DEGREES OF FREEDOM:
Developmental Math Innovation & University Transfer

Pamela Burdman
Barbara Illowsky
Kate Stevenson
Hongde Hu
Judy Kysh
California Community Colleges:
- Board of Governors policy (Title 5, Education Code, 2006)
- Basic Skills Initiative (2007)
- UC/CSU transfer requirements

California State University:
- Board of Trustees resolution (1995)
- Executive Order 665 (1998)
- Executive Order 1048 (2010)
Goals for Today

- Sharing Knowledge
- Understanding Implications for Transfer
- Deepening Ties
CSU: Admissions Standards

+ Targets top 1/3 of students
+ Minimum GPA of 2.0
+ Completion of a-g courses
  (Includes: Algebra 1, Geometry, Algebra 2)
+ High school diploma
Open admissions policies target the top 100% of students.

High school graduation requires two years of mathematics, including Algebra 1.

High school graduation is not required for admission.
**ENTRY LEVEL MATHEMATICS EXAMINATION (ELM)**

<table>
<thead>
<tr>
<th>Exempt from ELM – 51%</th>
<th>Required to take ELM – 49%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SAT math</strong> (550 or above)</td>
<td><strong>Pass ELM</strong> (score ≥ 50) 16%</td>
</tr>
<tr>
<td><strong>ACT math</strong> (23 or above)</td>
<td><strong>Not proficient</strong> (score &lt; 50) 33%</td>
</tr>
<tr>
<td><strong>AP Statistics</strong> (3 or above)</td>
<td></td>
</tr>
<tr>
<td><strong>AP Calculus</strong> (3 or above)</td>
<td></td>
</tr>
<tr>
<td><strong>Early Assessment Program</strong></td>
<td></td>
</tr>
<tr>
<td>• EAP test (ready)</td>
<td></td>
</tr>
<tr>
<td>• Conditionally ready + 12th grade math</td>
<td></td>
</tr>
<tr>
<td><strong>Transferable college math course</strong></td>
<td></td>
</tr>
<tr>
<td>• C or better in approved course</td>
<td></td>
</tr>
</tbody>
</table>

Source: CSU Analytic Studies Proficiency Reports
## PLACEMENT IN THE CCC: Assessed Readiness by College

<table>
<thead>
<tr>
<th>UNTIL NOW</th>
<th>GOING FORWARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>MULTIPLE TESTS:</td>
<td>SINGLE TEST:</td>
</tr>
<tr>
<td>ACCUPLACER (49%)</td>
<td>California Community College</td>
</tr>
<tr>
<td>MDTP (35%)</td>
<td>Common Assessment</td>
</tr>
<tr>
<td>Compass (13%)</td>
<td></td>
</tr>
<tr>
<td>Self-assessment (4%)</td>
<td></td>
</tr>
<tr>
<td>Locally developed (7%)</td>
<td></td>
</tr>
<tr>
<td>CUT SCORES: Vary by college</td>
<td>CUT SCORES: Vary by college</td>
</tr>
<tr>
<td>(In 2010 ACCUPLACER college-level score ranged from 43 to 63.)</td>
<td>MULTIPLE MEASURES</td>
</tr>
</tbody>
</table>

Source: Venezia et al, 2010. *A One-Shot Deal?*
+ Developmental curriculum varies by campus. Some offer alternative (e.g. stats) pathways.

+ Early Start: Students must begin in the summer before freshman year.

+ Students must complete remediation in their first year.

+ Students who don’t meet these requirements may be dis-enrolled.
About 85% of students require one or more dev math class.

Sequence varies from college to college

A three-level sequence is typical:
+ Pre-algebra (with arithmetic)
+ Elementary algebra
+ Intermediate algebra

Some colleges offer alternative (non-STEM) and accelerated sequences
FOR MORE INFORMATION:

Degrees of Freedom 1:  
*Diversifying Requirements for College Readiness and Graduation*

Degrees of Freedom 2:  
*Varying Routes to Math Readiness and the Challenge of Intersegmental Alignment*

Degrees of Freedom 3:  
*Probing Placement Policies at California Colleges and Universities*

Prior LearningWorks report:  
*Changing Equations: How Community Colleges are Re-Thinking College Readiness in Math*

Pamela Burdman  
info@changingequations.org
REAL Algebra Course

• The mathematics should build on prior learning and make sense.

• Students look to themselves and their fellow students to see whether their work is correct.

• The material should appear as possibly useful in their future lives.

• In general, there are several good ways to solve most problems.

• Students work on fewer problems, but each problem requires some thought.
Differences in TEACHING the New Course

Let students struggle and discuss how to solve (with teacher pocket questions) vs. Telling students how to proceed

A few problems with discussion vs. many.

Group work is necessary for learning Algebra.

Facilitation and discussion leadership skills are needed.
Activity 1: Vacation Trip

Carlos and Sasha are planning a big vacation as a graduation present to each other. Sasha found an amazing deal on airfare to Hawaii at $400 each. She found the perfect place to stay with surfing and snorkeling at $200 a day including food for the two of them. Carlos, meanwhile, searching on the other computer, has the cost for air fare to Tonga at $1100 each, with hotel at the beach, food, surfing and snorkeling for both of them at $75 a day. Sasha says they can’t beat the $400 dollar airfare and Carlos thinks they can’t pass up the $75 daily rate.
As a group analyze the two plans and write a group report that will help Sasha and Carlos to make an informed decision on which trip to take. Present as many ways to look at the problem as possible.
Activity 2: Building Towers

Build some towers by stacking cubes to different heights, and keep track of how many cubes you use and how high each tower is.

1. Make a table with different numbers of cubes: and the height of each tower.

2. Use the numbers in your table to draw a graph.

3. Write an equation that fits the graph and the table.

4. Use your equation to predict the height of a tower built with 20 cubes.
End of Class Question

In your own words explain what the y-intercept and the slope of a function mean in terms of a graph and in terms of a table.
Find Your Group

• You have a situation, a graph, a table or an equation.

• You must find three other representations that match your function.
How Did You Find Each Other? Which Connections Did You See?
Performance on Common Exam Questions

In Elementary Algebra:

• On 4 out of 6 common questions students from Revitalizing Algebra outperformed students from Control classes at the 95% level of significance.

• On the other two questions there was no significant difference.
Passing Rates & Passing Rate in Follow-up Courses

For Students taking the new Elementary Algebra vs. Control Statistics Courses
(no significant difference)

Business Calculus Courses
(no significant difference)

Pre-calculus
Pre-calculus
A significantly higher percent of students passed the course and a significantly greater percent earned A’s and B’s.

<table>
<thead>
<tr>
<th>Pre-Calculus</th>
<th>Passing Rate</th>
<th>Passing Rate</th>
<th>Percent A’s &amp; B”s</th>
<th>Percent A’s &amp; B’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Test</td>
<td>Control</td>
<td>Field Test</td>
<td>Control</td>
<td></td>
</tr>
<tr>
<td>Math 199</td>
<td>61%</td>
<td>43%</td>
<td>41%</td>
<td>27%</td>
</tr>
</tbody>
</table>
Passing Rate Now in Follow-up Courses with the Addition of New Intermediate Algebra

No significant difference in pre-calculus, business calculus, or statistics courses offered in other departments, BUT significantly greater percentage passing Math 124 (Statistics).
Statistics
A significantly higher percent passed the course and a significantly greater percent earned A’s and B’s.

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Passing Rate</th>
<th>Passing Rate</th>
<th>Percent A’s &amp; B’s</th>
<th>Percent A’s &amp; B’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Test Ratio</td>
<td>60/71</td>
<td>169/296</td>
<td>40/71</td>
<td>111/296</td>
</tr>
<tr>
<td>Percent</td>
<td>85%</td>
<td>57%</td>
<td>56%</td>
<td>38%</td>
</tr>
</tbody>
</table>

*REAL passing rates and percent of As & Bs significantly higher at .05 level.*
CSUN’s Developmental Math Program

Katherine Stevenson
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California State University Northridge
CSUN’s Developmental Math

- Pre-Algebra with introduction to linear equations (3 hours per week)
- Terminal DMP (5 hours per week)
  - Algebra Track: ELM material – light on number sense & geometry, heavy on algebra.
  - Pre-Statistics Track: ELM material – light on algebra, heavy on number sense in statistics context.
Passage Rates:

Passage rates by semester for traditional classes:

- 84% in summer early start math Face to Face
- 60-70% in fall
- 60% in spring

Some Discussion Questions:

- If there are 1000 students in Math 093 this Fall, how many do we expect to pass this fall?
- Can you estimate how many of the 1000 F14 Math 093 students will complete their DMP requirement this year?
- Who does calculations like these?
- Do you have an explanation for why the % vary so much?
Homework vs Average:

- What does each dot represent?
- What do the lines mean?
- What action does the line suggest you take this term?
- Was this a Spring term or a summer term?
CSUN DMP Day 1

Summer 2015 vs Spring 2015:

Attendance vs Overall %

Homework vs Overall %

Attendance vs Overall %

Homework vs Overall %
Which of the following did you do when looking at the 2013-3014 DMP data?

• Students will be able to perform **basic arithmetic with** fractions, decimals, and **percentages**. They will be able to **recognize contexts in which these operations are appropriate** and **interpret their results in context**.

• Students will be able to solve equations. They will be able to recognize contexts in which solving equations is an appropriate approach to solve a problem and will be able to interpret their solutions in context.

• Students will be able to graph equations, inequalities, and functions. They will be able to recognize contexts in which graphing is an appropriate approach to solve a problem or to communicate information. They will be able to **interpret graphs in context**.
CSUN’s Early Start Math Initiative

A tale of two approaches:

- Face to Face, 4 days per week, 3 hours per day, 6 weeks – Standard DMP format compressed.
- Face to Face, 1 day per week, 3 hours per day, 6 weeks
  - Asynchronous, adaptive (forward and backwards), online – ALEKS
  - Week 1 kick off: Welcome, SEL exercise, jumpstart on ALEKS
  - Weeks 2-5: Weekly progress goals, individual and small group instruction.
- Week 6: Final assessments – Note, students who complete early assess early and can move up to next level or complete.
- Proven Performance – Grade in Fall Math class.
A tale of two approaches:

- Face to Face, 4 days per week, 3 hours per day, 6 weeks – Standard DMP format compressed.
- Face to Face, 1 day per week, 3 hours per day, 6 weeks
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  - Week 6: Final assessments – Note, students who complete early assess early and can move up to next level or complete.

**RESULTS:** Both passed approximately 85%.
CSUN’s Early Start Math Initiative

Figure 2b. CSUN GPA at End of the First Academic Year by High School GPA and Participation in Summer 2012 Enrichment Programs

CSUN IR – The Virtues of Giving CSUN’s Entering Freshmen an Early Start
CSUN’s Early Start Math Initiative

Figure 6b. One-Year Continuation Rate by High School GPA and Participation in Early Start Programs

CSUN IR – The Virtues of Giving CSUN’s Entering Freshmen an Early Start
CSUN’s Early Start Math Initiative

Figure 28. One-Year Continuation Rate of First Time Freshman Entrants by Racial and Ethnic Background and Fall Entry Term

CSUN IR – Undergraduate Persistence at Cal State Northridge From 2000 Onwards
Pre-Statistics course, MATH 097:
Bring students up to ELM Competency while preparing them for any Introductory Statistics course
• Earlier attempts: Statway® and Math Lit – did no harm.
CSUN’s Statistics Pathway through Dev Math

Pre-Statistics course, MATH 097:
Bring students up to ELM Competency while preparing them for any Introductory Statistics course

• Earlier attempts: Statway® and Math Lit – did no harm.
• CSUN Workbook: Math as a novel – Four college students take a road trip, and as they travel across America they solve application problems pertinent to each part of their journey.
  • Engages students in mathematical and statistical analysis from day one by integrating English, math, statistics, and topics from science throughout.
  • Periodic assessments, nightly reading assignments with quizzes, online homework for computational fluency, cumulative final.
Pre-Statistics course, Results:

- Passage rates in the Pre-Statistics class are slightly higher than in the algebra track through developmental math: 70% vs 60%.
- Spring 2014
  - Pre-Stat/Stat path passage rate in Statistics: 59%
  - Algebra/Stat passage rate in Statistics: 54%
Pre-Statistics course, Results:

- Passage rates in the Pre-Statistics class are slightly higher than in the algebra track through developmental math: \(70\% \text{ vs } 60\%\).

- **Spring 2014**
  - Pre-Stat/Stat path passage rate in Statistics: \(59\%\)
  - Algebra/Stat passage rate in Statistics: \(54\%\)

- **Spring 2015** (after improving the homework—classwork connection)
  - Pre-Stat/Stat path passage rate in Statistics: \(78\%\)
  - Highest recorded passage rate in Statistics in any semester for the last ten years: \(69\%\)
<table>
<thead>
<tr>
<th></th>
<th>STATWAY</th>
<th>Path2Stats/CAP</th>
<th>Other Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UC-transfer</strong></td>
<td>Rejected twice; accepted on third review</td>
<td>Accepted initially, then rejected; pre-req challenge in use</td>
<td>Not reviewed; pre-req challenge in use; transfer guidelines due October 2015</td>
</tr>
<tr>
<td><strong>CSU-transfer</strong></td>
<td>Accepted for pilot til 2019 - CSU math chairs oppose</td>
<td>Rejected; pre-req challenge as CC purview; may apply to join pilot</td>
<td>Not formally evaluated; pre-req challenge in use</td>
</tr>
<tr>
<td><strong>CSU-freshmen</strong></td>
<td>Implemented by a few campuses – CSU math chairs oppose</td>
<td>Not in use</td>
<td>Variations at subset of campuses</td>
</tr>
</tbody>
</table>
Innovative Model for Developmental Mathematics: CLOSING MATH SKILL GAPS

Hongde Hu
California State Univ-Monterey Bay
Oct. 8, 2015
The Challenge

• 50%-55% of Freshmen need remediation in Math and/or English
• Students who fail the two-semester remedial math are dis-enrolled
• 51% of our students are first generation
• 35% of students at CSUMB are Latino
• Only 65% freshmen were retained in the fall of 2006
Math 98/99 Redesign

• The Project targets the group of freshmen who failed the CSU Entry Level MATH EXAM and those who are struggling with MATH in Gateway STEM courses.

• Partner with Hartnell and Cabrillo Colleges to create lessons to address specific areas of misunderstanding, weekly Pre- and Post-test, online modules for supplemental instruction, and a common final. These are updated every semester.

• Daily quizzes and assignments address specific areas of potential weakness.

• A coordinator for the developmental Math Program has been funded by the University.
Class Structure

- **Class meetings**: Twice a week for 110 minutes each time.
- **Class size**: Each section is from 55 to 90 students.
- **Classroom support**: One instructor and 2 or 3 Teaching Assistants for each section.
Interactive Classroom

• A typical day in class will address specific content areas. Students work together on activities. Individual and/or group quizzes are embedded in every class.

• Engaging with students: all Math 98/99 instructors use a Tablet PC which projects on large screens in the classroom.

• Peer Tutors serve in classrooms/labs to provide immediate assistance to students; Each tutor is personally responsible for tracking 15-20 students.
Outside class support

• **Open lab**: There are two hours of open lab, staffed by teaching assistants, five days a week throughout the semester from 6-8 PM to help students work on their daily assignments and address any other questions they might have.

• **Tutoring center**: University tutoring center provides semester-long, one-to-one help or drop in help every day of the week.
Other Components

• **Early Warning System**: keeps track of student progress regularly & identifying students at risk early in the term.

• **Individual Attention** to every student during class and outside class.

• **A LIVE grade-book** on *iLearn*.

• **Updated daily assignments/quizzes address students’ misunderstandings from the previous lesson**
Success of Math 98/99

This model was implemented Fall 2007.

- Passing percentage for all the sections has been between 85% to 95% over the past seven years.

- Retention Data: Students who completed Math 98/99 are retained at a higher rate than general freshmen population.

- Overall, freshmen retention at CSUMB has been improved to 80% (2014) from 65% in 2007.
<table>
<thead>
<tr>
<th></th>
<th>Cohort</th>
<th>Math 98 Retention Rate</th>
<th>Cohort</th>
<th>Math 99 only Retention Rate</th>
<th>Cohort</th>
<th>No Math Remediation Retention Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall 2013</td>
<td>186</td>
<td>76%</td>
<td>104</td>
<td>87%</td>
<td>576</td>
<td>85%</td>
</tr>
<tr>
<td>Fall 2012</td>
<td>216</td>
<td>71%</td>
<td>129</td>
<td>85%</td>
<td>557</td>
<td>83%</td>
</tr>
<tr>
<td>Fall 2011</td>
<td>320</td>
<td>78%</td>
<td>57</td>
<td>86%</td>
<td>496</td>
<td>80%</td>
</tr>
<tr>
<td>Fall 2010</td>
<td>349</td>
<td>82%</td>
<td>78</td>
<td>76%</td>
<td>402</td>
<td>75%</td>
</tr>
<tr>
<td>Fall 2009</td>
<td>384</td>
<td>75%</td>
<td>67</td>
<td>72%</td>
<td>498</td>
<td>77%</td>
</tr>
<tr>
<td>Fall 2008</td>
<td>381</td>
<td>70%</td>
<td>60</td>
<td>73%</td>
<td>472</td>
<td>71%</td>
</tr>
<tr>
<td>Fall 2007</td>
<td>340</td>
<td>65%</td>
<td>51</td>
<td>75%</td>
<td>355</td>
<td>68%</td>
</tr>
<tr>
<td>Fall 2006</td>
<td>270</td>
<td>67%</td>
<td>1</td>
<td>100%</td>
<td>263</td>
<td>63%</td>
</tr>
</tbody>
</table>
MATH REMEDIATION – Cost Comparison

Assume 75 students; $1,500 per credit; 4-credit class

Traditional Remediation:  
*failure rate 50%*

<table>
<thead>
<tr>
<th># of Students</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>$6,000</td>
</tr>
<tr>
<td>25 Repeats: 50 students, 2 sections, $12,000</td>
<td>$6,000</td>
</tr>
<tr>
<td><strong>TOTAL COST:</strong></td>
<td><strong>$27,000</strong></td>
</tr>
</tbody>
</table>

MATH HUGE  
*Pass rate 85-95%*

<table>
<thead>
<tr>
<th># of Students</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>75 students</td>
<td>$6,000</td>
</tr>
<tr>
<td>2 ISA’s (to assist faculty) Repeats: 8 students, 1 section, $600</td>
<td>$2,250</td>
</tr>
<tr>
<td><strong>TOTAL COST:</strong></td>
<td><strong>$8,850</strong></td>
</tr>
</tbody>
</table>
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