Advancing Equity in Mathematics
Pathways in the Era of the Pandemic

October 21, 2020
Welcome! Let’s get to know each other while we wait to start the webinar

Please answer the questions below in the “Chat,” located at the bottom of your screen.
❖ switch from panelists to all panelists and attendees

● Where are you from?
● What attracted you to enroll in this webinar?
Presenters

Connie Richardson, The Charles A. Dana Center
Ann Edwards, Carnegie Math Pathways, WestEd
Helen Burn, Highline College

Sponsored by the National Math Summit
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- AMATYC retains the right to show it again and to distribute it.
- By participating, you are agreeing that your contributions become part of the recording
Housekeeping

- Please make sure that you are muted.
- Open the chat by clicking on chat at the bottom of your screen.
- Click on the arrow to switch from panelists to all panelists and attendees so that everyone will be able to view your comments.
- We will have limited time to address questions. Type your question in the chat. We will save the chat and be able to address questions not answered during the webinar at a later date.
- Be open to new ideas and kind in comments to others.
Advancing Equity in Mathematics Pathways in the Era of the Pandemic

October 21, 2020
# Math Course Enrollments at Two-Year Institutions

<table>
<thead>
<tr>
<th>Course</th>
<th>2000</th>
<th>2005</th>
<th>2010</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA</td>
<td>173,000</td>
<td>206,000</td>
<td>230,000</td>
<td>292,000</td>
</tr>
<tr>
<td>Stat</td>
<td>71,000</td>
<td>111,000</td>
<td>134,000</td>
<td>251,000</td>
</tr>
<tr>
<td>MLA</td>
<td>43,000</td>
<td>59,000</td>
<td>91,000</td>
<td>97,000</td>
</tr>
<tr>
<td>Calc I</td>
<td>53,000</td>
<td>51,000</td>
<td>65,000</td>
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Compiled from Conference Board of Mathematical Sciences 2000-2015 Surveys
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<tr>
<td>CA</td>
<td>173 (51%)</td>
<td>206 (48%)</td>
<td>230 (44%)</td>
<td>292 (41%)</td>
</tr>
<tr>
<td>Stat</td>
<td>71 (21%)</td>
<td>111 (26%)</td>
<td>134 (26%)</td>
<td>251 (36%)</td>
</tr>
<tr>
<td>MLA</td>
<td>43 (13%)</td>
<td>59 (14%)</td>
<td>91 (18%)</td>
<td>97 (14%)</td>
</tr>
<tr>
<td>Calc I</td>
<td>53 (16%)</td>
<td>51 (12%)</td>
<td>65 (13%)</td>
<td>66 (9%)</td>
</tr>
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Compiled from Conference Board of Mathematical Sciences 2000-2015 Surveys
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<td>66,000</td>
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</tbody>
</table>

Compiled from Conference Board of Mathematical Sciences 2000-2015 surveys
Mathematics Pathways should...

- Provide students with math content that aligns with their academic and professional goals;
- Accelerate students who have been underserved in the past;
- Provide learning environments that:
  - support students’ identities as math learners and
  - invite and engage students in the development of skills and dispositions that serve them broadly to achieve their academic and career aspirations
Equitable Mathematics Pathways

- K12 foundation:
  - Detracking, improved instruction and supports, pathways

- Postsecondary math pathways
  - High-quality options
  - Transparency and awareness
  - Student-centered teaching
  - Rich content
  - Evidence-based assessments

Just Equations (2019)
Are your math pathways...

- Serving the right students (i.e., are your students in the right math pathway)?
- Serving students equitably?
- Providing the supports needed, even when virtual?
- Contributing to a strong STEM pipeline?
Recent Research

- Program analysis tools for equitable access
- The relationship between math pathways and corequisites
- What we know about corequisites: effectiveness, implementation, and design
- Transitioning Learners to Calculus in Community Colleges
Equity View of Program Enrollments

1. What programs are our students currently enrolled in?
2. What opportunity does each program lead to in terms of further education (e.g., transfer to bachelor’s programs or bridges into more advanced workforce credentials) and/or immediate job prospects and earnings. Which programs lead to greater or lesser opportunity?
3. Is student representation across programs proportionate? Which subgroups of students (by race/ethnicity, gender, socioeconomic status, and age) are underrepresented in higher-opportunity programs?

https://ccrc.tc.columbia.edu/publications/unpacking-program-enrollments-completion-equity.html
Program Enrollments and Opportunity Categories

Are most of your students preparing for high-wage or low wage jobs?

Which students are preparing for high-wage jobs?

https://ccrc.tc.columbia.edu/publications/unpacking-program-enrollments-completion-equity.html
Program Enrollments and Opportunity Categories

Figure 4. College B: Program Opportunity Categories by Race/Ethnicity

Percent of Students

<table>
<thead>
<tr>
<th>Category</th>
<th>HU-Students of Color</th>
<th>Asian or White</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Privacy Suppressed Programs*</td>
<td>14.1%</td>
<td>19.5%</td>
<td>19.9%</td>
</tr>
<tr>
<td>Uncategorized</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown or Undeclared</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workforce: High</td>
<td>40.1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workforce: Medium</td>
<td>40.9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workforce: Low</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structured Transfer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unstructured Transfer</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Number of Students

<table>
<thead>
<tr>
<th>HU-Students of Color</th>
<th>Asian or White</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>6K</td>
<td>4K</td>
<td>2K</td>
</tr>
</tbody>
</table>

*This figure is based on a COEO analysis of SBOTC data that required the suppression of program information among those programs with fewer than 10 students enrolled.
Math pathways and corequisites

The study found that enrolling students in corequisite courses resulted in large positive effects, and attributes these effects to state-wide efforts to enroll students in math courses aligned with the requirements of their program, i.e., enrolling more students in Statistics rather than placing them into algebra by default. ...[M]ath students placed into corequisite courses were 8 percentage points more likely to enroll in and pass an additional college-level math course compared with students placed into college-level directly.

Summary approved by lead researcher Florence Xiaotao Ran
Personal communication April 27, 2020
Math pathways and corequisites

A significant takeaway from this study is that math pathways and corequisite courses should not be viewed as competing reform efforts, but rather, as complementary system-wide strategies that lead to student success in gateway level math courses. In fact, ..., offering viable math pathways is essential to maximizing the benefits of corequisite remediation.

Summary approved by lead researcher Florence Xiaotao Ran
Personal communication April 27, 2020
References

What is Corequisite Remediation?

Direct enrollment into a college level course alongside additional academic support in the same term

Many different implementation models

- Alignment of content and pedagogy
- Delivery mode
- Cohort
Why Corequisites?

- Inaccuracy of placement mechanisms
- Reduce course sequence (eliminating potential exit points) and increase student “momentum” in earning college credits
- Reduce potential stigma and aversion; improve motivation
- In some implementations, content is more closely aligned to student interest and is less abstract
Do corequisites “work”?  

Outcomes  
- Passing college-level course within one year  
- Subsequent course-taking and credit accumulation (GE, math)  
- Graduation and transfer
Do corequisites “work”?

Primary Studies

**Tennessee**
- System-wide implementation in the 13 colleges in TBR (2015)
- Regression discontinuity analysis incl longer term outcomes

**CUNY**
- RCT with 3 colleges implementing Stat Coreq incl longer-term outcomes (2013)
- Additional PSM study of pass rates with 4 colleges (2013 - 2015)

**Texas**
- Regression discontinuity analysis in math incl longer term outcomes (2014 - 2016)
- RCT with 5 colleges in English (2016 - 2017)
Do corequisites “work”?

- Passing college-level course within one year
  - TN, CUNY, TX: More likely to pass gateway math than prereq remediation

- Subsequent course-taking and credit accumulation (GE, math)
  - TN, CUNY: More likely to enroll in and pass subsequent math course
  - CUNY: More likely to have passed GE reqs
  - TX: No significant impact on credit accumulation, progress to degree

- Graduation and transfer
  - TN & TX: No significant impacts on graduation and transfer
  - CUNY: More likely to graduate
Do corequisites “work”?

What can we take away?

- Corequisite remediation gets students through gateway math faster and just as well.
- Implementation with math pathways reforms may support longer-term effects.
- Improvements in transfer and completion depend on much more than just gateway course completion. Additional supports are needed.
Corequisite Design & Implementation

Growing consensus on principles of design and implementation:

- Alignment with math pathways
- Same college content and outcomes
- Alignment of instructional approach in college and corequisite components
- Corequisite support tailored for the college level course
- Attention to mindset, sense of belonging, relevance and other SEL factors
- Explicit attention to equitable participation and outcomes
Active, collaborative learning
Productive struggle
Rich authentic contexts
Explicit connections to concepts
Deliberate practice
Social-emotional learning supports
Language and literacy supports
Flexibility of implementation
Guides for recommended use of materials

Carnegie Math Pathways Corequisite Design
Elements of Effective Design

- Student-centered, collaborative pedagogy
- Relevant content and contexts
- Higher contact hours
- Cohort model
Suggestions for Implementation

<table>
<thead>
<tr>
<th>Adequate preparation time</th>
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</thead>
<tbody>
<tr>
<td>Flexibility and adaptability</td>
</tr>
<tr>
<td>Learn students' needs early</td>
</tr>
<tr>
<td>Slow down first two weeks</td>
</tr>
<tr>
<td>Student expectations and encouragement</td>
</tr>
<tr>
<td>Instructor support and collaboration</td>
</tr>
</tbody>
</table>
What we still need to learn

What works for whom under what conditions?

- For what students are corequisites less effective? What do we know about the students who are not succeeding with corequisites? How can corequisites better serve those students?
- How can corequisites be designed for equity?
- What other reforms are complementary with and amplify the effectiveness of corequisites?
- What data should institutions be looking at to know whether their corequisite is “working” and for whom?
References

Racial Equity in the STEM Math Pathway

Transitioning Learners to Calculus in Community Colleges
https://occrl.illinois.edu/tlc3

Helen Burn, Highline College
Vilma Mesa, University of Michigan-Ann Arbor
J. Luke Wood, San Diego State University
Chauntee Thrill, Appalachian State University
Eboni Zamani-Gallaher, University of Illinois at Urbana-Champaign

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# Transitioning Learners to Calculus in Community College (TLC3)

## Project Goals

<table>
<thead>
<tr>
<th>Project Goals</th>
<th>Research Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify practices to enhance the success of racially minoritized students in the STEM math pathway</td>
<td>Race-conscious, interdisciplinary</td>
</tr>
<tr>
<td>Create an Institutional Self-Assessment tool to transform how colleges identify and remove barriers for racially minoritized students</td>
<td>National Survey of Community College Mathematics Chairs</td>
</tr>
<tr>
<td></td>
<td>Case studies of minority-serving institutions (PBI, HSI, AANAPISI, Tribal College)</td>
</tr>
<tr>
<td></td>
<td>Content validation by TLC3 Advisory Board</td>
</tr>
</tbody>
</table>
# Racial Equity in the STEM Math Pathway

## Multiple Domains
- Math Placement
- STEM Math Courses
- Instruction
- Student support
- Institutional responsibility

## Multiple Challenges
- Receives less attention than other pathways
- Course sequence is long and may include developmental courses
- Underrepresentation of racially minoritized students and faculty
Accessing TLC3 Tools

Pandemic opportunity to do planning and to build infrastructure, develop action plans.

Single-page infographic with domains and practices

https://drive.google.com/file/d/1-JzK07Klh1ZQAhMxVFOquS2W9j1PRjE0U/view?usp=sharing
1. Multiple measures used for placement, including high school transcripts

2. Advising about the placement process and results is given to students

3. Policies and practices ensure highest possible placement (e.g., retesting, test prep resources, adjusting after term begins)
Accessing TLC3 Tools

Institutional Self-Assessment Tool

Multi-page document with interactive response set

https://drive.google.com/file/d/1-S9Y6jKo1LjUPb5oyc9V3lGR0qAfWwqo/view?usp=sharing
# 4. Student Support

*Refers to out-of-class supports for URM students in the STEM math pathway.*

<table>
<thead>
<tr>
<th></th>
<th>To what extent has your college implemented this practice?</th>
<th>Are the majority of your URM students aware of this practice?</th>
<th>What next steps are needed to enhance your efforts around this practice?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4.1</strong></td>
<td>Current grade standing is available to students throughout the term</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>○ Fully implemented ○ Being implemented ○ Being proposed ○ Not implemented</td>
<td>○ Yes ○ No ○ Unsure ○ Not applicable</td>
<td></td>
</tr>
<tr>
<td><strong>4.2</strong></td>
<td>Dedicated space is available on campus for students to gather and work together on mathematics</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>○ Fully implemented ○ Being implemented ○ Being proposed ○ Not implemented</td>
<td>○ Yes ○ No ○ Unsure ○ Not applicable</td>
<td></td>
</tr>
<tr>
<td><strong>4.3</strong></td>
<td>Math tutoring and instructor office hours are available and easily accessible to students</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>○ Fully implemented ○ Being implemented ○ Being proposed ○ Not implemented</td>
<td>○ Yes ○ No ○ Unsure ○ Not applicable</td>
<td></td>
</tr>
<tr>
<td><strong>4.4</strong></td>
<td>Relevant support services are highlighted in syllabi and during instruction (e.g. tutoring, disability services, transfer advising, wellness)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>○ Fully implemented ○ Being implemented ○ Being proposed ○ Not implemented</td>
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Accessing TLC3 Tools

Institutional Self-Assessment Tool

Online form (mobile-friendly)
https://survey.az1.qualtrics.com/jfe/form/SV_73Blw6xBAzFfbeJ

Follow-up available through 2020-21 academic year
hburn@highline.edu
Racial Equity in the STEM Math Pathway

Five Domains

1. Math Placement
2. STEM Math Courses
3. Instruction
4. Student support (out of class)
5. Institutional responsibility
STEM Math Courses

1. The course sequence and required course materials in the STEM math pathway are optimized for timely progress

2. Courses are designed to transfer to baccalaureate institutions

3. Data on student outcomes in STEM math pathway courses, disaggregated by race/ethnicity (African American, Latinx, Indigenous, Southeast Asian) within gender, are reviewed at least annually by mathematics faculty
Institutional Responsibility

1. Permanent base funding is provided by the college to bolster and support the success of URM students in the STEM math pathway.

2. High-quality and ongoing professional learning focused on inclusive teaching strategies, implicit bias, and racial microaggressions is provided to full- and part-time mathematics faculty.

3. Targeted efforts are undertaken by the college to provide resources for students facing food, health, and housing insecurities (e.g., food pantry, free walk-in clinic, emergency financial assistance).
<table>
<thead>
<tr>
<th>Mathematical Instruction Practices</th>
<th>Relational Instruction Practices</th>
</tr>
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<tbody>
<tr>
<td>Student active involvement in problem solving is central to mathematics instruction</td>
<td>Authentic care and welcomeness to engage are expressed to students</td>
</tr>
<tr>
<td>Students are invited to discuss or share their thinking about mathematics with each other</td>
<td>Student questions and concerns are validated and addressed in a timely fashion</td>
</tr>
<tr>
<td>The relevance of mathematics (to careers, personal lives, etc.) is made explicit to students during class or in class materials</td>
<td>What students find helpful or hindering in their college and math courses is well-known and understood by mathematics faculty</td>
</tr>
<tr>
<td>The mathematical content and tasks are challenging in terms of cognitive demand</td>
<td>Performance monitoring techniques are used consistently (e.g., feedback on learning, reminders about deadlines, etc.)</td>
</tr>
</tbody>
</table>
Thank you!

Helen Burn  
Highline College  
hburn@highline.edu  
(206) 592-3496


Upcoming 4th National Mathematics Summit
June 14 & 15, 2021
Westgate Resort and Casino
Las Vegas, NV

Planning Leadership Team
Annette Cook, Paul Nolting, Julie Phelps and Nancy Sattler

Steering Committee
Christina Cobb and Denise Lujan (NOSS)
Rochelle Beatty, Kathryn Van Wagoner, and Laura Watkins (AMATYC)
Connie Richardson and Paula Talley (Charles A. Dana Center)
Ann Edwards (Carnegie Math Pathways/WestEd)
April Strom (MAA)
The 4th National Math Summit begins at 1:00 p.m. on Monday, June 14th, and features keynote speaker, Jenna Carpenter, concurrent sessions, and more. The program will conclude Tuesday, June 15th, at 5:00 p.m. This is a pre-conference to the NOSS 2021 conference and requires separate registration (https://thenoss.org/Math-Summit/)

The Math Summit is sponsored by AMATYC, NOSS, and Paul Nolting. Supporting partners include: Charles A. Dana Center, Carnegie Math Pathways/WestEd, and the MAA.
Upcoming 4th National Mathematics Summit
June 14 & 15, 2021
Westgate Resort and Casino
Las Vegas, NV

January 22, 2p.m. ET
Student Engagement
Presenters: April Strom and Julie Phelps

February - Title and Date TBA
Presenters: Mary Monroe-Ellis, Amy Tankersley, and Suzanne Etheridge

March - TBA

April - Professional Development and Department Issues
Upcoming 4th National Mathematics Summit
June 14 & 15, 2021
Westgate Resort and Casino
Las Vegas, NV

Questions??