Multiple Measures Assessment Project: The Opportunity and Adversity of Increasing Placement Accuracy

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October 6, 2016

http://www.rpgroup.org/projects/multiple-measures-assessment-project
Overview

• Project Overview
• Research Basis
• Success of Pilot Implementation
• Impact Analysis and Relationship to Equity
• Impact of Placement System Choices on Equity
• Self-Reported Transcript Data
• Integration with CAI
Interactive Activity #1
Is your college a MMAP pilot college?

• Yes
• No
• I’m not sure
• I don’t work at a college
What is your primary role at your campus?

• Researcher
• Classroom Faculty
• Assessment Staff
• Counselor
• Administrator
• Scapegoat
• Other
Project Overview

**Collaboration**
- CAI
- CCCCCO
- Cal-PASS+
- RP Group
- 60 CCCs

**Model Development**
- English
- Math
- ESL
- Reading
- Non-cognitive Variables
- Self-reported transcript data

**Engagement**
- Local replication
- Webinars
- Professional development
- Support
- Pilot results inform statewide implementation
Growing body of evidence

- **Weak relationship** between assessment tests and college course outcomes: bit.ly/CCRCAssessment

- **Incredible variability** in cut scores; CCCs often use HIGHER cut scores than 4-year institutions: bit.ly/NAGB2012

- **Underestimates** students of color, women, first generation college students, low SES: bit.ly/DefiningPromise

- Long thread of research in the CCCs
  - Hetts, Fuenmayor, & Rothstein, 2012 http://www.lbcc.edu/PromisePathways
Why Multiple Measures?

• Tests used in isolation have been under-placing students
• Multiple measures
  • provides a more complete picture of student ability
  • provides a way to increase the accuracy of placement, particularly reducing underplacement
• are required by law (Title V)
• supported by statewide senate
## Transfer Level MMAP Rule Sets

<table>
<thead>
<tr>
<th>Transfer Level Course</th>
<th>Direct Matriculant</th>
<th>Non-Direct Matriculant</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Algebra (STEM)</td>
<td>HS 11 GPA &gt;=3.2 OR HS 11 GPA &gt;=2.9 AND Pre-Calculus C (or better)</td>
<td>HS 12 GPA &gt;=3.2 OR HS 12 GPA &gt;=3.0 AND Pre-Calculus or Statistics (C or better)</td>
</tr>
<tr>
<td>Statistics (Non STEM)</td>
<td>HS 11 GPA &gt;=3.0 OR HS 11 GPA &gt;=2.3 AND Pre-Calculus C (or better)</td>
<td>HS 12 GPA &gt;=3.0 OR HS 12 GPA &gt;=2.6 AND Pre-Calculus C (or better)</td>
</tr>
<tr>
<td>English</td>
<td>HS 11 GPA &gt;=2.6</td>
<td>HS 12 GPA &gt;=2.6</td>
</tr>
<tr>
<td>Reading</td>
<td>HS 11 GPA &gt;=2.7</td>
<td>HS 12 GPA &gt;=2.8</td>
</tr>
<tr>
<td>ESL</td>
<td>HS 11 GPA &gt;=2.7</td>
<td>HS 12 GPA &gt;=2.6</td>
</tr>
</tbody>
</table>
Fall 2015: Cañada College

Transfer-level Placements

<table>
<thead>
<tr>
<th></th>
<th>Compass</th>
<th>MMAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2014 Math</td>
<td>191</td>
<td></td>
</tr>
<tr>
<td>F2015 Math</td>
<td>192</td>
<td>53</td>
</tr>
<tr>
<td>F2014 English</td>
<td>123</td>
<td></td>
</tr>
<tr>
<td>F2015 English</td>
<td>123</td>
<td>134</td>
</tr>
</tbody>
</table>

Transfer-level Success Rates

<table>
<thead>
<tr>
<th></th>
<th>Compass</th>
<th>MMAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math</td>
<td>65%</td>
<td>68%</td>
</tr>
<tr>
<td>English</td>
<td>78%</td>
<td>75%</td>
</tr>
</tbody>
</table>
Spring 2016 English Pilot – Mira Costa

Placement into Transfer-Level English

Overall: 57% Previous, 71% MMAP
African American: 44% Previous, 58% MMAP
Hispanic: 42% Previous, 62% MMAP
Asian: 66% Previous, 76% MMAP
PI: 47% Previous, 63% MMAP
White: 69% Previous, 83% MMAP
Mira Costa Transfer-Level English Success rate by year/placement type

<table>
<thead>
<tr>
<th>Year/Placement Type</th>
<th>Success Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2013</td>
<td>63%</td>
</tr>
<tr>
<td>S2014</td>
<td>64%</td>
</tr>
<tr>
<td>S2015</td>
<td>66%</td>
</tr>
<tr>
<td>S2016 - Old</td>
<td>66%</td>
</tr>
<tr>
<td>S2016 - MMAP</td>
<td>69%</td>
</tr>
</tbody>
</table>
Impact Analysis and Relationship to Equity
Retrospective Impact Analysis by College

- **4 graphics available** for each college and overall based on disjunctive model for Math and English [bit.ly/MMAPProjections]
  - Overall
  - Overall with range
  - By Ethnicity
  - By Ethnicity with range
    - Range = Expected estimates vary depending on data availability

- **Limitations:**
  - Does not include self-reported data
  - Based on students with Cal-PASSPlus data
  - Retrospective projections
  - Placement vs Enrollment
Math and English Transfer Placement by Ethnicity - IVC
<table>
<thead>
<tr>
<th>Site</th>
<th>Subject</th>
<th>Level</th>
<th>Enrollment Fall 2016</th>
<th>Enrollment Fall 2015</th>
<th>Placement Fall 2016</th>
<th>Placement Fall 2015</th>
<th>Historic Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irvine</td>
<td>Math</td>
<td>-3</td>
<td>127</td>
<td>181</td>
<td>319</td>
<td>421</td>
<td>40.0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-2</td>
<td>406</td>
<td>417</td>
<td>713</td>
<td>788</td>
<td>56.9%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-1</td>
<td>353</td>
<td>428</td>
<td>473</td>
<td>573</td>
<td>74.6%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>1090</td>
<td>855</td>
<td>1331</td>
<td>1054</td>
<td>81.9%</td>
</tr>
<tr>
<td></td>
<td>English</td>
<td>-3</td>
<td>184</td>
<td>305</td>
<td>351</td>
<td>607</td>
<td>52.4%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-2</td>
<td>279</td>
<td>420</td>
<td>442</td>
<td>673</td>
<td>63.1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-1</td>
<td>245</td>
<td>323</td>
<td>374</td>
<td>518</td>
<td>65.5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>1137</td>
<td>664</td>
<td>1516</td>
<td>877</td>
<td>75.0%</td>
</tr>
<tr>
<td>Saddleback</td>
<td>Math</td>
<td>-3</td>
<td>193</td>
<td>290</td>
<td>653</td>
<td>920</td>
<td>29.5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-2</td>
<td>477</td>
<td>459</td>
<td>869</td>
<td>846</td>
<td>54.9%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-1</td>
<td>375</td>
<td>454</td>
<td>506</td>
<td>611</td>
<td>74.1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>861</td>
<td>583</td>
<td>1098</td>
<td>749</td>
<td>78.4%</td>
</tr>
<tr>
<td></td>
<td>English</td>
<td>-3</td>
<td>12</td>
<td>12</td>
<td>50</td>
<td>50</td>
<td>23.9%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-2</td>
<td>444</td>
<td>746</td>
<td>904</td>
<td>1439</td>
<td>49.1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-1</td>
<td>279</td>
<td>365</td>
<td>471</td>
<td>582</td>
<td>59.2%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>1250</td>
<td>773</td>
<td>1648</td>
<td>998</td>
<td>75.8%</td>
</tr>
</tbody>
</table>

Notes: Levels: -3=three levels below transfer, -2: two levels below transfer ... 0=transfer level.

- Enrollment projections of new students for a disjunctive MMAP model (Fall 2018). Projections are weighted by historic enrollment rates (see below). MMAP projections assume information available for all students (students with missing data were projected at equal proportions to students with complete information). Thus, these numbers estimate the maximum expected impact/enrollment.

- Actual enrollments for past fall term (Fall 2015)

- Historic Weight = Percent of students who enroll in course out of all students who were placed into course (5 year average)
Placement System Configurations and their Impact on Student Equity
What are some possible placement systems?

• **Disjunctive placement**: Take the highest placement suggested by either the test or the multiple measures. Recommended by MMAP.

• **Compensatory placement**: Blend information from multiple sources to derive a single placement recommendation. Often accomplished by adding or subtracting points to a student’s score on placement test, depending on their answers to other questions other attributes of the student (aka, multiple measures). Alternatively, information may be combined using a statistically derived algorithm such as via logistic regression.

• **Conjunctive placement**: Require both the test and multiple measures to agree on placement level. Highly restrictive. Not recommended by the CCCC0.
How can we compare these systems?

Establish a common set of metrics that tell us something important about placement system performance.

- **Accuracy**: The proportion of students who are correctly predicted to be successful or to be unsuccessful.

- **PPV**: Positive predictive value, the number of passing students (i.e., true positives) divided by the number of students predicted to be successful.

- **1 year throughput rate**: The number of students successfully completing the gatekeeper course at the end of a course sequence divided by the number of students in the initial cohort within 1 year.

- **Underrepresented Minority Placement Rate**: Equity and disproportionate impact are major considerations when evaluating the performance of placement systems.
Information that can be used to evaluate placement systems

<table>
<thead>
<tr>
<th></th>
<th>Predicted to Fail</th>
<th>Predicted to Pass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actually Failed</td>
<td><strong>True Negative</strong></td>
<td><strong>False Positive</strong></td>
</tr>
<tr>
<td>Actually Passed</td>
<td><strong>False Negative</strong></td>
<td><strong>True Positive</strong></td>
</tr>
</tbody>
</table>
Interactive Activity #2
Which of the following metrics can be calculated retrospectively for any placement system, whether it be disjunctive, compensatory or conjunctive?

- Accuracy: 23%
- Negative Predicted Value (NPV): 4%
- Positive Predicted Value (PPV): 65%
- Specificity: 4%
- Sensitivity: 4%

When poll is active, respond at PollEv.com/statbot
Text STATBOT to 22333 once to join
Evaluating Placement System Performance

Models were built using the same ACCUPLACER test data and the MMAP decision rules

- **Conjunctive model** – takes observed placements into statistics via ACCUPLACER and removes any students who do not also meet the MMAP requirements

- **Disjunctive model** – keeps any students who were already placed into transfer-level math via ACCUPLACER and adds those who would have qualified if the MMAP decision rules had been applied using a criterion of 70% or greater probability of passing. Most inclusive.

- **Compensatory model** – uses logistic regression to combine ACCUPLACER test scores with the high school performance elements from the MMAP decision rules
  - The compensatory model was run at two cut-values: one with the cut-value or criterion set to 0.70, to match the MMAP criterion level; and a second, exploratory model with a 0.50 criterion in order to maximize the model’s accuracy.
Statistics Decision Rules for Direct Matriculants

• 11th grade cumulative GPA of 3.0
  – Or
• 11th grade cumulative GPA of 2.3 AND a C or better in Pre-Calculus

• Also: Students must have successfully completed at least Algebra I or better in high school
Accuracy: Statistics Course

Accurate Placement in College Statistics

- Conjunctive: 61.0%
- Disjunctive (0.70)*: 57.4%
- Compensatory (0.70): 67.0%
- Compensatory (0.50): 68.1%
Positive Predicted Value (PPV): Statistics Course

PPV for College Statistics by Placement System

- Conjunctive: 0.73
- Compensatory (0.70): 0.78
- Disjunctive (0.70): 0.65
- Compensatory (0.50): 0.70

Proportion Correctly Predicted to Pass
One Year Throughput Rate: College Statistics Course

Statistics Class Throughput rate by Placement System

- Conjunctive
- Disjunctive (0.70)
- Compensatory (0.70)
- Compensatory (0.50)
Projecting Throughput

Formula for projecting 1-year throughput

\[(N \text{ placed } \times \text{ PPV}) + (0.38 \times (\text{cohort-N placed}) \times 0.18) + (0.2 \times (N \text{ placed} - (N \text{ placed} \times \text{PPV}))\]

Throughput of those placed directly into transfer level

Throughput of those placed one level below

Throughput of those placed directly into transfer level who repeat in second term
Percentage of Transfer-placed Students who are URM

Percentage Transfer-placed Students who are URM by Placement System

- Conjunctive
- Disjunctive (0.70)
- Compensatory (0.70)
- Compensatory (0.50)
Summary of Placement Models

• No single metric is sufficient but several well-chosen metrics can allow for a more informed decision

• Throughput is an important metric to consider

• PPV can be calculated for all placement systems; metrics that require a True Negative cannot be calculated for disjunctive placement systems.

• When requiring >70% probability of passing transfer-level course, disjunctive models have higher access and throughput than compensatory models

• If compensatory model is set to a 0.50 criterion or cut-value, it can outperform a disjunctive model (with a .70 criterion) in terms of accuracy, access, PPV and throughput

• The conjunctive model was very restrictive and had the lowest throughput rates and URM placement rates
Self-Reported Transcript Data
Interactive Activity #3
When you were assessed and placed into English, did you feel you were:

- Placed too high: 18%
- Placed just right: 64%
- Placed too low: 18%

When poll is active, respond at PollEv.com/statbot
Text STATBOT to 22333 once to join
When you were assessed and placed into math, did you feel you were:

- Placed too high: 47%
- Placed just right: 33%
- Placed too low: 20%
- Did not receive a placement/Other: 0%

When poll is active, respond at PollEv.com/statbot
Text STATBOT to 22333 once to join
Potential use of self-reported high school info

• UC admissions uses self-report but verifies after admission
  – 2008: 9 campuses, 60,000 students. No campus had >5 discrepancies between reported grades and student transcripts: http://bit.ly/UCSelfReportGPA

• College Board: Shawn & Matten, 2009: “Students are quite accurate in reporting their HSGPA”, $r(40,299) = 0.73$: http://bit.ly/CBSRGPA

• ACT research often uses self-reported GPA, generally find it to be a highly powerful predictor and highly correlated with students actual GPA: ACT, 2013: $r(1978) = 0.84$ http://bit.ly/ACTSRGPA
# High School GPA and Self-reported HSGPA


<table>
<thead>
<tr>
<th>HSGPA Level</th>
<th>N</th>
<th>Mean HSGPA</th>
<th>Mean diff.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Actual</td>
<td>Self-reported</td>
</tr>
<tr>
<td>3.50–4.00</td>
<td>599</td>
<td>3.79</td>
<td>3.75</td>
</tr>
<tr>
<td>3.00–3.49</td>
<td>451</td>
<td>3.24</td>
<td>3.23</td>
</tr>
<tr>
<td>2.50–2.99</td>
<td>408</td>
<td>2.81</td>
<td>2.76</td>
</tr>
<tr>
<td>2.00–2.49</td>
<td>265</td>
<td>2.24</td>
<td>2.35</td>
</tr>
<tr>
<td>1.50–1.99</td>
<td>172</td>
<td>1.77</td>
<td>2.04</td>
</tr>
<tr>
<td>0.00–1.49</td>
<td>85</td>
<td>1.03</td>
<td>1.85</td>
</tr>
<tr>
<td>Total</td>
<td>1,980</td>
<td>2.95</td>
<td>3.02</td>
</tr>
</tbody>
</table>

Using Self-Reported GPA from CCC Apply

• New **optional** items included in Open CCCApply
  – Grade Point Average
  – Highest English Course Taken
  – Highest English Course Taken Grade
  – Highest Math Course Taken
  – Highest Math Course Taken Grade
  – Highest Math Course Passed
  – Highest Math Course Passed Grade

• Need to opt-in!
  – Contact CCCAssess Product Manager, John Hadad, [jhadad@ccctechcenter.org](mailto:jhadad@ccctechcenter.org) to opt-in
  – Requesting all MMAP pilot colleges to opt-in and share data with the MMAP team for validation
Self-reported data - Plan for use

• Fully test reliability of self-reported high school info, particularly using the CCCApply questions
• Use as backup/supplement to actual high school transcript data for:
  – Students from high schools not participating in CalPASS Plus or with gaps in CalPASS Plus participation for that student
  – Students from out-of-state
  – Possible use of information from senior year for direct matriculants
Integration of MMAP with CAI
Integration of MMAP with CAI

• Note: Common Assessment updates currently on pause
• Common Assessment platform will house transcript data repository
  – repository will be source-agnostic & store transcript data from variety of sources, including CalPASS & self-report via CCC Apply
  – statewide decision trees programmed into platform, for internally generated Multiple Measures placement recommendation
  – expect data points used in MM placement recommendation
• Students will receive single placement recommendation created from disjunctive placement model
• Platform users with the “Counselor” role will have access to all placement recommendations for a student
• Initial integration will be available in early 2017
Subsequent integration with CAI

• **Initial** integration will not allow local customization.
  – Future phases will support Conjunctive and Compensatory methods
  – Guidance, limits, and thresholds for local customization will be provided as phased releases progress
• Functionality for additional local multiple measures not yet determined.
  – Will rely on feedback and direction from field (e.g., the MMAP project and all of you)
• Timeline for subsequent phases to be determined in forthcoming road mapping exercise.
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