



**Carnegie Foundation**  
for the Advancement of Teaching

# Pathways Post-Participation Outcomes: Preliminary Findings

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**CARNEGIE MATH PATHWAYS  
RESEARCH BRIEF**

The Carnegie Foundation for the Advancement of Teaching's Math Pathways seek to improve outcomes for community college students who take remedial math courses. The Pathways include two comprehensive instructional systems—Statway<sup>®</sup> and Quantway<sup>®</sup>, described further below—that are designed to support students to achieve the necessary math credits, and ultimately, earn a degree or other credential, either at a two- or four-year institution. In this report, we present initial findings related to degree attainment and transfer for Pathways students.

### **Background**

In 2009, the Carnegie Foundation for the Advancement of Teaching (Carnegie Foundation) assembled a team of community college faculty members, educational researchers, and college administrators aiming to dramatically increase student success in developmental mathematics. The team, organized as a Networked Improvement Community<sup>1</sup> (NIC), developed two new integrated instructional systems as alternatives to traditional developmental math offerings. The first, Statway, is organized around college-level statistics and the second, Quantway, around the instructional objectives found in college-level quantitative reasoning courses. Both Pathways aim to accelerate student progress toward attaining college-level math credit, while providing students with the supports they need to be successful in mastering their ambitious content. The Pathways present engaging, relevant, and useful mathematics concepts that students can use in their daily lives. Statway and Quantway are taught using common curriculum, pedagogy, assessments, an online platform, and innovative instructional approaches.

The goal of Quantway is to prepare students for success in college-level mathematics and to develop quantitatively literate students. Quantway 1 is focused on quantitative reasoning that fulfills developmental requirements of traditional developmental mathematics classes in a single semester or quarter. In 2012, Quantway 2 was added to create a complete Pathway to college credit. Results presented in this paper focus only on the post-participation effects of Quantway 1. As follow-on data for Quantway 2 becomes available, a subsequent report will be issued.

Statway is focused on statistics, data analysis, and causal reasoning. It combines developmental mathematics and college-level statistics in a seamless and consecutive two semester or quarter program that allows students to fulfill both developmental and credit-bearing mathematics in a single academic year. Statway is designed to teach mathematics skills that are essential for a growing number of occupations in which decision-making under conditions of uncertainty is a part of daily work.

Previously, the Carnegie Foundation has assessed the impact of participation in the math Pathways on immediate outcomes, including assessing course completion of the Pathways as compared to traditional courses, credit accumulation post-Pathways, and (for Quantway students) grades earned in subsequent math courses attempted. Details about these analyses and results have been previously published.<sup>2</sup> In this brief, we move on to longer-term

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<sup>1</sup> See Bryk, Gomez, Grunow, & LeMahieu (2015) for a complete description of Networked Improvement Communities.

<sup>2</sup> General information regarding the data for students, the sample, and other issues along with more detailed information about the proximal outcomes' methods and data can be found in four published papers. Descriptive statistics and information on statistical methods used for the immediate and proximal outcomes and on participating schools and faculty for Statway can be found in Yamada & Bryk (2016) and Huang &

outcomes of interest: completion rates of two-year degrees in community colleges and transfer from community college to a 4-year degree-granting institution.<sup>3</sup>

### **Post-Pathways Participation Outcomes: Transfer to Four-Year Institutions and Degree Attainment**

The key question examined in this brief is, “Do students who participated in a Pathways graduate with a credential and/or transfer to a four-year institution?” As noted above, peer-reviewed published reports document that Pathways accelerate students through their developmental- and college-level math requirements at triple the success rate in half the time it would take students to complete those same requirements by following a traditional course sequence. These results have also been sustained over 5 years, despite more than doubling the number of institutions participating and quadrupling the number of students enrolled annually. Maintaining success rates beyond the initial developers is a relatively rare occurrence in education research suggesting that design elements intended to sustain efficacy at scale are themselves effective.

Here we provide findings from preliminary analyses of student outcomes along with information about the data and methods used in these analyses to answer that question. Although the data resources available for assessing these post-participation outcomes are more limited, our findings to date are generally consistent with our earlier published immediate outcomes studies.

### **Post-Participation Pathways Data**

Our analyses of post-participation outcomes focused on transfer from a two-year to a four-year institution and receipt of a two-year (Associate) degree. For Statway, this includes data from students enrolling in Statway in 2011-12 (referred to as cohort 1) and in 2012-13 (referred to as cohort 2). For Quantway, cohort 1 consists of students who enrolled in Quantway 1 in the winter term of 2012 or the spring term of 2012. Cohort 2 for Quantway includes students who enrolled in Quantway 1 in fall of 2012 or spring of 2013. The data set is based on all students who enrolled in Statway or Quantway during these time periods regardless of whether or not they actually completed the Pathway. Data provided by each college’s institutional research offices were matched with National Student Clearinghouse (NSC) data to provide information on post-participation outcomes (described further below).

In merging data across these two sources—institutional research data from each school with data from the NSC—not all students who originally enrolled in a Pathway were included in the final analytic sample. On average, 86% of students who had enrolled in Statway could be matched to NSC data in cohorts 1 and 2. Due to errors in administrative data that prohibited matching NSC records, only 10% of students in two colleges in cohort 1 were matched for the analytic sample. However, all other schools in cohort 1 and all schools in cohort 2 matched 90% or more students. For Quantway, on average, 77% of students who had enrolled in Quantway 1

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Yamada (2017). Descriptive statistics and information on statistical methods used for the proximal outcomes and on participating schools and faculty for Quantway can be found in Yamada (2017). A five-year review of Pathways performance and NIC improvement goals can be found in Hoang, Huang, Yesilyurt & Yamada (2017).

<sup>3</sup> We also plan to provide analysis of 4-year degree completion rates. However, comparison data for such measures are only available for 6-year cohorts. We will be exploring 6-year success rates for baccalaureate degrees in Fall 2017 when the first Pathways cohort reaches the 6-year mark.

could be matched to NSC data for cohorts 1 and 2. Again, due to errors in college administrative records, two colleges for one term had match rates of less than 50%.

In the final analytic sample for Quantway, cohort 1 consists of 389 students and cohort 2 includes 1,109 students; a total of 1,498 students. These students enrolled in Quantway at one of 10 two-year institutions located in 5 states. Statway's final analytic sample includes 564 students in cohort 1 and 737 students in cohort 2, for a total of 1,301 students. These students enrolled in Statway at one of 17 two-year institutions located in 5 states. A list of the institutions in the post-participation sample can be found in Appendix A.

### Comparison Data

In our immediate outcome analyses, each Pathways program participant was directly matched to another similar student within their own community college, using a propensity score strategy based on 40 different indicator variables. This was not possible in the post-participation analyses as the necessary identifying information to follow up on non-Pathways students was not available to us. As an alternative, two sources of federally collected national data were leveraged to generate comparison benchmarks. Each set of data provided an approximate comparison group for the Statway and Quantway enrollees.

The first data source used as a comparison benchmark comes from IPEDS (the Integrated Post-Secondary Education System).<sup>4</sup> The IPEDS data center allows users to select individual institutions by year of enrollment. For this analysis, we drew IPEDS data for all Statway and Quantway schools for the cohort years 2011-12 and for 2012-13 separately. Since the IPEDS data comes directly from individual post-secondary institutions, these data only include information on receipt of associate of arts or other two-year degrees, diplomas, or certificates. Information on transfer or completion of degrees at follow-on transfer institutions is not available through IPEDS.

The IPEDS data provide a stronger comparison reference point for examining attainment of a two-year degree or credential, since these data include only students at the same schools that offered a Pathways course(s) and for the exact same time period. We note that the IPEDS data used to calculate degree attainment for each school and student cohort include both Pathways and non-Pathways students (i.e. the population of all students at the sample schools in the selected cohort years). We likely underestimate the true magnitude of the Pathways post-participation effect. The big source of bias in these results is that IPEDS provides success rates for all students at the college. The Pathways, in contrast, are targeted at students who are significantly behind academically. Consequently, these results are conservative.

The second data source used is NSC data from *Completing College: A National View of Student Attainment Rates – Fall 2010 Cohort*. These data were used to compare the proportion of students who transferred from two-year institutions (Shapiro et al., 2016). The data in that report capture degree and transfer attainment within six years after students first enrolled in a two-year institution (either full time or part time). The NSC data is the only national source that tracks students transferring from 2-year to 4-year institutions. This is the primary path to complete a bachelor's degree for many students in this country. Statway and Quantway are

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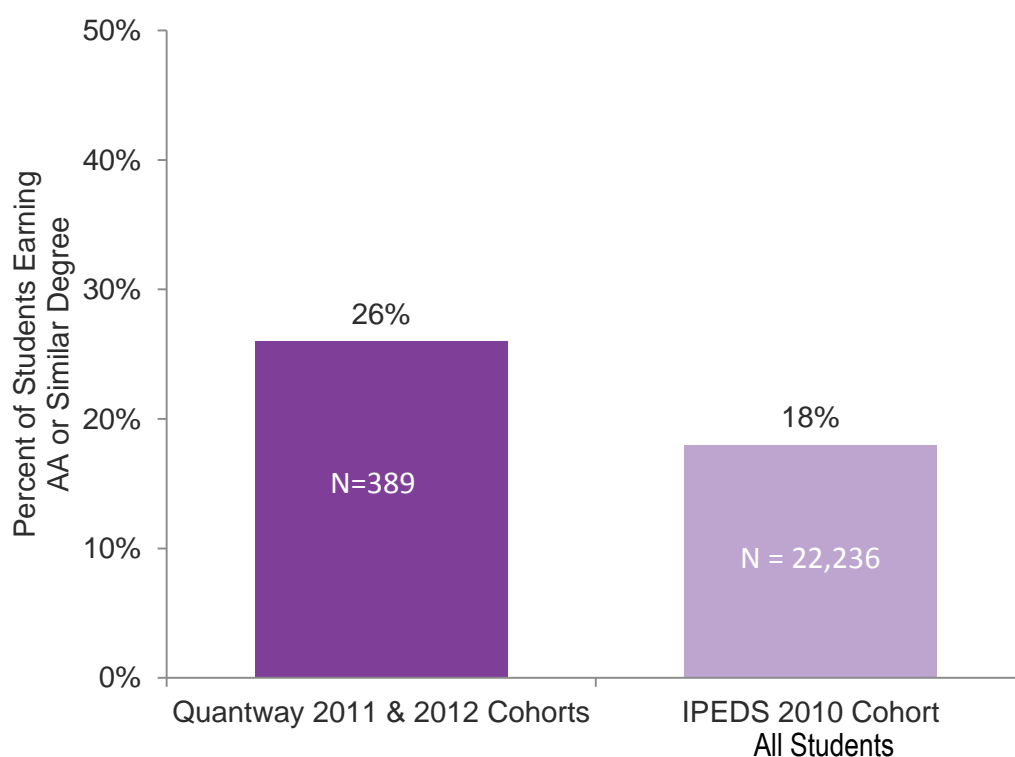
<sup>4</sup> IPEDS Data. Retrieved from <https://nces.ed.gov/ipeds/datacenter/InstitutionByName.aspx> on December 21, 2016.

intended to improve student transfer rates by enabling many more traditionally underserved students to complete their college math requirements.

It is important to note that the Quantway and Statway data follow students for four years (cohort 2) or five years (cohort 1) while the NSC data cover a six-year window. Additionally, the NSC data, like IPEDS, include all students who entered a two-year institution in 2010—that is, both students who were well-prepared for college and those needing remediation—whereas Statway and Quantway courses enrolled only students needing remediation in math. Consequently, for both reasons, this is a relatively conservative comparison benchmark for assessing Pathways effects. All other things equal, we would expect students in the NSC data to have better outcomes than Pathways students. So, to the extent Pathways outcomes are equal to or better than those found in NSC data, we have a reasonably compelling case that Pathways has significant longer-term effects.<sup>5</sup>

### Degree Attainment

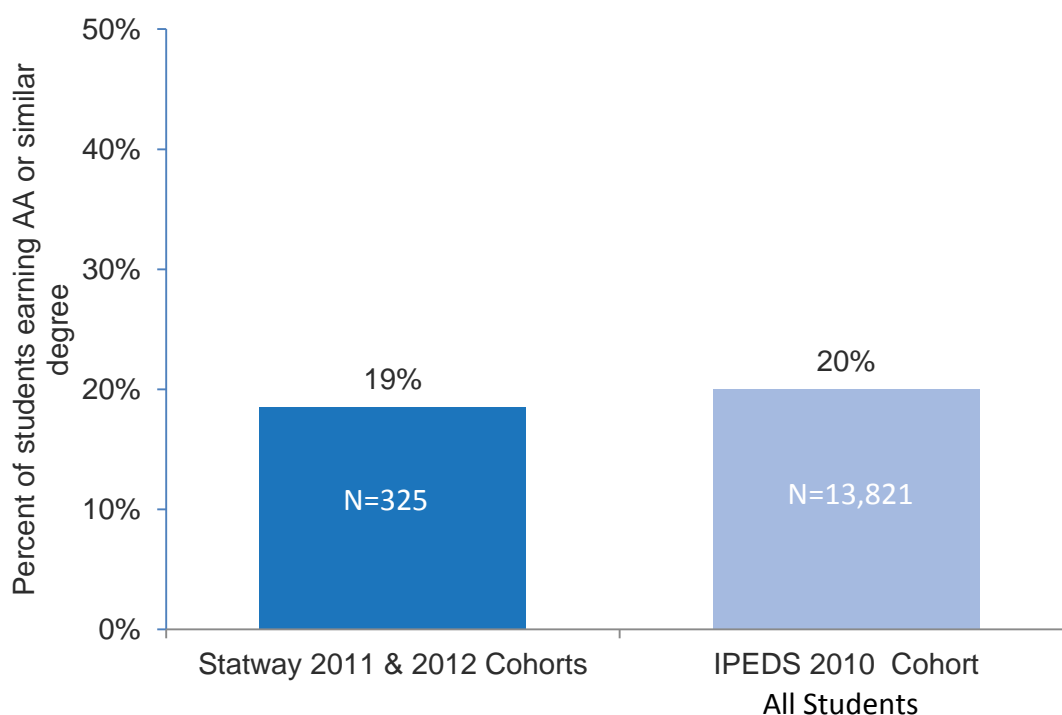
The following two Figures compare the 2-year degree completion rates of Pathways students to the completion rates of all students at the same colleges. For all comparisons, we use the federal 200% reporting rule; that is, the rate for double the time the degree would normally require for a full-time student. Therefore, the 200% reporting period is 4 years.



**Figure 1. Quantway 1 students earn AA or other 2 year credentials at a higher rate compared to all students at the same schools**

<sup>5</sup> For a short description of how the NSC data were categorized, see Appendix B.

In Figure 1 above, we present associate degree (AA) completion rates for Quantway students compared to all students from the same baseline years across both cohorts. This comparison shows that for the same schools and years, Quantway students were more likely to complete AA degrees than other students at the same colleges (both remediated and non-remediated students).



**Figure 2. Statway students earn AA or other 2 year credentials at about the same rate as all students at the same schools**

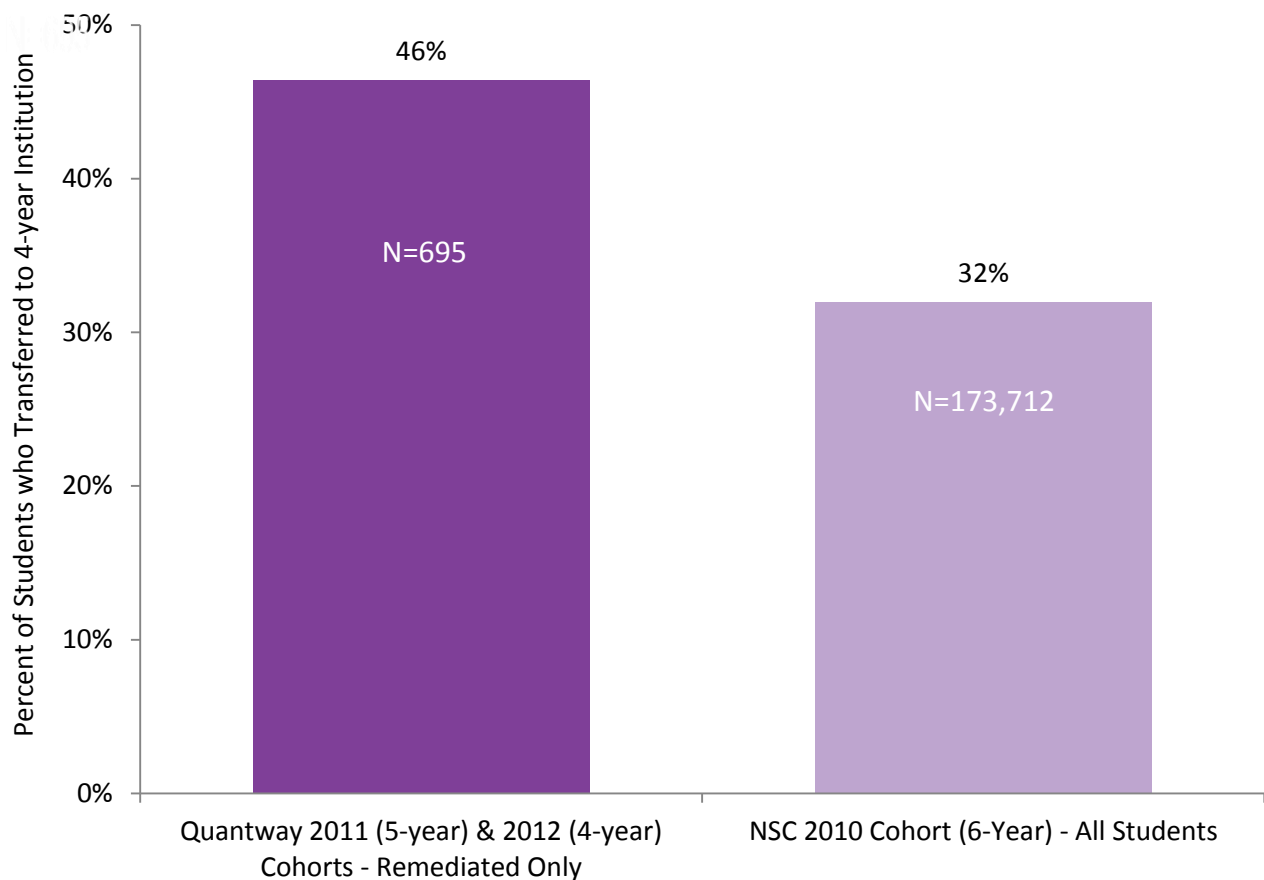
Just as we were able to do with IPEDS data from Quantway schools, we were able to use IPEDS data to compare AA completion rates for Statway students in the same colleges and baseline years. Figure 2 shows that for the same schools and years, Statway students were about as likely to complete AA degrees as students at large (both remediated and non-remediated students). Since the comparison group is academically more advantaged, the results suggest positive, albeit smaller, effects for Statway students as well.

We note that the specific differences in policy contexts among the states involved create different incentives for degree completion before transfer. Differences in local labor market opportunities affect the value of two-year degrees as well (and, thereby, the incentive to complete before transferring). Regardless, these results suggest that Quantway and Statway are effective solutions for helping students complete AA degrees.

### **Transfer from Two-Year to Four-Year Institutions**

In Figure 3, we compare the transfer rates of Quantway students in the first two cohorts (2011 and 2012) to the general transfer rates from the NSC data. First, we should note that Quantway students have not had as much time to transfer as students reported by the NSC.

The 2011 cohort has had 5 years and the 2012 cohort 4 years versus the national population of comparison students who have had 6 years.<sup>6</sup> We find that Quantway 1 students are transferring to 4-year institutions at higher rates when compared to NSC reports for the 2010 cohort, despite having less time to achieve that outcome. This supports the argument that students who complete their mathematics requirements through the Quantway pathway are not somehow disadvantaged with respect to transferring to a 4-year college. Indeed, these data suggest that Quantway may substantially improve transfer rates for remediated students compared to students at large.

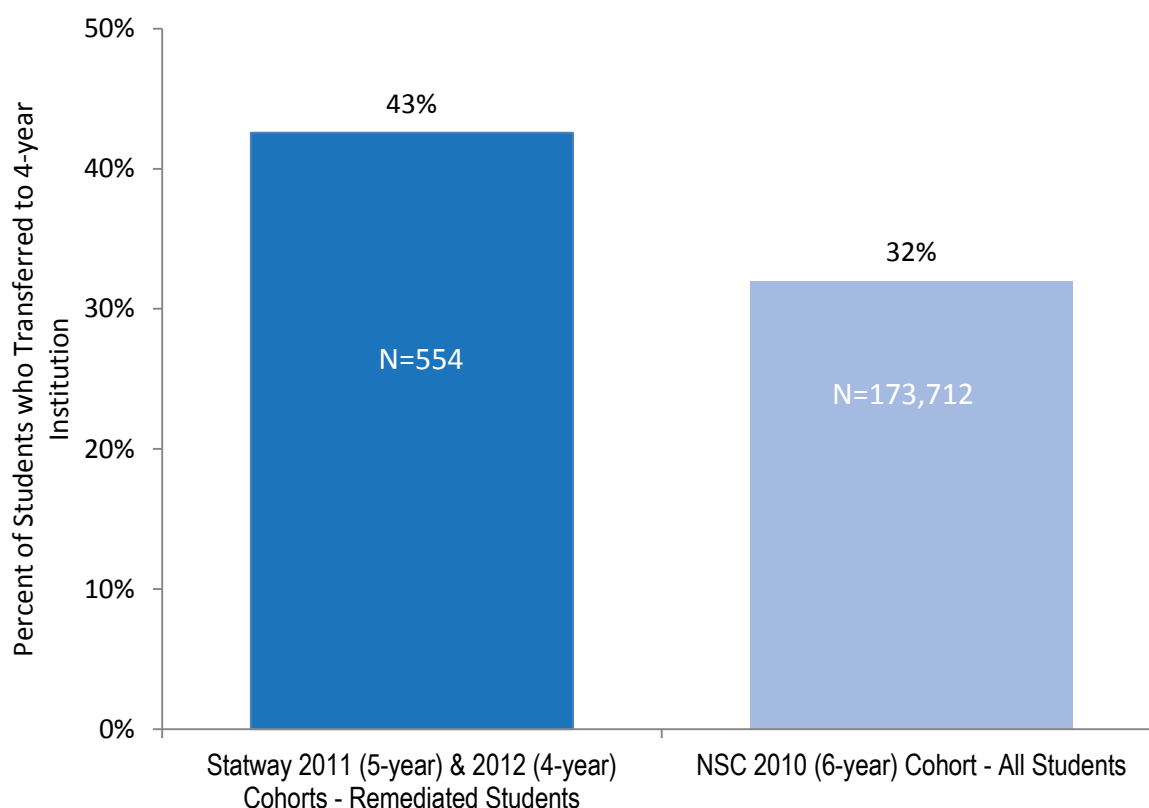


**Figure 3. Quantway 1 students are more likely to transfer to 4-year institutions compared to students at large**

In Figure 4, we compare the transfer rates of Statway students in the first two cohorts (2011 and 2012) to the transfer rates from this NSC study. The same caveats as outlined for the figure above also hold for the comparison data from the NSC. Again, this national comparison

<sup>6</sup> The NSC data for transfers represent the maximum possible proportion of students who may have transferred during the six-year period. The actual proportion is likely smaller, but is not reported by the NSC. The NSC data represent a 300% graduation rate for AA (that is, 3x the “normal” estimated graduation time for AA), while our data for our two cohorts are 250% (for 2011 cohort) and 200% (for 2012 cohort).

data is for a six-year period compared to a five- and four-year period for cohorts 1 and 2 respectively. Given these caveats, transfer rates for Statway students (all remediated students) are substantially above those of the 2010 national cohort. Likewise, we see that Statway students are achieving transfer status at rates higher than the national average for all students—an impressive accomplishment for students who were identified as needing math remediation.



**Figure 4. Statway students are more likely to transfer to 4-year institutions compared to students at large**

Just as we saw with AA degree completion rates, Pathways students are in no way disadvantaged with respect to their opportunity to transfer to a 4-year institution. In fact, both Quantway and Statway students are transferring at rates higher than the national average for all students. Another recent report (Jenkins, D. & Fink, J., 2016, pp. 19-20), provides state by state transfer rates from two-year colleges for the 2007 6-year cohort for all students. In all cases, Statway and Quantway students are performing at a higher level than the average for the states in which their respective colleges are located. It seems safe to conclude that the Pathways are achieving their goal of providing college and career opportunities for students who are not well served by traditional mathematics preparation approaches.



### **Conclusion**

As noted earlier, the comparison data currently available for post participation outcomes are limited and likely underestimate the true long-term effects of Pathways participation. Given the positive results reported above, it seems reasonable that Pathways enrollment accelerates students' subsequent progress toward transfer and degree attainment. Carnegie Foundation staff are currently in the process of developing a study to examine further post-participation outcomes with a stronger quasi-experimental design (similar to the propensity score matching strategy used in our published immediate outcomes analyses). Additional reports will be forthcoming.

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**Appendix A****List of Participating Community Colleges****Statway**

American River College (CA)  
Austin Community College (TX)  
Capital Community College (CT)  
Gateway Community College (CT)  
El Paso Community College (TX)  
Foothill College (CA)  
Housatonic Community College (CT)  
Houston Community College (TX)  
Mt. San Antonio College (CA)  
Naugatuck Valley Community College (CT)  
Richland College (TX)  
San Diego City College (CA)  
Seattle Central Community College (WA)  
Tacoma Community College (WA)  
Tallahassee Community College (FL)  
Valencia College (FL)

**Quantway**

Borough of Manhattan Community College (NY)  
Cuyahoga Community College (OH)  
East Georgia State College (GA)  
University of North Georgia, Gainesville (GA)  
Onondaga Community College (NY)  
Ridgewater College (MN)  
Rockland Community College (NY)  
Sinclair Community College (OH)  
South Georgia State University  
Westchester Community College (NY)

## Appendix B

### Degree Attainment and Transfer from Two-Year to Four-Year Institutions

Carnegie Foundation staff identified three outcome events of interest related to post-participation in either Quantway or Statway in the NSC data set.

1. AA degree or other two-year credential
2. Transfer from two-year to four-year institution
3. BA degree or other four-year degree<sup>7</sup>

All degrees, diplomas, and credentials from two-year institutions were included in a single category (abbreviated “AA”). All degrees from four-year institutions were included in a single category (abbreviated “BA”). In Quantway, one student’s records were excluded from the analysis because the student earned a master’s degree; in Statway, five students’ records were excluded because they earned master’s degrees.

The total number of records was calculated for each student for both community college and four-year school attendance.<sup>8</sup> Students with no records from four-year institutions were coded as “community college only.” Students with records from both two-year and four-year schools were coded as “community college, with transfer to four-year school.” Students’ degrees were also counted and coded; students with any type of degree or certificate from a two-year institution were coded “AA” students, and students with any type of degree from a four-year institution were coded as “BA” students. The four outcomes were then combined into a single record for each student.

Students’ “academic paths” were created based on the above four categories and were then assigned one of six mutually exclusive, possible outcomes:

1. AA, transfer, BA
2. AA, transfer, no BA
3. AA, no transfer
4. no AA, transfer, BA
5. no AA, transfer, no BA
6. no AA, no transfer

Additionally, students were also classified according to four outcomes:

1. AA degree only
2. BA degree, with or without AA degree

<sup>7</sup> While we did receive data from the National Student Clearinghouse on 4-year completion, all available comparison data sets use a 6-year cohort. It is difficult to interpret the comparison of 6-year completion rates for our four- and five-year cohorts. We will include BA completion results when we are able to compare cohorts of equal length.

<sup>8</sup> National Student Clearing House data include separate entries (observations) for each “spell” of attendance for each student. The NSC data include individual entries for each spell at any particular two- or four-year institution and a separate entry for the date, school, and degree at graduation.

3. Student transferred, with or without ANY type of degree
4. No degree or transfer

Figures 3 and 4 were generated using data from category 3 – Student transferred with or without ANY type of degree.



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