in Quantway 2 in Year Four at Community Colleges and Four-Year Institutions

	Institutions	Analytic Sample	Students Successfully Completing Quantway 2	Success Rate
Community Colleges	4	254	172	68%
Four-year Institutions	1	32	21	66%

It is noteworthy that in 2015-2016, one large institution offered Quantway as a pathway similar to the Statway sequence in which a cohort of students completes both terms sequentially with the same instructor. The overall success rate (including both Quantway as a pathway and stand-alone Quantway) for that institution is 50%; on the other hand, the success rate for Quantway as a pathway is 55%. One likely explanation for the lower overall success rate is that a number of students went on to take a different math courses instead of Quantway 2 (because they were not recruited at the outset to participate in two courses as a sequence). This offering is now an official pathway at several colleges. We will share the results in next year's annual report.

Transfer Rates

In addition to the promising success rate, Pathways students also have high transfer rates. Specifically, Statway students across all participating community colleges transfer from two-year to four-year colleges at a rate of 43% within four or five years compared to the 32% transfer rate of all community college students within six years, as reported by the NSC[13] (see Figure 4).

Given that it takes time for students to earn enough credits to transfer, the comparison with NSC data is particularly favorable since Pathways students have had less time to transfer compared to the national comparison group. Additionally, since the NSC data captures all community college students, it includes both remediated and non-remediated students. For both these reasons, the success of Pathways students in transferring is particularly notable.

[13] The data from the NSC are the best benchmark data currently available for transfer among two-year community college students, and the 2010 cohort data are the most recently compiled. Data are currently not available that exactly match the schools and time period for the Pathways students for transfer rates. The NSC data capture outcomes for all students within 300% of normal completion (i.e., three years) at two-year institutions. Statway students have had four to five years to complete a degree or transfer, which is a similar duration. See Norman (2017) for an analysis of post-Statway and Quantway analysis – including data on transfer and completion.

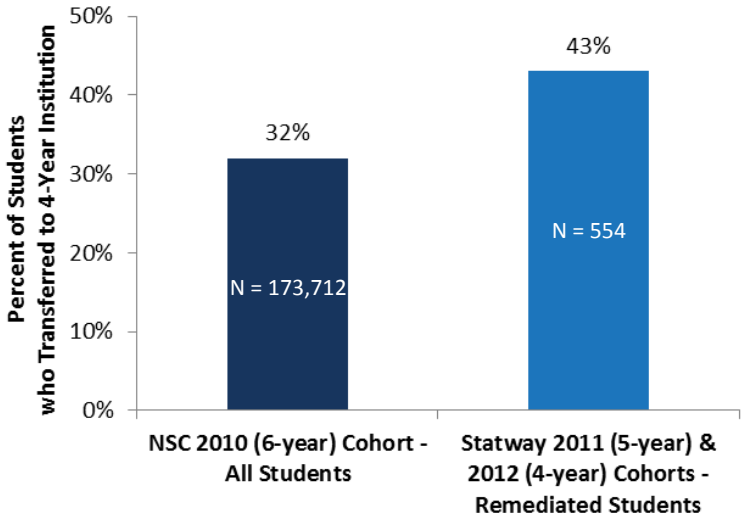

Figure 4. National Transfer Rates to Four-Year Institutions Versus Statway Transfer Rate (With or Without Degree)

Similarly, 46% of Quantway students transfer from community college to four-year institutions within five years. By comparison, nationally only 32% of all community college students transfer to four-year institutions within six years (see Figure 5). Also, 27% students who successfully complete Quantway go on to earn an associate degree compared to 20% of non-Quantway students at the same school[14].

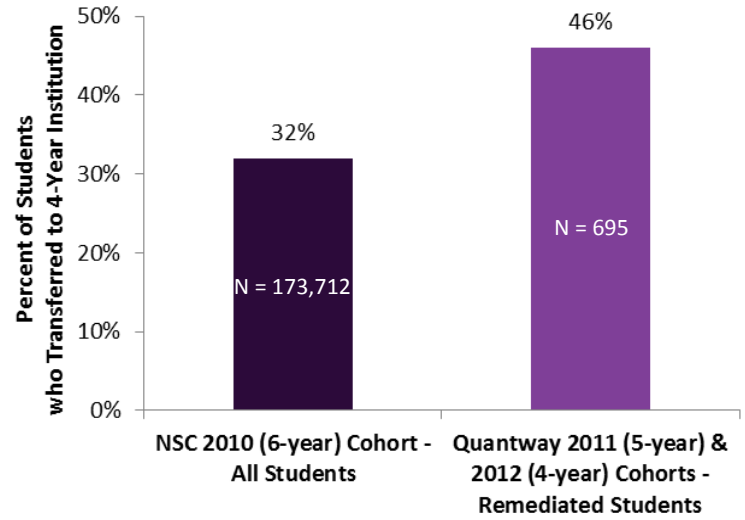

Figure 5. National Transfer Rates to Four-Year Institutions versus Quantway Transfer Rate (With or Without Degree)

[14] The data from the NSC are the best benchmark data currently available for transfer among two-year community college students, and the 2010 cohort data are the most recently compiled. Data are currently not available that exactly match the schools and time period for the Pathways students for transfer rates. The NSC data capture outcomes for all students within 300% of normal completion (i.e., three years) at two-year institutions. Quantway students have had four to five years to complete a degree or transfer, which is a similar duration. See Norman (2017) for an analysis of post-Statway and Quantway analysis – including data on transfer and completion.

Evolution of the Pathways Networked Improvement Community

While the origins of the Pathways NIC can be traced back to convenings of practitioners and research experts, as well as the work of the development partners in 2009, the activity of the NIC has changed dramatically as efforts have shifted from creating and testing the original content and instructional practices to learning how to apply a set of explicit interventions at scale. From its creation, the Pathways improvement efforts have engaged the scholarly math societies and a range of education researchers and experts on relevant practices. Although Carnegie initiated this process and served as stewards of the effort initially, it has been led by the field, for the field. The notion of strong field ownership was part of the vision from the outset and continues to be operationalized as the NIC has matured.

This broad engagement can be seen in the ongoing development of content (Gomez, Gomez, Rodela, Horton, Cunningham, & Ambrocio, 2015), support for new instructors (Edwards, Sandoval, & McNamara, 2015), and in setting priorities for the NIC at large. In particular, the NIC has made it a priority to write new assessment items and develop new types of items to better measure higher skill levels. The Pathways use common end-of-course assessments that need to be updated and refreshed both to align with curriculum improvements and to ensure test security. At the same time, as the materials are revised and examples changed, the item banks used for in-class, formative assessment also need to be updated. Carnegie staff worked with a group of NIC faculty and national math assessment experts to design the goals for and build an online item writing course that is now being taught by NIC faculty to NIC faculty. Similarly, the Pathways have developed resources to train mentors of new faculty. There is a similar learning structure for the curriculum development process.

One significant development that supports broad field engagement is formation of the Carnegie National Faculty (CNF). While many of the CNF are engaged in the development and professional learning activities described above, they also serve as an advisory group that helps formulate strategy. The CNF is composed of highly effective instructors who have a desire to participate in the NIC's governance. Their insights and expertise are a critical part of keeping the work problem-focused and user-centered. This, along with the examples cited above, illustrate the extent to which responsibility for the direction and operation of the NIC has been increasingly shared among members, thus significantly developing the NIC's leadership.

Improvement Priorities for Pathways Success

Now in the fifth year of Pathways, we continue to explore the question: How might we improve the Pathways offerings to further increase student success in developmental math? While outcomes so far have been hugely positive, we are continuing to study why some students have difficulty completing the course. We are using improvement research tools to explore the ways in which students fail to succeed in order to better target interventions. Statway is more institutionally complex than Quantway because it keeps students in a cohort across two semesters. The analysis below helps us understand what is happening at each point when students fail to complete part of the pathway or continue into the next.

In Statway, there are five primary ways in which one can think of non-success in the 2015-2016 academic year:

1. Students who completed but failed the first term of Statway (SW1), and thus did not enroll in the second term (SW2) (33% of non-successful students in 2015-2016).
2. Students who succeeded in SW1, enrolled in SW2, but failed SW2 (23%).
3. Students who withdrew from SW1 and did not enroll in SW2 (16%).
4. Students who succeeded in SW1 but did not enroll in SW2 (16%).
5. Students who succeeded in SW1 and enrolled in but withdrew from SW2 (11%).

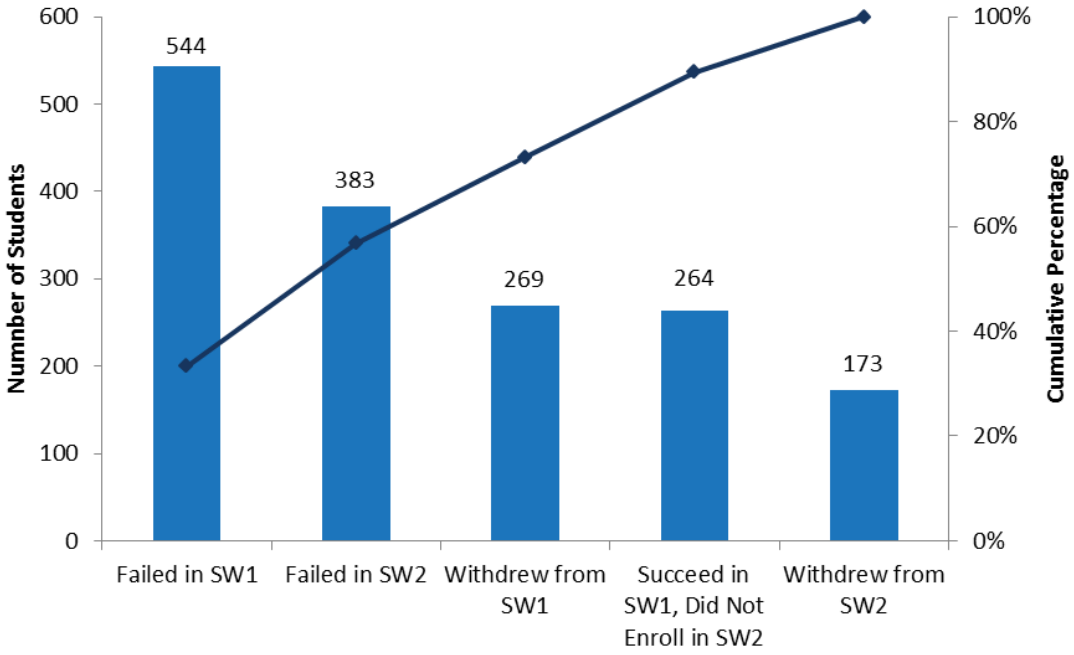

Figure 6. Reasons Students Did Not Complete Statway in 2015-2016

In figure 6 we use a Pareto chart (adapted from Provost & Murray, 2011) with light blue bars depicting the number of students falling into each category of non-success in the 2015-2016 academic year. The dark blue line adds up the counts in each bar for a total of the cumulative percentage of students (across the reasons for failure) who did not succeed in the sequence. These results identify high-leverage points that are ripe for improvement by researchers, faculty, and college administrators.

This raises some improvement questions: Can we understand the characteristics of students who fail in the first term or second term and, particularly, the reasons for that failure? Is there a difference in characteristics of students who fail in Statway 1 versus those who fail Statway 2? Can we compare what is being done in classrooms with high and low success rates to understand if differences in implementing the primary features of Statway (socio-emotional supports, good study routines, productive challenge, group work, etc.) are being delivered well? If the interventions work in some classrooms or institutions and not others, can we capture how these contexts differ to better prepare instructors or improve the materials? Using an improvement approach suggests investigating the practical theory that informed the creation of Statway to determine if that theory could be refined to improve the whole program.

The third and fifth categories, withdrawing from Statway 1 and withdrawing from Statway 2, suggest the need to examine the effectiveness of advising and placement for

Statway 1 as well as the socio-emotional supports, pedagogy, and curriculum for both Statway 1 and 2. For example, are students dropping the course because they aren't getting enough or the right kind of support? Which criteria are being used by advisors to refer students to a Pathways program? It's possible that course failure rates and withdrawals are being driven by poor placement decisions.

Another key group to target for improvement is described by category four: students who succeeded in the first semester of Statway but did not subsequently enroll in the second semester. These students were academically successful in the first term, so it is important to understand why they unexpectedly failed to enroll in the second term. There are numerous reasons why this might occur, including lack of available sections and other scheduling difficulties, taking time off from school, or enrolling in a different college-level math course. Over the past year, we have worked with colleges that have an above average proportion of students who succeeded in Statway 1 but did not enroll in Statway 2. The challenges are diverse. One large college has technical problems with its room and staff scheduling software that makes offering courses at consistent times from semester to semester nearly impossible. Another college shared that disruptions in the local labor market meant that a number of students were unable to enroll in the term we were studying. This in an area in which an improvement approach challenges us to understand the root causes of the non-successes and prototype and test possible changes that might address them.

In addition to improving the Pathways overall, we are also focused on supporting existing colleges as they move to scale at each institution. For example, in a discussion of the most recent Statway results at our 2016 National Forum, a college by college review revealed that the decline in the average success rate across the NIC is actually driven by a single large college. Beginning in 2013, this institution moved to implement Statway for a significant number of its developmental math students. As the number of sections rapidly increased, the success rates during the last three years have languished at around 28%, compared to 43% in the first two years before the large-scale implementation. We turned to faculty leaders from that college to understand what had changed in their implementation.

We learned that as enrollment in its Pathways courses increased, the college did not fully attend to the program's original design. A review of student enrollment also showed that cohorts of students were not being kept together as they moved from the first to second semester, even though Pathways courses rely on group work and the resulting formed social bonds to keep students motivated and engaged and to foster a sense of belonging. Indeed, at this college, students were almost completely redistributed with fewer than 10 of nearly 300 students being taught by the same instructor in the second semester (Huang, Hoang, Yesilyurt, & Thorn, 2016). In addition to this structural challenge, new faculty (both full-time and adjunct) did not receive the professional development designed to support Statway's challenging pedagogy and curriculum. This suggests that faculty may be struggling to implement many of the key practices, such as the socio-emotional support routines and effective support of group work, if they even attempt them at all.

Rather than thinking of this as an individual failure, a major benefit of NIC participation is being able to discuss difficulties and problems with others whose schools have successfully implemented the Pathways and get ideas and recommendations to fix the situation. Department leaders at this college are also rethinking hiring practices; in particular, how to

ensure that the same faculty are available to teach both semesters with the same cohort of students. Additionally, they are examining current room scheduling policies that make it difficult to offer the second half of the two-term sequence on the same days and times as the first semester. Making progress on the consistency of staffing and scheduling would improve the institution's ability to keep cohorts together. Experience throughout the rest of the NIC strongly suggests that this would substantially improve outcomes.

This instance is a concrete example of how—rather than operating in a punitive accountability environment—a NIC can examine variation in performance to foster improved learning. Regardless of the causes of undesired variation, which may even differ by setting, there is a value and potential in learning from implementation, especially when informed by the theory of improvement or driver diagram that guides the entire implementation effort.

Conclusion

In the 2015-2016 academic year, the Carnegie Math Pathways initiative continues to outperform traditional developmental math courses by a wide margin. A central aspect of this year's improvement work will be to take the work we did last year studying scaling institutions and build resources and training materials that will support a new role in the NIC: administrative coaches. We are fortunate to have four experienced Pathways administrators who will be working with us to continue to build out and test our implementation framework and administrator training process. We are working with larger numbers of new colleges and a number of regional collaboratives. This new role should help us provide direct support to more sites as they prepare to offer the Pathways to their students.

The consistently high success rates at almost all of our institutions suggest that the NIC and its members have created an improvement approach that can spread. Statway continues to deliver three times the success rate of traditional pathways in half the time, with 50% of students successfully completing the course and, thereby, earning college credit within one year. Quantway 1 and Quantway 2 produced comparably impressive results with, respectively, 64% and 67% of students successfully completing the course, enabling them to fulfill their developmental math requirements. These completion rates are consistent with outcomes from previous years and are considerably higher than those of traditional developmental math courses. This set of interventions (something we often refer to as a "change package") can, when thoughtfully adapted to local context using improvement science tools, be spread to other colleges and systems and deliver similar outcomes.

When the initiative began, it was an open question as to whether an accelerated approach to developmental mathematics that also required significant professional development and an entirely new set of lessons, would work well or at all. Strikingly, the Carnegie Math Pathways produced convincing results at the original 29 colleges and managed to maintain these outcomes (with the one noted exception), while increasing enrollment and expanding to a diverse range of schools from large urban systems like the City University of New York to, recently, more rural colleges in Wisconsin and California. These positive results suggest that the program's effectiveness has not been compromised by its efforts to scale. Overall, Year 5 results confirm mounting evidence that the Pathways can help large numbers of

students across an array of settings acquire fundamental mathematics knowledge in pursuit of their academic goals.

The NIC is currently developing an evaluation tool for the single-term Pathways. As with the two-term Statway, it's critical to find out which students benefit from the new design and which students are not helped by it.

In addition to gathering and assessing crucial outcome data, the NIC has become more comfortable with and capable of self-determination, especially as the network of trained professionals grows. These new leaders, representing various constituencies, have taken on more of the core technical competencies, such as curriculum development, assessment, writing new lessons, and coaching of new faculty, as the network has grown. NIC members have also initiated important adaptions (such as a version of Statway that can be delivered in a single term) to better meet the needs of their students. These nested communities of expertise provide resiliency and inherent capacity that is critical to successfully integrating the Pathways' complex set of interventions into new local contexts effectively, reliably, and at scale.

Participating Institutions in the 2015-2016 Academic Year

STATWAY

American River College
De Anza College
Diablo Valley College
Foothill College
Kapi'olani Community College
LaGuardia Community College
Los Angeles Pierce College
Minneapolis Community and Technical College
Minnesota State College - Southeast Technical
Mt. San Antonio College
Normandale Community College
North Hennepin Community College
Renton Technical College
Richland College
Rochester Community and Technical College
San Diego City College
San Jose State University
Seattle Central Community College
South Seattle Community College
Tacoma Community College
Tallahassee Community College
University of Washington, Bothell

QUANTWAY

Capital Community College
Chippewa Valley Technical College
Cuyahoga Community College
Foothill College
Laramie County Community College
Madison College
Onondaga Community College
Ridgewater College
Rockland Community College
Sinclair Community College
South Georgia State College
Suffolk County Community College
University of North Georgia, Gainesville
University of Washington, Bothell
University of Wisconsin - Milwaukee
Westchester Community College

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Appendix

Table A1. Pathways Enrollment, 2015-2016

	Institutions	Sections	Faculty	Students Enrolled
Statway	21	140	100	3,254
Quantway	16	180	122	2,966
Total	36	320	222	6,220

The Pathways student body is diverse and includes groups that have been historically underserved in higher education. Both Pathways enroll more female students than males, and the average age of students is higher than that of a typical entering college student. Also, the Pathways student body includes a high degree of racial/ethnic diversity. Both Pathways enroll large percentages of students who are African-American, Hispanic/Latino, or multiracial.

Table A2. 2015-2016 Pathways Student Demographics

	Statway (n=3,254)	**Quantway** (n=2,966)
Sex		
Female	34%	38%
Male	18%	21%
Declined to State/Missing	48%	41%
Average Age in Years		
	24	24
Race / Ethnicity		
White	14%	31%
Hispanic/Latino	23%	12%
African-American	7%	10%
Multiracial	3%	3%
Asian	4%	2%
Pacific Islander	<1%	<1%
American Indian/Alaska Native	<1%	1%
Unknown	48%	41%

Note: Demographic data in previous issues of the Impact Report were given by institutional researchers at participating colleges. The 2015-2016 demographic data were self-reported by students on a survey distributed at the beginning of the course. However, more than 40% of students did not complete the demographic questions on the survey, indicating the need to explore new ways of increasing the response rate to more accurately understand who is enrolling in Pathways and how well the initiative is serving them.

Table A3. Statway Enrollment and Success, Fall 2011 to Fall 2015

		Colleges	SW1 Enroll	SW1 Complete	SW1 Success	SW2 Enroll	SW2 Complete	SW2 Success	SW1 Enroll	SW1 Complete	SW1 Success	SW2 Enroll	SW2 Complete	SW2 Success
Fall 2011 Cohort	CCs*	18	968	890	649	563	523	468	100%	92%	67%	58%	54%	48%
	CSUs	2	152	151	130	121	119	99	100%	99%	86%	80%	78%	65%
	Combined	20	1,120	1,041	779	684	642	567	100%	93%	70%	61%	57%	51%
Fall 2012 Cohort	CCs	18	853	774	603	524	501	445	100%	91%	71%	61%	59%	52%
	CSUs	4	204	199	180	170	167	153	100%	98%	88%	83%	82%	75%
	Combined	22	1,057	973	783	694	668	598	100%	92%	74%	66%	63%	57%
Fall 2013 Cohort	CCs	19	1,294	1,115	887	788	716	620	100%	86%	69%	61%	55%	48%
	CSUs	3	141	140	131	122	122	117	100%	99%	93%	87%	87%	83%
	Combined	22	1,435	1,255	1,018	910	838	737	100%	87%	71%	63%	58%	51%
Fall 2014 Cohort	CCs	16	1,391	1,206	922	815	730	652	100%	87%	66%	59%	52%	47%
	CSUs	2	94	93	81	74	74	68	100%	99%	86%	79%	79%	72%
	Combined	18	1,485	1,299	1,003	889	804	720	100%	87%	68%	60%	54%	48%
Fall 2015 Cohort	CCs	20	2,467	2,196	1,656	1,394	1,335	1,212	100%	89%	67%	57%	54%	49%
	CSUs	1	64	61	57	55	54	51	100%	95%	89%	86%	84%	80%
	Combined	21	2,531	2,257	1,713	1,449	1,389	1,263	100%	89%	68%	57%	55%	50%
Total	CCs	30	6,973	6,181	4,717	4,084	3,805	3,397	100%	89%	68%	59%	55%	49%
	CSUs	5	655	644	579	542	536	488	100%	98%	88%	83%	82%	75%
	Combined	35	7,628	6,825	5,296	4,626	4,341	3,885	100%	89%	69%	61%	57%	51%

*"CCs" refers to community colleges participating in Statway

Table A4. Quantway 1 Enrollment and Success, Spring 2012 to Spring 2016

	Colleges	Enroll	Complete	Success	Enroll	Complete	Success
Spring 2012	8	418	346	234	100%	83%	56%
Fall 2012	8	630	552	357	100%	88%	57%
Spring 2013	8	772	628	375	100%	81%	49%
Fall 2013	11	1,091	919	656	100%	84%	60%
Spring 2014	11	714	617	406	100%	86%	57%
Fall 2014	10	1,169	965	710	100%	83%	61%
Spring 2015	10	767	551	397	100%	72%	52%
Fall 2015	15	1,565	1,380	1,050	100%	88%	67%
Spring 2016	16	1,115	980	674	100%	88%	60%
Total	16	8,241	6,938	4,859	100%	84%	59%

Table A5. Quantway 2 Enrollment and Success, Spring 2013 to Spring 2016

	Colleges	Enroll	Complete	Success	Enroll	Complete	Success
Spring 2013	3	44	42	30	100%	95%	68%
Fall 2013	3	72	54	38	100%	75%	53%
Spring 2014	5	145	133	107	100%	92%	74%
Fall 2014	3	73	58	39	100%	79%	53%
Spring 2015	3	95	74	57	100%	78%	60%
Fall 2015	3	100	90	66	100%	90%	66%
Spring 2016	5	186	166	127	100%	89%	68%
Total	5	671	575	434	100%	86%	65%

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