Overview

- What are multiple measures?
- The CAI flow chart – where does MMAP fit in?
- The data story
- Research on multiple measures
- Validation of multiple measures
- Models of integrating multiple measures with test data
What are multiple measures?

- High school transcript data
- High school testing data
- Noncognitive variables (NCVs)/psychometric data
- Survey questions/self-reported data
- Essays/writing samples

- Historically, multiple measures were not required to be validated
  - Does not really make sense to ignore them as they impact placement
  - Need to validate impact of entire placement system on students
* Steering Committee and Work Groups composed of appointees representing ASCCC, Students, Assessment Professionals, IT, Research, psychometricians, K-12, CSU/UC, Student Services, and other stakeholders.
Multiple Measures Assessment Project

- Quantifying students' likelihood of passing any given course in the English and/or math sequence based on academic history/multiple measures
- Looking at noncognitive variables (NCVs) as possible predictors of student success, as well as other downstream uses for NCVs
- Evaluating CCCApply data
- Examining utility (reliability, validity, predictive power) of other survey questions and history indicators as multiple measures
- Does not include protected category information as predictors (e.g., gender, age, ethnicity, etc.)
Research on placement & multiple measures

- Content validity
- Criterion validity
- Arguments-based validity
  - Validating the outcome of the decision that is made based on the placement system/process
- Recent scans of multiple measures usage in CCCs show a variety of approaches (RelWest, 2011; WestEd, 2012; WestEd, 2014).
- Critiques of current placement system as prone to high degree of “severe error” which could be remediated through the use of multiple measures, including HS GPA (Belfield & Crosta, 2013; Scott-Clayton, 2012; Scott-Clayton, Crosta, & Belfield, 2012; Willett, 2013)
The data story

- **Data timeline**
  - First data file delivered on March 3, 2014 (STEPS 2.0 data file)
  - Second, improved data file with more elements was delivered on 9/3/14; third data file delivered on 10/18/14 (first to include Accuplacer data); fourth data file delivered on 11/4/14
  - The latest data file (fifth) was delivered on 11/17/14
  - Every data file takes time (weeks) to vet before new models can be shared

- **Goal of deploying pilot measures in spring 2015 for students enrolling in fall 2015**
  - Short project timeline → pressure to show results and make recommendations even as work is ongoing and data files are still being developed and refined.
  - The team’s data work includes: data screening, feasibility testing, identifying promising areas, and creating models that maximize accuracy of placement
  - Found sources of psychometric variables/NCVs but data are not yet in hand
What data do we have?

- **Data files**
  - About 390,000 cases of students with high school transcript data linked to enrollment in English at a California community college.
  - Similar file for math enrollments
  - ESL file in development

- **Data elements**
  - High school coursework, grades, GPA, test scores
  - Community college coursework, grades, GPAs
  - English Accuplacer data on 137,000 students (about 35% of the cases)
  - Math Accuplacer data on 109,000 students (about 29% of the cases)
Data infrastructure

- Academic history as a multiple measure is predicated on a statewide infrastructure that extracts data from the California Pupil Longitudinal Achievement Data System (Cal-PADS) for use in modeling
  - Cal-PASS Plus key player in creating & maintaining the data infrastructure
  - Timing
    - Senior year data not uploaded to Cal-PADS until October after graduation
    - Can use data through 11th grade with self-reported information on Senior year
  - Local solutions: LBCC and College of the Canyons have systems for processing/handling transcript data that includes senior year data
  - Staffing – expanded roles and responsibilities re: transcripts handling
  - CAS interface can be used to gather data for NCVs, survey questions, and other indicators & predictors
  - Robust data warehouse backend to provide unified data source for management, research and reporting
Level of and Success in First College Math for Students whose Last High School Course was Algebra 2 with Grade of B or Better (n=35,806)

<table>
<thead>
<tr>
<th>Level of First Community College (CC) Course</th>
<th>Pre-Algebra/Elementary Algebra (back one or more levels)</th>
<th>Intermediate Algebra (repeating same level)</th>
<th>Transfer Level (moved up 1+ levels)</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Success Rate</td>
<td>URM=69%</td>
<td>URM=58%</td>
<td>URM=44%</td>
</tr>
<tr>
<td>Percent Enrolled at CC Level</td>
<td>Male=37%</td>
<td>Male=42%</td>
<td>Male=49%</td>
</tr>
<tr>
<td></td>
<td>URM=24%</td>
<td></td>
<td>URM=44%</td>
</tr>
<tr>
<td></td>
<td>CST=275</td>
<td>CST=301</td>
<td>CST=334</td>
</tr>
<tr>
<td></td>
<td>Acc=57</td>
<td>Acc=84</td>
<td>Acc=97</td>
</tr>
</tbody>
</table>

- Male = 37%
- URM = 69%
- CST = 275
- Acc = 57%
- Male = 42%
- URM = 58%
- CST = 301
- Acc = 84%
- Male = 49%
- URM = 44%
- CST = 334
- Acc = 97%
Level of and Success in First College English for Students whose Last High School Course was 12th Grade Standard English with Grade of B or Better (n=75,830)

Level of First Community College (CC) Course

- College Success Rate
- Percent Enrolled at CC Level

<table>
<thead>
<tr>
<th>Level of First CC Course</th>
<th>Sent Skl=61</th>
<th>Sent Skl=62</th>
<th>Sent Skl=71</th>
<th>Sent Skl=83</th>
<th>Sent Skl=98</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 levels below</td>
<td>URM=69%</td>
<td>Male=39%</td>
<td>CST=306</td>
<td>Read Cmp=50</td>
<td>67%</td>
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<td>3 levels below</td>
<td>URM=74%</td>
<td>Male=42%</td>
<td>CST=317</td>
<td>Read Cmp=51</td>
<td>72%</td>
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<td>2 levels below</td>
<td>URM=71%</td>
<td>Male=42%</td>
<td>CST=336</td>
<td>Read Cmp=61</td>
<td>71%</td>
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<td>1 level below</td>
<td>URM=63%</td>
<td>Male=42%</td>
<td>CST=359</td>
<td>Read Cmp=74</td>
<td>72%</td>
</tr>
<tr>
<td>Transfer Level</td>
<td>URM=48%</td>
<td>Male=42%</td>
<td>CST=386</td>
<td>Read Cmp=88</td>
<td>74%</td>
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Read Cmp = 50, 51, 61, 74, 88
Sent Skl = 61, 62, 71, 83, 98
Training Set

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<thead>
<tr>
<th>Tid</th>
<th>Attrib1</th>
<th>Attrib2</th>
<th>Attrib3</th>
<th>Class</th>
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<td>Yes</td>
<td>Large</td>
<td>125K</td>
<td>No</td>
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<tr>
<td>2</td>
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<td>No</td>
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<tr>
<td>4</td>
<td>Yes</td>
<td>Medium</td>
<td>120K</td>
<td>No</td>
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<td>5</td>
<td>No</td>
<td>Large</td>
<td>95K</td>
<td>Yes</td>
</tr>
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<td>9</td>
<td>No</td>
<td>Medium</td>
<td>75K</td>
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<td>10</td>
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</table>

Test Set

<table>
<thead>
<tr>
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<th>Attrib3</th>
<th>Class</th>
</tr>
</thead>
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<td>14</td>
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<tr>
<td>15</td>
<td>No</td>
<td>Large</td>
<td>67K</td>
<td>?</td>
</tr>
</tbody>
</table>

General approach for building a classification model.

Transfer-level math MM decision tree

- Place into transfer level math if:
  - 11th grade cum GPA is 2.9 or higher
Impact of proposed MM rule set
Meta-model thinking

- How do we best make use of all of the test, academic history and other multiple measure data that is available?
  - Disjunctive (“either or”)
    - Example: Test score OR “good” grade in high school
  - Conjunctive (“both and”)
    - Example: Minimum score on reading and writing for placement into Freshman Comp
  - Compensatory (“weighted and blended”)
    - Example: Average of Reading Comprehension and Writing Scores; regression
  - Mix and match?
Math placement models for transfer-level

- Current test only: 29.4% placed, 62.5% success rate
- MM only: 26.9% placed, 71.2% success rate
- Disjunctive combo: 36.3% placed, 62.7% success rate

NB: MM rule derived from 250,000 cases in training data set, performance data from application of MM to 130,000 cases of students transitioning to a CCC in 2011-2012 or 2012-2013 (Data source: Cal-PASS+).
Thank you.

Questions & discussion
Additional resources

The slides that follow are provided as additional resources for the MMAP pilot colleges. For questions, please contact Terrence Willett (twillett@rpgroup.org) or Craig Hayward (chayward@rpgroup.org).
Additional transition data

Increasing alignment between high school and college curriculum can reduce remediation and course repetition.
<table>
<thead>
<tr>
<th>Last high school math, B or better</th>
<th>Level of First Community College (CC) Course</th>
<th>4 levels below</th>
<th>3 levels below</th>
<th>2 levels below</th>
<th>1 level below</th>
<th>Transfer Level</th>
<th>Total Percent</th>
<th>Total Count</th>
</tr>
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<tbody>
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<td>54%</td>
<td>47%</td>
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<td>Percent Enrolled at CC Level</td>
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<td>18%</td>
<td>30%</td>
<td>24%</td>
<td>19%</td>
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<td>13%</td>
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<td>26%</td>
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<td>27%</td>
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<td>23,016</td>
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<td>70%</td>
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<td>65%</td>
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<td>6%</td>
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<td>8,476</td>
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<td>5%</td>
<td>12%</td>
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<td>58%</td>
<td>100%</td>
<td>101</td>
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<tr>
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<td>16%</td>
<td>21%</td>
<td>28%</td>
<td>35%</td>
<td>100%</td>
<td>101</td>
</tr>
</tbody>
</table>

**Red** = transitioned **down** one or more levels from high school to college  
**Yellow** = repeated **similar** level in college already completed in high school  
**Green** = transitioned **up** one or more levels from high school to college
<table>
<thead>
<tr>
<th>Last high school English</th>
<th>Grade</th>
<th>College Success Rate</th>
<th>4 levels below</th>
<th>3 levels below</th>
<th>2 levels below</th>
<th>1 level below</th>
<th>Transfer Level</th>
<th>Total Percent</th>
<th>Total Count</th>
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<tbody>
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<td>12th Grade Standard English</td>
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<td>College Success Rate</td>
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<td>62%</td>
<td>60%</td>
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<td>60%</td>
<td>100%</td>
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<td>18%</td>
<td>34%</td>
<td>42%</td>
<td>100%</td>
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<td>B</td>
<td>College Success Rate</td>
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<td>31%</td>
<td>50%</td>
<td>100%</td>
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<td>A</td>
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<td>74%</td>
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<td>77%</td>
<td>78%</td>
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<td>4%</td>
<td>15%</td>
<td>81%</td>
<td>100%</td>
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</tr>
</tbody>
</table>
Level of and Success in First College Math for Students whose Last High School Course was Algebra 2 (n=113,217)

- **Pre-Algebra/Elementary Algebra (back one or more levels)**
  - College Success Rate: 58%
  - Percent Enrolled at CC Level: 38%
- **Intermediate Algebra (repeating same level)**
  - College Success Rate: 53%
  - Percent Enrolled at CC Level: 33%
- **Transfer Level (moved up 1+ levels)**
  - College Success Rate: 58%
  - Percent Enrolled at CC Level: 30%

**Level of First Community College (CC) Course**
- College Success Rate
- Percent Enrolled at CC Level
Level of and Success in First College Math for Students whose Last High School Course was Algebra 2 with Grade of C- or Better (n=80,883)

- Pre-Algebra/Elementary Algebra (back one or more levels): 63% College Success Rate, 31% Percent Enrolled at CC Level
- Intermediate Algebra (repeating same level): 57% College Success Rate, 34% Percent Enrolled at CC Level
- Transfer Level (moved up 1+ levels): 60% College Success Rate, 35% Percent Enrolled at CC Level
Level of and Success in First College English for Students whose Last High School Course was 12th Grade Advanced Placement English with Grade of B or Better (n=15,957)

- **College Success Rate**
  - 2+ levels below: 79%
  - 1 level below: 79%
  - Transfer Level: 82%

- **Percent Enrolled at CC Level**
  - 2+ levels below: 6%
  - 1 level below: 16%
  - Transfer Level: 79%
Psychometric data

Cabrillo College & Chaffey College pilot the predictive utility of psychometrics/NCVs
Developed by the Academy for College Excellence

Nagelkerke R-Square = .156
N = 462

OR 1.46
Mindfulness Observing (PRE)

OR 1.59
Self-Efficacy (PRE)

OR 2.00
Self-Efficacy (Change)

OR 1.44
Mindfulness Observing (Change)

OR 1.54
Leadership and Teamwork (Change)

OR 0.64
Mindfulness Distraction (Change)

OR 0.44
Interacting with Others (Change)

Success in Degree English (CB21A)

OR 1.38
College Identity (Pre)

OR 0.68
Mindfulness Distracted (Pre)

OR 0.67
Leadership and Teamwork (Pre)

OR 1.41
College Identity (Change)

OR 0.68
Mindfulness Distracted (Change)

Success in transfer-level English

N = 264
R-square = .084
Evaluating placement accuracy
Metrics for assessing classification accuracy of placement models
Fit Statistics: Evaluating classifications

- **Misclassification rate** - the number of incorrect predictions divided by the total number of classifications.
- **Sensitivity** - the percentage of cases that actually experienced the outcome (e.g., "success") that were correctly predicted by the model (i.e., true positives).
- **Specificity** - the percentage of cases that did not experience the outcome (e.g., "unsuccessful") that were correctly predicted by the model (i.e., true negatives).
- **Positive predictive value** - the percentage of correctly predicted successful cases relative to the total number of cases predicted as being successful.
- **Negative predictive value** - the percentage of correctly predicted unsuccessful cases relative to the total number of cases predicted as being unsuccessful.
Validity of self-report

How valid is self-reported academic data?
Self Reported Senior Year Coursework vs. Transcript

- Transcript
  - Accurate
  - Lags due to timing of data collection & transmission
  - Potential issues with out-of-state or returning students

- Self-Report
  - Logistically easy
  - Can be collected from all students
  - Is it a reliable / valid reflection?
Transcript vs. Self-Report: 12th Grade Math

- Senior Math Class
  - Few self-report higher, some report lower (possibly because they assessed in 11th grade)
  - Chi-square results: $\chi^2 (20)=835.86, p<0.001$
  - Spearman Rho = 0.826
  - 29% misclassification rate

Passing grade (A, B, or C)
  - Strong agreement
  - Chi-square results: $\chi^2 (1)=135.37, p<0.001$
  - Spearman Rho = 0.433
  - Only an 18% misclassification rate (593 match out of 723)