The Carnegie Pathways: Innovating for Student Success in Statway and Quantway

Ann R. Edwards & Rachel Beattie
Carnegie Foundation for the Advancement of Teaching

We acknowledge the generous support of the Bill and Melinda Gates Foundation, Kresge Foundation, Carnegie Corporation of New York, Lumina Foundation, Great Lakes Foundation, William and Flora Hewlett Foundation, and the National Science Foundation (DUE-1322844).

MSRI Critical Issues in Mathematics Education: Developmental Mathematics  March 18, 2015
The Problem

60-70% Community College students need at least 1 developmental math course before enrolling in college-credit courses

80% Percent of students never get out of the developmental math pathway

500,000 students in every cohort will never complete math requirement

We cannot continue using the same approach and expect different results.
A New Way: Coherent, Intensive, Accelerated Learning

QW1: College Level QR Course

SW: College Math Credit

Elem Alg → Int Alg → College Math

Semester 1 → Semester 2 → Semester 3
Increase the percentage of Developmental Math students achieving college math credit within one year of continuous enrollment.
Guiding Principles for Learning and Teaching

The Learning Opportunities

*Productive struggle* with important mathematics

*Explicit connections* to mathematical concepts

*Deliberate practice* applying concepts and procedures in order to solve problems
Pathways Instructional System

Learning Opportunities
- Productive Struggle
- Explicit Connections
- Deliberate Practice

Statway/Quantway Curricula

Pathways Pedagogy

Productive Persistence

Language & Literacy Supports

Ambitious learning goals and curricular materials designed around authentic and relevant problem situations

Research-based collaborative and student-centered pedagogical practices that support deep and long lasting understanding
Statistics - Learning Outcomes
AMA, AMATYC, CAUSE, MAA, ASA

- Students will understand the data analysis process and the well-designed statistical studies.
- Students will demonstrate the use of distributional thinking to reason about data in order to describe trends and patterns, judge a fit of a model to distribution, and describe similarities and differences in comparing distributions.
- Students will demonstrate an ability to use appropriate statistical evidence to reason about population characteristics an experimental treatment effects.
Students will demonstrate quantitative reasoning to analyze problems, critique arguments, and draw and justify conclusions.

Communicate quantitative results both in writing and orally using appropriate language, symbolism, data and graphs

Use technology appropriately as a tool

Exhibit confidence in quantitative reasoning through perseverance and ability to transfer prior knowledge in unfamiliar contexts
Increase the percentage of Developmental Math students achieving college math credit within one year of continuous enrollment.
Students have skills, habits and know-how to succeed in college setting.

Students believe they are capable of learning math.

Students feel socially tied to peers, faculty, and the course.

Students believe the course has value.

Students have skills, habits and know-how to succeed in college setting.

Aim: Students continue to put forth effort during challenges and when they do so they use effective strategies.
Increase the percentage of Developmental Math students achieving college math credit within one year of continuous enrollment.

Theory of Change

- Institutional Structures & Leadership
- Instructional System
- Productive Persistence
- Language and Literacy
- Advancing Quality Teaching
Where We Are Now 2014

9,000 students

53 Community Colleges

15 States
Pathways Enrollment

Approximately 18,000 students enrolled total
Statway’s success exceeds the comparison groups in half the time

- 2011-2012: Statway 48%, Comparison 16%
- 2012-2013: Statway 52%, Comparison 14%
- 2013-2014: Estimate 11% success after one year, predicted 15% at two years

*Estimate – 11% success after one year, predicted 15% at two years
College Math Success by Subgroup

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Hispanic</th>
<th>Black</th>
<th>White</th>
<th>Multi</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>7%</td>
<td>5%</td>
<td>15%</td>
<td>12%</td>
<td>17%</td>
</tr>
<tr>
<td>Male</td>
<td>8%</td>
<td>7%</td>
<td>11%</td>
<td>6%</td>
<td>6%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Hispanic</th>
<th>Black</th>
<th>White</th>
<th>Multi</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Statway</td>
<td>36%</td>
<td>43%</td>
<td>61%</td>
<td>48%</td>
<td>51%</td>
</tr>
<tr>
<td>Statway</td>
<td>42%</td>
<td>47%</td>
<td>55%</td>
<td>55%</td>
<td>55%</td>
</tr>
</tbody>
</table>
Statway Student versus Comparison Student Success Rates (C or better) AY 2013-2014
Quantway’s success rate exceeds the comparison group’s in one half the time.
# Developmental Math Success by Subgroup

## Quantway Comparison Fall 2013

<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># of Students</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>622</td>
<td>57</td>
</tr>
<tr>
<td>Black</td>
<td>781</td>
<td>438</td>
</tr>
<tr>
<td>White</td>
<td>792</td>
<td>494</td>
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<tr>
<td>Multi</td>
<td>103</td>
<td>565</td>
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<tr>
<td>Other</td>
<td>91</td>
<td>80</td>
</tr>
<tr>
<td>Unknown</td>
<td>126</td>
<td>17</td>
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<tr>
<td>Hispanic</td>
<td>161</td>
<td>106</td>
</tr>
<tr>
<td>Black</td>
<td>154</td>
<td>113</td>
</tr>
<tr>
<td>White</td>
<td>17</td>
<td>16</td>
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<tr>
<td>Multi</td>
<td>17</td>
<td>14</td>
</tr>
<tr>
<td>Other</td>
<td>18</td>
<td>10</td>
</tr>
<tr>
<td>Unknown</td>
<td>93</td>
<td>46</td>
</tr>
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</table>

### Success Rates

<table>
<thead>
<tr>
<th></th>
<th>Non-Quantway</th>
<th>Quantway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hispanic</td>
<td>66%</td>
<td>78%</td>
</tr>
<tr>
<td>Black</td>
<td>53%</td>
<td>46%</td>
</tr>
<tr>
<td>White</td>
<td>20%</td>
<td>12%</td>
</tr>
<tr>
<td>Multi</td>
<td>27%</td>
<td>24%</td>
</tr>
<tr>
<td>Other</td>
<td>69%</td>
<td>35%</td>
</tr>
<tr>
<td>Unknown</td>
<td>48%</td>
<td>35%</td>
</tr>
</tbody>
</table>

- **Hispanic:** 35% Non-Quantway, 28% Quantway
- **Black:** 27% Non-Quantway, 20% Quantway
- **White:** 27% Non-Quantway, 12% Quantway
- **Multi:** 35% Non-Quantway, 24% Quantway
- **Other:** 69% Non-Quantway, 35% Quantway
- **Unknown:** 48% Non-Quantway, 35% Quantway
Quantway Student versus Comparison Student Success Rates (C or better) AY 2013-2014
“ I praise the fact that someone finally had enough sense to realize that a great deal of students have been kept from furthering their education due to this overpowering wall, and now there is hope for a lot of us, not only to pursue higher education but to learn something that would really apply to our everyday life. ”
“It gave me hope at the beginning of this quarter. And so now it’s kind of like ‘I can [do this]’ but I’m also doing something that I think is very useful... The stereotypes [that minorities and females can’t do math] aren’t true!”
“This class has helped me in my other classes. This has…exercised my mind enough for me to become a better writer, believe it or not.”
What Faculty Are Saying

“In [the network], we are working with other faculty, interacting with other teachers, both in my own college and across the country, and we learn from each other.”

Kristen Spiegelberg, Cuyahoga Community College

“It has provided both personal and professional growth ... I have been exposed to experts in his field and others who understand what I am attempting to achieve.”

Duane Benson, South Georgia College
Ann Edwards, Director of Advancing Quality Teaching
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Rachel Beattie, Director of Productive Persistence
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Karon Klipple, Director of Community College Pathways
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Community College Pathways — Network Improvement Communities
I praise the fact that someone finally had enough sense to realize that a great deal of students have been kept from furthering their education due to this overpowering wall, and now there is hope for alot of us, not only to pursue higher education but to learn something that would really apply to our everyday life.

Course relevance

“I feel that if one person put in the work to really understand the concepts they can pass. I was never a "math person" but coming into Statway has completely made a 360 degree turn about how i feel about math. It is great!”

Math and test anxiety

“I panic alot when I hear anything to do with testing”

A growth mindset
What Students are Saying

“It really makes you think critically for math instead of just getting answers.”

“This class was really interesting and even though I hate math, I started to like it.”

“This course actually relates to the real world and made math more easy.”

“…less calculation, fewer formulas, greater thinking….It will help you in everyday life.”
Statway’s success exceeds the comparison groups in half the time

The success rate of the comparison group was calculated as successfully fulfilling college math within two years as opposed to one year for the Statway group.
Statway is effective across different gender groups – 2012-2013

Note. Data from unknown gender status were excluded; very few were unknown. “Other” also contains data from unknown race/ethnicity status.
Statway is effective across different race/ethnicity groups – 2011-2012

Note. Data from unknown gender status were excluded; very few were unknown. “Other” also contains data from unknown race/ethnicity status.
Statway is effective across different race/ethnicity groups – 2012-2013

Note. Data from unknown gender status were excluded; very few were unknown. “Other” also contains data from unknown race/ethnicity status.
Quantway’s success rate exceeds the comparison group’s in one half the time.

Quantway's success rate exceeds the comparison group's in one half the time.

The pass rate of the comparison group was calculated as successfully fulfilling dev math within two semesters as opposed to one semester for the Quantway group.
Quantway is effective across different gender groups – Spring 2012

- Male
  - Non-QW: 33%
  - QW: 58%

- Female
  - Non-QW: 39%
  - QW: 54%
Quantway is effective across different race/ethnicity groups – 2012

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>Non-QW</th>
<th>QW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>33%</td>
<td>43%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>48%</td>
<td>49%</td>
</tr>
<tr>
<td>White</td>
<td>40%</td>
<td>66%</td>
</tr>
<tr>
<td>Other</td>
<td>29%</td>
<td>67%</td>
</tr>
<tr>
<td>Unknown</td>
<td>27%</td>
<td>64%</td>
</tr>
</tbody>
</table>

Note. “Other” also contains data from unknown race/ethnicity status.
Quantway is effective across different gender and race/ethnicity groups – Spring 2012

Note. “Other” also contains data from unknown race/ethnicity status.