Disjunctive Placement: Throughput and Output
Historical Background
pre-Fall 2016

FALL 2012- FALL 2015

• Creating a statistics pathway
• Shortening the Sequence
• Proper placement
Math Sequence (1969-2011)

- Arithmetic
- Pre-Algebra
- Elem. Algebra
- Int. Algebra
- Statistics

STEM Transfer Courses
Current Math Sequence (2015-present)

- Arithmetic
- Pre-Algebra
- Elem. Algebra
- Int. Algebra
- Elem. Algebra
- Int. Algebra For Stats
- Statistics
- STEM Transfer Courses

Moved to non-credit
Course Success Rates by each Placement Level across 3 years
2012 - 2014 - 2015

*Increased access did not make a detrimental impact on success rates.
Current Model
Fall 2016 Placement changes

**Self-reported**
- H.S. GPA
- Last Math Course
- Grade in last Math course
Two Placements

Each student can receive up to 2 placements

• STEM Placement
• Direct Placement in Statistics
Direct Placement into Statistics: Rules

Direct placement into Statistics if a student meets *any* of the following:

- High School GPA >2.999; *or*
- Trigonometry or Statistics or PreCalc/Calc with C or higher; *or*
- Algebra II with B- or higher; *or*
- Algebra II or higher with C or better *and* GPA 2.7 or higher; *or*
- Grade of B- or higher for an Algebra 1B or Geometry *and* GPA 2.7 or higher.
STEM Floors

**Transfer-Level Placement Minimum**

Grade of C or higher in HS Pre-calculus or Calculus

- Transfer (100-level) math

---

**Intermediate Algebra Placement Minimum**

Grade of C or higher in HS Algebra 2, Trigonometry, or Statistics

- Intermediate Algebra (or higher)

---

**1st Floor**

**2nd Floor**
LEVEL 1
- MATH 058 Algebra Preparation (5 units)
- MATH 060 Elementary Algebra (5 units)

LEVEL 2
- MATH 060 Elementary Algebra (5 units)
- MATH 070 Intermediate Algebra (5 units)
- MATH 083 Geometry (5 units)

LEVEL 3
- MATH 070 Intermediate Algebra (5 units)
- MATH 075 Intermediate Algebra for Statistics (5 units)
- MATH 102 Trig (3 units)
- MATH 103 College Algebra (4 units)
- MATH 104 PreCalculus (5 units)
- MATH 111 Finite Math (4 units)
- MATH 130 Elementary Teachers (3 units)
- MATH 140 Introductory Statistics (4 units)
- PSYCH 104/SOCI 137 Statistics for the Social & Behav. Sciences (3 units)
- ECON 291 Statistical Method in Business & Econ (3 units)
- MATH 211 Calculus I (5 units)
- MATH 240 Math Analysis for Business & Social Science (5 units)
Visual- Floor 2

LEVEL 1
- MATH 058 Algebra Preparation (5 units)

LEVEL 2
- MATH 060 Elementary Algebra (5 units)
- MATH 070 Intermediate Algebra (5 units)
- MATH 083 Geometry (5 units)

LEVEL 3
- MATH 075 Intermediate Algebra for Statistics (5 units)

TRANSFER LEVEL
- MATH 111 Finite Math (4 units)
- MATH 130 Elementary Teachers (3 units)
- MATH 140 Introductory Statistics (4 units)
- PSYCH 104/SOCI 137 Statistics for the Social & Behav. Sciences (3 units)
- ECON 291 Statistical Method in Business & Econ (3 units)
- MATH 103 College Algebra (4 units)
- MATH 102 Trig (3 units)
- MATH 104 PreCalculus (5 units)
- MATH 211 Calculus I (5 units)
- MATH 240 Math Analysis for Business & Social Science (5 units)

Blocked levels (in grey) for Pre-Calculus or Calculus
Of the 4,363 students...

- Direct Placement into Statistics
  71% received direct placement

- Floors
  - 54% received at least one floor

- [VALUE] students
Direct Placement Rates into Statistics by STEM Placement: Fall 2016

- Calculus I, II (n=92): 100.0% Received Direct placement, 0.0% Did not receive Direct placement
- Pre-Calc., Math Analysis (n=287): 98.6% Received Direct placement, 1.4% Did not receive Direct placement
- Transfer-Level (n=913): 99.1% Received Direct placement, 0.9% Did not receive Direct placement
- Intermediate Alg./Geom. (n=1796): 80.9% Received Direct placement, 19.1% Did not receive Direct placement
- Elem. Alg./Alg. for Statistics (n=573): 34.6% Received Direct placement, 65.4% Did not receive Direct placement
- Alg. Prep (n=702): 24.2% Received Direct placement, 75.8% Did not receive Direct placement
STEM Placement Rate Changes as a result of Floors
Fall 2016 vs. prior 3 years

Traditional 2011 (n=4011) | Traditional 2014 (n=4504) | Traditional 2015 (n=4008)

- **Four Levels below: Arithmetic**
  - Traditional 2011: 38.3%
  - Traditional 2014: 24.1%
  - Traditional 2015: 21.3%

- **Three Levels below: Algebra Prep**
  - Traditional 2011: 19.9%
  - Traditional 2014: 25.4%
  - Traditional 2015: 32.6%

- **Two Levels below: Elem Algebra**
  - Traditional 2011: 7.4%
  - Traditional 2014: 5.8%
  - Traditional 2015: 25.4%

- **One Level below: Intermediate Algebra/Geometry**
  - Traditional 2011: 10.3%
  - Traditional 2014: 14.9%
  - Traditional 2015: 14.7%

- **Transfer-Level**
  - Traditional 2011: 13.1%
  - Traditional 2014: 22.1%
  - Traditional 2015: 41.2%
Placement Rate Changes as a result of Direct Placement
Fall 2016 vs. prior 3 years

<table>
<thead>
<tr>
<th>Year</th>
<th>Traditional 2011 (n=4011)</th>
<th>Traditional 2014 (n=4504)</th>
<th>Traditional 2015 (n=4008)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate</td>
<td>10.3%</td>
<td>14.9%</td>
<td>14.7%</td>
</tr>
<tr>
<td>Levels</td>
<td>Three Levels below: Arithmetic</td>
<td>One Level below: Algebra for Statistics</td>
<td>Two Levels below Transfer: Algebra Prep</td>
</tr>
<tr>
<td>%</td>
<td>44.0%</td>
<td>46.7%</td>
<td>59.9%</td>
</tr>
<tr>
<td>%</td>
<td>38.3%</td>
<td>32.6%</td>
<td>25.4%</td>
</tr>
</tbody>
</table>

Legend:
- Blue: Three Levels below: Arithmetic
- Teal: One Level below: Algebra for Statistics
- Brown: Two Levels below Transfer: Algebra Prep
- Purple: Transfer-Level

- Latinx/Hispanic: 5% (2011), 9% (2015), 9% (2016)
- White: 18% (2015), 18% (2016)

Legend:
- Red: Traditional 2011 (n=4011) Accuplacer & Multiple Measures
- Yellow: Traditional 2015 (n=4008) Accuplacer & Multiple Measures
Transfer Placement by Race/Ethnicity: Disproportionate Impact

- **Latinx/Hispanic**: 22% (57% vs. 66% benchmark)
- **African-American/Black**: 15% (60% vs. 75% benchmark)
- **White**: 32% (80% benchmark)
- **Asian**: 66% (87% benchmark)

80% benchmark of Statistics Placement rate *No D.I.

80% benchmark of STEM Placement rate
Clarifying questions about Math Placement model?
“How did the students do?”
Fall 2016 Success Rates in Transfer-level for new placements vs. others

Fall 2016 Math Course enrollments (Ns)

<table>
<thead>
<tr>
<th>Course</th>
<th>Other</th>
<th>Fall 2016 Placed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trigonometry</td>
<td>239</td>
<td>163</td>
</tr>
<tr>
<td>College Algebra</td>
<td>199</td>
<td>44</td>
</tr>
<tr>
<td>Pre-Calculus</td>
<td>196</td>
<td>67</td>
</tr>
<tr>
<td>Statistics</td>
<td>700</td>
<td>316</td>
</tr>
<tr>
<td>Calculus</td>
<td>235</td>
<td>19</td>
</tr>
</tbody>
</table>

### Success Rates

- **Trigonometry**: 65% Other, 75% Fall 2016 Placement
- **College Algebra**: 55% Other, 57% Fall 2016 Placement
- **Pre-Calculus**: 69% Other, 78% Fall 2016 Placement
- **Statistics**: 60% Other, 70% Fall 2016 Placement
- **Calculus**: 68% Other, 60% Fall 2016 Placement
Fall 2016 Success Rates in below-transfer levels for new placements vs. others

<table>
<thead>
<tr>
<th></th>
<th>Other</th>
<th>Fall 2016 Placement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algebra Prep.</td>
<td>321</td>
<td>301</td>
</tr>
<tr>
<td>Elem. Algebra</td>
<td>416</td>
<td>126</td>
</tr>
<tr>
<td>Interm. Algebra</td>
<td>539</td>
<td>412</td>
</tr>
<tr>
<td>Interm. Alg. for Stats</td>
<td>285</td>
<td>158</td>
</tr>
<tr>
<td>Geometry</td>
<td>130</td>
<td>41</td>
</tr>
</tbody>
</table>

Fall 2016 Math Course enrollments (Ns)
Success Rates for Direct Placement Transfer Statistics

Success Rates for students who received direct placement, and enrolled in Transfer Statistics by STEM placement (N=312)
Transfer Completion in 1 semester after Placement

incoming FA15 Students (n=1557) vs incoming FA16 Students (n= 1691)
Transfer Completion 1 semester by Race/Ethnicity

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>2015 (n)</th>
<th>2016 (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latino/ Hispanic</td>
<td>748</td>
<td>858</td>
</tr>
<tr>
<td>African Am./Black</td>
<td>74</td>
<td>75</td>
</tr>
<tr>
<td>White</td>
<td>550</td>
<td>516</td>
</tr>
<tr>
<td>Asian</td>
<td>78</td>
<td>110</td>
</tr>
<tr>
<td>Filipino</td>
<td>81</td>
<td>91</td>
</tr>
</tbody>
</table>
Disproportionate Impact for Transfer Completion 1 semester

<table>
<thead>
<tr>
<th>Race</th>
<th>Fall 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latinx/Hispanic</td>
<td>22.0%</td>
</tr>
<tr>
<td>African Am./Black</td>
<td>14.7%</td>
</tr>
<tr>
<td>White</td>
<td>32.9%</td>
</tr>
<tr>
<td>Asian</td>
<td>60.2%</td>
</tr>
<tr>
<td>Filipinx</td>
<td>42.9%</td>
</tr>
</tbody>
</table>

80% benchmark for transfer-completion
## Logistic Regression on Success

<table>
<thead>
<tr>
<th></th>
<th>Model I: N= 1358</th>
<th>Model II: N= 1356</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \chi^2 = 105.77; p &lt; .01 )</td>
<td>( \chi^2 = 129.51; p &lt; .01 )</td>
</tr>
<tr>
<td><strong>Odds Ratio</strong></td>
<td>95% CI</td>
<td>95% CI</td>
</tr>
<tr>
<td>High School GPA (categ.)</td>
<td>1.64**</td>
<td>1.46 – 1.83</td>
</tr>
<tr>
<td>Highest Math Course</td>
<td>1.06*</td>
<td>.99 – 1.12</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>African Amer./Black</td>
<td>.460**</td>
<td>.26 – .81</td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
<td>1.87**</td>
<td>1.10 – 3.18</td>
</tr>
<tr>
<td>Filipinx</td>
<td>1.3</td>
<td>.76 – 2.23</td>
</tr>
<tr>
<td>Latinx/Hispanic</td>
<td>.79*</td>
<td>.61 – 1.02</td>
</tr>
<tr>
<td>Native Amer. /Alaskan</td>
<td>1.52</td>
<td>.42 – 5.57</td>
</tr>
<tr>
<td>Other/Unknown</td>
<td>1.51</td>
<td>.54 – 4.22</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>1.18</td>
<td>.94 – 1.48</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (at Placement)</td>
<td>0.99</td>
<td>.96 – 1.02</td>
</tr>
</tbody>
</table>

**Reference Group:** White, Male

**Sig.**  
**\( **p < .05; \* p < .10**

---

Reference Group: White, Male

Sig. **\( p < .05; \* p < .10**
Transfer-Level Success Data Trend

<table>
<thead>
<tr>
<th>Year</th>
<th>Trigonometry</th>
<th>College Algebra</th>
<th>Pre-Calculus</th>
<th>Statistics</th>
<th>Calculus</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011FA</td>
<td>44.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012FA</td>
<td>52.1%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014FA</td>
<td>56.8%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015FA</td>
<td>65.8%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016FA</td>
<td>77.2%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Developmental Level Success Data Trend

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2011FA</td>
<td>56.9%</td>
<td>63.3%</td>
<td>59.1%</td>
<td>65.0%</td>
<td>60.7%</td>
</tr>
<tr>
<td>2012FA</td>
<td>49.9%</td>
<td>60.7%</td>
<td>59.1%</td>
<td>62.1%</td>
<td>55.5%</td>
</tr>
<tr>
<td>2014FA</td>
<td>49.9%</td>
<td>59.1%</td>
<td>59.1%</td>
<td>62.10%</td>
<td>55.5%</td>
</tr>
<tr>
<td>2015FA</td>
<td>48.1%</td>
<td>52.1%</td>
<td>55.60%</td>
<td>62.40%</td>
<td>55.5%</td>
</tr>
<tr>
<td>2016FA</td>
<td>48.1%</td>
<td>52.1%</td>
<td>61.5%</td>
<td>71.6%</td>
<td>61.5%</td>
</tr>
</tbody>
</table>

Note: The graph shows the success rates for different developmental levels from 2011FA to 2016FA.
BASELINE: Fall 2007 Cohort thru Spring 2011 (4yr. Actual Rates)

10,000 Students enter, assess and enroll in Math

10,100 assigned to college level

889 students pass (88%)

121 either failed or failed to enroll (12%)

8,990 assigned to developmental

2,819 passed to, and enrolled* in college level (31.4%)

2,058 students pass (73%)

761 failed (27%)

6,171 failed or failed to enroll (68.6%)

*Pass rates include rates for students who repeat courses in the Math sequence within the 4-year time frame.

*20% of students don’t enroll in transfer after completing 1 level below transfer because they’ve either met their degree Math requirement, or did not enroll for other reasons. This was accounted for in the rate for those who pass to and enroll in college-level.

29.2% overall Gateway Math Completion Rate
Fall 2016 STEM and Statistics Combined 4 yr. projection

10,000 Students who enter, assess and enroll in Math

5,490 assigned to college level

4,365 students pass (79.5%)

1125 either failed or failed to enroll (20.5%)

54.9% assigned to college-level

4,510 assigned to developmental

2,160 eligible for college level (47.9%)

1,648 students pass (76.3%)

512 students failed (23.7%)

2,350 failed or failed to enroll (52.1%)

2,350 failed or failed to enroll (52.1%)

This model assumes 70/30 split with 70% of the students taking the statistics pathway and 30% taking the STEM pathway to derive weighted averages.
• Pass (completion) rates include rates for students who repeat courses in the Math sequence within the projected 4-year time frame.
• Both models assume equal access to the courses and allows for course repetition over a 4 year time-frame.
• If a student is on the particular pathway, these are their pass rates.
• STEM Pathway: Assumes that Dev. Ed completion and enrollment rates are similar to traditional pathway (73%) because there are fewer courses to complete due to changes in sequence since Fall 07.
• Statistics Pathway: assumes a drop in transfer level pass rate to account for the inclusion of non-cognitively underprepared, first-time college students.
Fall 2016: STEM Pathway 4 yr. projections

- Pass (completion) rates include rates for students who repeat courses in the Math sequence within the projected 4-year time frame.
- Both models assume equal access to the courses and allows for course repetition over a 4 year time-frame.
- If a student is on the particular pathway, these are their pass rates.
- STEM Pathway: Assumes that Dev. Ed completion and enrollment rates are similar to traditional pathway (73%) because there are fewer courses to complete due to changes in sequence since Fall 07.
- Statistics Pathway: assumes a drop in transfer level pass rate to account for the inclusion of non-cognitively underprepared, first-time college students.
Implications

• Scheduling

### Transfer-Level Courses

<table>
<thead>
<tr>
<th>Course Type</th>
<th>FALL 2011</th>
<th>FALL 2014</th>
<th>FALL 2015</th>
<th>FALL 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trigonometry</td>
<td>7</td>
<td>9</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>College Algebra</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>PreCalculus</td>
<td>5</td>
<td>7</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Introductory Statistics</td>
<td>15</td>
<td>22</td>
<td>24</td>
<td>37</td>
</tr>
<tr>
<td>Calculus I</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Calculus II</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Calculus III</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

### Below Transfer-Level Courses

<table>
<thead>
<tr>
<th>Course Type</th>
<th>FALL 2011</th>
<th>FALL 2014</th>
<th>FALL 2015</th>
<th>FALL 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arithmetic</td>
<td>16</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Algebra Prep</td>
<td>13</td>
<td>16</td>
<td>26</td>
<td>19</td>
</tr>
<tr>
<td>Elem. Algebra</td>
<td>26</td>
<td>21</td>
<td>23</td>
<td>17</td>
</tr>
<tr>
<td>Intermediate Algebra</td>
<td>32</td>
<td>28</td>
<td>26</td>
<td>30</td>
</tr>
<tr>
<td>Intermediate Algebra for Stats</td>
<td>15</td>
<td>19</td>
<td>14</td>
<td></td>
</tr>
</tbody>
</table>

*Excludes Geometry

---

Number of Sections Offered

- **Transfer-level**
  - 2011: 46
  - 2014: 59
  - 2015: 63
  - 2016: 80
  - 2017: 86

- **Below Transfer-level**
  - 2011: 87
  - 2014: 96
  - 2015: 94
  - 2016: 82
  - 2017: 85

---

Transfer -Statistics

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Sections Offered</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>15</td>
</tr>
<tr>
<td>2014</td>
<td>22</td>
</tr>
<tr>
<td>2015</td>
<td>24</td>
</tr>
<tr>
<td>2016</td>
<td>37</td>
</tr>
<tr>
<td>2017</td>
<td>41</td>
</tr>
</tbody>
</table>
## Transfer completion: Proportionality Index

<table>
<thead>
<tr>
<th></th>
<th>Fall 2015</th>
<th></th>
<th>Fall 2016</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Proportion in Total</td>
<td>Proportion in Outcome</td>
<td>Proportionality Index (.8 or lower)</td>
<td>Proportion in Total</td>
</tr>
<tr>
<td><strong>African American</strong></td>
<td>4.8%</td>
<td>1.4%</td>
<td>0.30</td>
<td>4.4%</td>
</tr>
<tr>
<td><strong>Asian American</strong></td>
<td>5.0%</td>
<td>5.9%</td>
<td>1.18</td>
<td>6.5%</td>
</tr>
<tr>
<td><strong>Latinx</strong></td>
<td>48.0%</td>
<td>10.8%</td>
<td>0.22</td>
<td>50.7%</td>
</tr>
<tr>
<td><strong>White</strong></td>
<td>35.3%</td>
<td>18.7%</td>
<td>0.53</td>
<td>30.5%</td>
</tr>
<tr>
<td><strong>Unknown</strong></td>
<td>0.4%</td>
<td>0.2%</td>
<td>0.45</td>
<td>1.0%</td>
</tr>
<tr>
<td><strong>Filipinx</strong></td>
<td>5.2%</td>
<td>6.1%</td>
<td>1.17</td>
<td>5.4%</td>
</tr>
<tr>
<td><strong>Hawaiian/Pacific Islander</strong></td>
<td>0.3%</td>
<td>0.2%</td>
<td>0.68</td>
<td>0.2%</td>
</tr>
</tbody>
</table>
Implications

• Professional Development for Statistics Instruction

It is with great pleasure that I announce that Dr. Roxy Peck, a pioneer and international leader in the field of statistics education as well as fabulous presenter, will be the keynote speaker at the Chancellor’s Statistics Institute (CSI). Dr. Peck will provide guidance for activities at an all-day event (Saturday, October 24th) with Dr. Peck and talk the prior evening. CSI is a collection of yearlong activities for high school and community college faculty to help deepen understanding of the teaching and learning of statistics. This first weekend will focus on high school statistics and will include topics such as conceptual understanding, informal inference vs. formal inference, utilizing technology, choosing the proper test, and p-value.

• Student Advising on Pathways
  • STEM or Statistics?
Implications: Role of IR

• Pre-requisites & Course sequence for non-Math depts.
• Collaborating with Dept. Faculty
• Collaborating with Student Services
• Accountability Metrics
What about *Recency*?

“How long has it been since you last participated in formal education in High school or college?”

<table>
<thead>
<tr>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 2 years</td>
<td>1502</td>
</tr>
<tr>
<td>2-5 yrs</td>
<td>103</td>
</tr>
<tr>
<td>5-7 yrs</td>
<td>40</td>
</tr>
<tr>
<td>More than 7 yrs</td>
<td>46</td>
</tr>
</tbody>
</table>

By Success in Math Course

- Less than 2 years: 55.1%
- 2-5 yrs: 45.6%
- 5-7 yrs: 50.0%
- More than 7 yrs: 52.2%

<table>
<thead>
<tr>
<th>χ²</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.914*</td>
<td>3</td>
<td>0.271</td>
</tr>
</tbody>
</table>
Resources:


Joseph Gerda
Mathematics Professor
joseph.gerda@canyons.edu

Saburo Matsumoto
Mathematics Department Chair
saburo.matsumoto@canyons.edu

Daylene Meuschke
Institutional Research, Dean
daylene.Meuschke@canyons.edu

Preeta Saxena
Institutional Research, Sr. Research Analyst
preeta.saxena@canyons.edu