UTILIZING CRITICAL LITERACY STRATEGIES IN MATHEMATICS INSTRUCTION

May 18, 2016
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Desegregation, race, gender, national origin
Great Lakes Equity Center Mission

- Ensure equity in student access to and participation in high quality, research-based education
- Expand states’ and school systems’ capacities to provide robust, effective opportunities to learn for ALL students
- Reduce disparities among and between groups in educational access, participation, and outcomes
- Serve as a resource for the Office for Civil Rights and Department of Justice
Today’s Facilitation Team

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Welcome to EquiLearn Webinars

This webinar is interactive - join the discussion live via the chat feature.

To reduce noise distractions, participants’ microphones will be disabled.

A recording of this webinar and materials will be posted to greatlakesequity.org.
Centering Equity In Educator Effectiveness Webinar Series...

- Culturally Responsive and Sustaining Classrooms
  - November 18, 2015

- Utilizing Critical Literacy Strategies in Mathematics Instruction
  - May 18, 2016

- Beyond Letter Grades and General Praise: Engaging Students Through Intentional Feedback
  - September 6, 2016
Today’s Objectives

Participants in this webinar will...

Identify characteristics of critical mathematic literacy instruction;

Explain at least two major implications of the current Standards movement on mathematics instruction;

Articulate the importance of supporting traditionally under-represented students in developing positive math identities; and

Describe (and enact) at least one instructional approach/strategy that promotes critical literacy skills in mathematics.
This webinar is not about a "know how" or "ten steps to…", it is more of a "recalibration" to cultivate mindsets or paradigms that support critical consumption of pedagogical practices and theories that perpetuate inequities and erase the development of our own critical literacy. As equity-oriented educators, we must tend to our own critical consciousness through vigilant self-reflection.
Educational Equity

- Representation
- Meaningful Participation
- Access
- Positive Outcomes

(Equity) (Fraser, 1998)
Context of Mathematics
Teaching and Learning
Use the poll feature below to answer the following questions:

- **Why is mathematics important for students to learn?**

- **What are the key equity issues you have observed related to mathematics education?**
“Nationwide, between 10-25% of high schools do not offer more than one of the core courses in the typical sequence of high school math and science education — such as Algebra I and II, geometry, biology, and chemistry.”

(OCR, 2014a)
Percent of US High Schools Offering Mathematics Courses, by Topic (OCR, 2014a)

<table>
<thead>
<tr>
<th>Course</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algebra I</td>
<td>89%</td>
</tr>
<tr>
<td>Geometry</td>
<td>85%</td>
</tr>
<tr>
<td>Algebra II</td>
<td>81%</td>
</tr>
<tr>
<td>Calculus</td>
<td>50%</td>
</tr>
</tbody>
</table>

NOTE: "High schools" is defined as public schools offering grades 10 or 11. Data in this chart represents 99% of high schools in the CRDC universe (25,030 high schools).
“Even less access for Black, [Latina/o], American Indian, and Alaska Native students...” (OCR, 2014a)
US Students with Access to the Full Range of Math and Science Courses, by Race/Ethnicity (OCR, 2014a)

NOTE: Figure reflects data for 99% of CRDC high schools, including approximately 200,000 American Indian/Alaska Native students, 743,000 Asian students, 75,000 Native Hawaiian/Other Pacific Islander students, 2.5 million black students, 3.3 million Latino students, 340,000 students of two or more races, and 8.5 million white students.

Percent of US Students Enrolled, Taking Algebra I, and Passing Algebra I in Grades 7 and 8 by Race/Ethnicity (OCR, 2014a)

AIAN = American Indian and Alaskan Native; NHPI = Native Hawaiian or Pacific Islander

NOTE: Data reflects only those schools included in both the CRDC collection and the National Center for Education Statistics (NCES) Common Core of Data Public School Universe Survey, approximately 98.5% of CRDC schools. Totals include 6.8 million students enrolled in grades 7 or 8, 1.4 million students enrolled in Algebra I in grades 7 or 8, and 1.1 million students passing Algebra I in grades 7 or 8.

Students in districts that serve a greater proportion of non-white students are more likely to be taught by under qualified and inexperienced teachers (OCR, 2014b)
What’s going on in schools that surrounds teaching and learning of mathematics?

- Standards, and New Standards
- New Teachers’ Evaluations
- More uniformity across grade levels
  - Scope & sequence guides
  - Unit pre- & post-tests
  - Response to Intervention
Finding Common Ground – What’s the problem with mathematics instruction?

- Often treated as an individual, cognitive activity; fixed body of knowledge

- Presented from a White-dominant perspective (Cobb & Russell, 2015; Gutstein, 2003; Gutierrez, 2012)

- Prevalent math ideologies and narrow notions of mathematical success serve to sort children and contribute to a sense of competence

- Lack of focus on children’s thinking; preoccupation with how we might “confuse” learners

- Many of us struggle to envision a math teaching and learning space that honors children’s experiences, intuition, and cultural ways of knowing – multiple mathematics knowledge bases (Turner et al., 2012)
What is critical math literacy?
Critical Math Literacy

Involves the 1) ability to ask basic [mathematical] questions in order to deepen one’s appreciation of particular issues, and 2) the ability to present data to change people’s perceptions of those issues (Frankenstein, pp. 336-337, 1990)

Draws a distinction between functional literacy (i.e., being able to read and do mathematics) and critical literacy (i.e., approaching knowledge critically, seeing social events in the interrelationship of their historical and political contexts, and acting in one’s own interest as a conscious agent in and on the world [Freire, 1992; de Macedo, 1994] (Gutstein, p. 39, 2003)
Social Justice Pedagogy (SJP) allows students from all backgrounds to engage in meaningful mathematics while developing a [positive] mathematics identity.

SJP can be used in mathematics classrooms to help students interpret and apply mathematical knowledge to answer questions that will potentially empower their lives and their communities (Leonard et al, p. 264, 2010).
Using the chat feature…

- Share ONE word or phrase to describe your math identity
Dominant literacies (Morrell, 2008) are mathematical skills, competencies, and understandings that allow for the ‘doing’ of advanced mathematics – math that results in successful testing throughout PreK-12 pipeline and leads into post-secondary access and possible careers in STEM fields.

Critical literacies are those skills, competencies, and understandings that allow for the critique of and successful intervention in issues of social injustice (Terry, p. 78, 2010).

Aiming for a critical literacy in and through math knowledge.
Using the chat feature…

- What are some common stereotypes you have heard related to who can and can not do math?
Critical Math Literacy: Key Constructs

Identity
(Aguirre, Martin, & Ingram-Mayfield, 2013)

Participation
(Boaler & Staples, 2008)

Power
(Gutierrez, 2007)

Affinity
(Gee, 2005)

Relevancy
(Gutstein, 2006; Martin, 2010)
Approaches Toward Critical Math Literacy
A Framework Toward Critical Literacy in Mathematics Instruction

- Reasons for how math is “done” and who does/not benefit
- Discourse, structure, and connections
- Educator and student identities, agency etc.
- Selection of texts, activities, and valued outcomes

Mathematics History and Contexts
Mathematics Identity

Critical Mathematics Practice
Critical Reflection on Mathematics Instruction

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Approaches to Teaching math to develop CML

• Pay attention to Discourse:
  o In how we talk about mathematics (e.g., who’s math is it?)
  o In how we define mathematical activity (e.g., social, collaborative, perseverance, questioning)
  o In how we position kids in relation to math (e.g., who can be successful with math?)

• Think about structure:
  o What is our balance between whole class, small group, partner, or individual mathematical activity?
  o With who, and in what proportion, are we having mathematical exchanges? (Wedekind, 2011)

• Prioritize mathematical connections:
  o Math concepts as they relate to lived and local experiences (Ladson-Billings, 1992; Moll, 1992)
  o Relationship among mathematical ideas
Critical Math Literacy Vignette

(Aguirre, Martin, & Ingram-Mayfield, 2013)
The dot (Point A) on this graph represents a rectangle whose area is 24 square inches.

Mark two other points on the graph that represent other rectangles with area of 24 square inches.

Explain why you put each dot at a particular point. (Hint: The marks on the lines are not units of 1.)

(Aguirre, Martin, & Ingram-Mayfield, pp. 61, 2013)
## Ms. Davis’ Stations

<table>
<thead>
<tr>
<th>Multiplication Stations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Station 1</strong></td>
</tr>
<tr>
<td>Multiplication Arrays</td>
</tr>
<tr>
<td>[Students create a set of array cards.]</td>
</tr>
</tbody>
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| **Station 2**          |
| Why does it look like a square? |
| [Students build, record, and cut out models of the following facts on colored paper: 2 x 2, 3 x 3, 4 x 4, 4 x 5, 5 x 5, ... 12 x 12. Then they arrange them in ways that show an increase or decrease in area.] |

| **Station 3**          |
| Division: A rectangle, then a little more... |
| [Students create a rectangular array for each of the following division problems: 15/4, 64/3, 84/5; 65/7; 44/9. Then they represent each one on graph paper.] |

(Aguirre, Martin, & Ingram-Mayfield, pp. 62, 2013)
Station One: Multiplication Arrays

(Aguirre, Martin, & Ingram-Mayfield, pp. 63, 2013)
Closing Thoughts

Knowledge is Power
ONLINE TOOLS AND RESOURCES

ONLINE EQUITY LIBRARY

EQUITY PUBS

EQUITY TOOLS
THANK YOU FOR YOUR PARTICIPATION!!

PLEASE PROVIDE YOUR FEEDBACK

Post-Session Questionnaire

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REFERENCES


