

Session 703
11 am – noon
Convention Center 605

**The Current State of Pre-service Elementary
Teachers' Beliefs About Diversity: Moving Forward
with Culturally Relevant Mathematics**

National Council of Teachers of Mathematics

Annual Meeting, Denver, CO

Saturday, April 20, 2013

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The Research

- Purpose:
 - This study explores the current state of preservice elementary teachers' beliefs about diversity in a teacher education program in a New England university.
- Grant – Materials to teach Culturally Relevant Mathematics
- Next Steps:
 - To explore the effects of teaching Culturally Relevant Mathematics in a mathematics methods course on beginning elementary teachers' classroom practice.

The Timeline

- The CCSU Diversity Transformation Project, Fall 2008
- Transform mathematics method course, Spring 2009
 - Add two objectives pertaining to Culturally Relevant Mathematics (CRM), Explicit connections to culture
 - Add assignments to explore CRM
- Administer Diversity Awareness Scale survey (five sections of mathematics methods students), 2009 – 2012
- Administer follow-up surveys teaching CRM during student teaching or during first year of teaching, 2010 – 2012
- Will administer follow-up surveys teaching CRM during first year of teaching, 2013

Demographics

People QuickFacts	USA	Connecticut	Hartford	New Britain
Population	281,424,602	3,404,565	121,578	71,538
White	72.4%	77.6%	27.7%	69.4%
Black	12.6%	10.1%	38.1%	10.9%
American Indian, Alaska Native	0.9%	0.3%	0.5%	0.4%
Asian	4.8%	3.8%	1.6%	2.4%
Native Hawaiian, Pacific Islander	0.2%	0.0%	0.1%	0.1%
Two or more races	2.9%	2.6%	5.4%	3.8%
Hispanic or Latino origin	16.3%	13.4%	40.5%	26.8%

Data taken from 2000 U.S. Census Quick Facts:

Diversity Designation

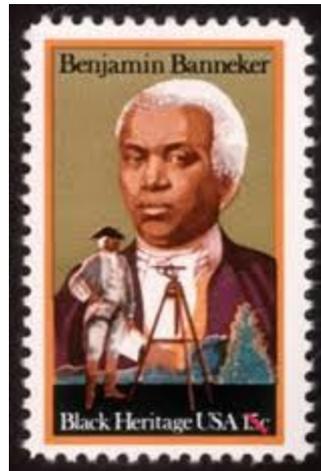
Courses bearing the [D] designation should pursue the following objective and outcome:

- To assist students to recognize issues of social equity and social justice in the United States, with relevant outcomes including the ability to:
 - Recognize the diverse forms and effects of social and economic inequality;
 - Understand bias and discrimination based on individual and group factors such as race, color, religious creed, age, sex, national origin, ancestry, sexual orientation, and mental or physical disability.

Professional Development for Culturally Relevant Mathematics

- Helping Mathematics Teachers Become Culturally Relevant Educators: New Tools for a New Generation Conference
- Beyond the Numbers: Celebrating the Best of How Teachers Teach and African American Students Learn Math

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AND URBAN EDUCATION
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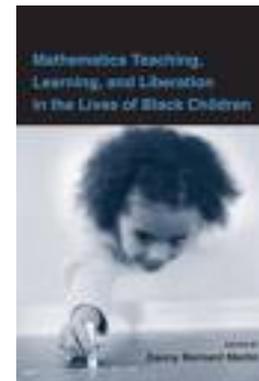
The People

- Marta Civil – University of Arizona
 - Cultural Responsiveness in Teaching Mathematics: Parents and Students Working Together
- Arthur Powell – Rutgers University
 - CRM Teaching as Respect for Diverse Mathematical Ideas



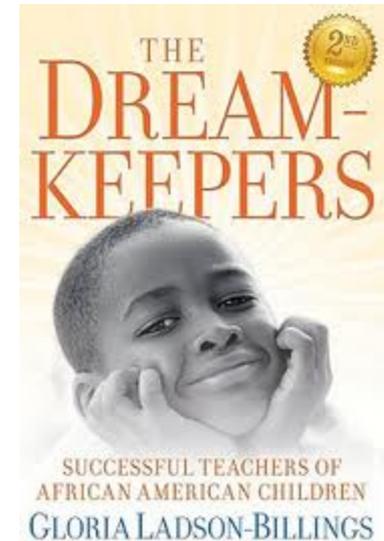
The People

- Sonia Nieto – Professor Emerita, University of Massachusetts, Amherst
 - The Light in Their Eyes: Creating Multicultural Learning Communities
- Danny Bernard Martin – University of Illinois at Chicago
 - Mathematics Teaching, Learning, and Liberation in the Lives of Black Children



The People

- Gloria Ladson-Billings –
University of Wisconsin,
Madison
 - ❖ The Role of Culture in
Mathematics Education
- Jacqueline Leonard –
University of Wyoming
 - ❖ Culturally Specific
Pedagogy in the
Mathematics Classroom:
Strategies for Teachers and
Students



Reflection

On your Own – Think about the following and then share your experience with your elbow neighbor (or a small group):

- ❖ What are some of the salient features of Culturally Relevant Teaching?
- ❖ Who are the people that have influenced your view of Culturally Relevant Teaching?
- ❖ What conferences, workshops, professional development have you attended to learn more about Culturally Relevant Teaching?

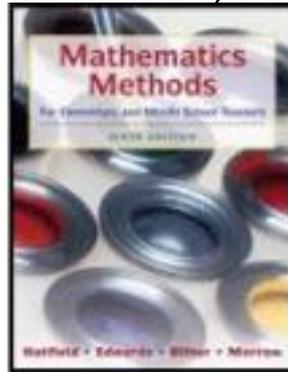
The Course

Course Objectives:

To examine the contributions of different cultures in the development of mathematics and to use the mathematics of diverse cultures to instruct children.

To help students become more aware of how to teach Culturally Relevant Mathematics.

- Mathematics Methods by M. Hatfield, N. Edwards, G. Bitter, and J. Morrow



Chapter Two: Culturally Relevant Mathematics

Culturally Relevant Mathematics

Is about

The importance of celebrating the intellectual contributions of many cultures to the field of mathematics and assuring that ALL students have an equal chance to succeed in mathematics.

Culturally Relevant Teaching

A pedagogy that empowers students intellectually, emotionally, and politically by using culture referents to impart knowledge, skills, and attitudes

- Schools often do not meet the needs of culturally different students because they do not provide a social context for learning that allows the students to access knowledge in ways that are comfortable and familiar to them.

(Gloria Ladson-Billings, 1994, pp. 17 – 18)

Culturally Relevant Mathematics: Main Ideas

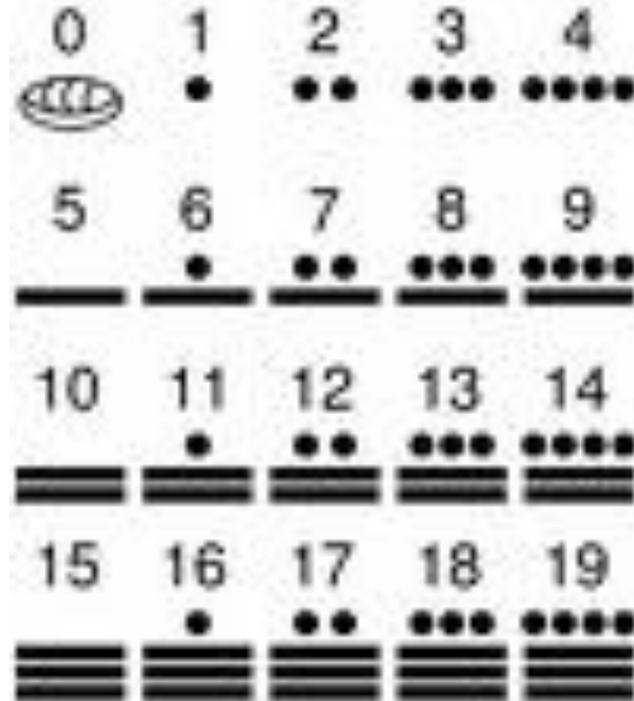
Multiculturalism – The [fact] that mathematics has always been present in every culture. [This includes realizing and acknowledging] the giftedness of mathematics in each culture.

Equity – The [NCTM Principle] that everyone has the right to acquire the mathematical power needed for success in today's world.



Cultures to Explore

- Ancient Cultures
- African American
- Latino American
- Asian American
- Native American
- Women
- Other _____



Assignments

- What Resources are available to highlight the unique contributions and characteristics of different cultures?

- What resources are available to highlight women's contributions to mathematics?

- Chapter 2 –

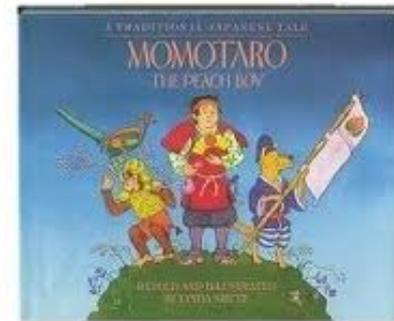
- Each small group (of students) will choose one self help question to discuss with class.
- Choose one famous mathematician from one of the cultures we spoke about to research and share your discoveries with the class. Write a brief summary and reflection on this mathematician. Please think outside of the box. Someone new that you haven't already heard about. Someone current even or someone you think deserves recognition that has been denied such.

Community Connections Journal Writing:
This assignment is to help you to understand the community where you are teaching. Please research your school and answer the following: Who is the school building named after? What was the importance of this person's role in the community (state or country)? How long has the school been there? Who lived in the town when the school was built? How has the town changed? You may add any other info you find relevant. How does any of this information help you to understand your school community? Name one thing you could do in response to learning this information.



The Methods

- Read Chapter on CRM
- Answer Self-Help Questions
- Have Discussions
- Play Games
- Compare Characteristics of CRM with Traditional Teachers
- Students find CRM resources
- Students write CRM lesson plan (some present CRM lesson)
- Use Cultural Literature to teach math lessons



The Students

Math Methods Course

- Undergraduate students in a mathematics methods course
- Final course before Student Teaching
- Students took a modified version of the M-GUDS-S survey (Pre and Post) – First and last day of class

Treatment vs Control

- Three sections of treatment group ($n=41$) – covered chapter on CRM and given additional assignments to incorporate cultural connections into mathematics instruction
- One section of control group ($n = 12$) – covered the chapter on CRM only

The Diversity Scale Survey

Miville-Guzman Universality-Diversity Scale - Short Form, (M-GUDS-S)

- Subscales
 - Diversity of Contact
 - Relativistic Appreciation
 - Comfort with Differences
- Miville, M., Gelso, C., Pannu, R., Liu, W., Touradji, P., Hollaway, P. et. Al. (1999)
- Fuertes, J., Miville, M., Mohr, J., Sedlacek, W., & Gretchen, D. (2000)
- Maddux, E. (2003, January). Dissertation Abstracts International

1. I would like to join an organization that emphasizes getting to know people from other cultures.

2. I would like to go to dances/clubs that feature music from other countries.

3. I often listen to the music of other cultures.

4. I am interested in learning about the many cultures that have existed in this world.

5. I attend events where I might get to know people from different racial backgrounds.

6. Persons with disabilities can teach me things I could not learn elsewhere.

7. I can best understand someone after I get to know how s/he is both similar and different from me.

8. Knowing how a person differs from me greatly enhances our friendship.

9. In getting to know someone, I like knowing both how s/he differs from me and is similar to me.

10. Knowing about the different experiences of other people helps me understand my own problems better.

11. Getting to know someone of another race is generally an uncomfortable experience for me.

12. I am only at ease with people of my own race.

13. It's really hard for me to feel close to a person from another race.

14. I often feel irritated by persons of a different race.

Strongly Disagree, Disagree, Neither Agree/Nor Disagree, Agree, Strongly Agree

Preliminary Results: Item Analysis

The following items had the most agreement:

- Most students *Strongly Agreed* that persons with disabilities can teach me things I could not learn elsewhere (4.6/5.0)
- Most students *Strongly Disagreed* with the following statements:
 - ❖ It's really hard for me to feel close to a person from another race. (1.3/5.0)
 - ❖ I am prejudiced toward some racial and ethnic groups. (1.35/5.0)
 - ❖ I often feel irritated by persons of a different race. (1.35/5.0)
 - ❖ I am only at ease with people of my own race. (1.41/5.0)

The Results – Treatment Group

Paired T-Test and CI: Treatment Pre, Treatment Post

Paired T for Treatment Pre – Treatment Post

	N	Mean	StDev	SE Mean
TrePre	943	3.7084	1.2001	0.0391
TrePost	943	3.7550	1.1848	0.0386
Difference	943	-0.0467	0.8060	0.0262

95% CI for mean difference: (-0.0982, 0.0048)

T-Test of mean difference = 0 (vs not = 0): T-Value = -1.78

P-Value = 0.076

The Results – Control Group

Paired T-Test and CI: Control Pre, Control Post

Paired T for Control Pre - Control Post

	N	Mean	StDev	SE Mean
ConPre	253	3.7431	1.2317	0.0774
ConPost	253	3.7668	1.1185	0.0703
Difference	253	-0.0237	0.7763	0.0488

95% CI for mean difference: (-0.1198, 0.0724)

T-Test of mean difference = 0 (vs not = 0): T-Value = -0.49 P-Value = 0.627

Initial Results of DSA

Grant funding was secured to purchase follow-up classroom resources for CRM.

Students will use as Student Teachers and first-year teachers.

- The post scores were higher for the treatment group (at the 10% significance level).
- This is promising and further statistics and analysis will be conducted on the subscales.
- _____
- _____
- _____
- _____

Results of Student Teacher Follow-up Survey (n = 16)

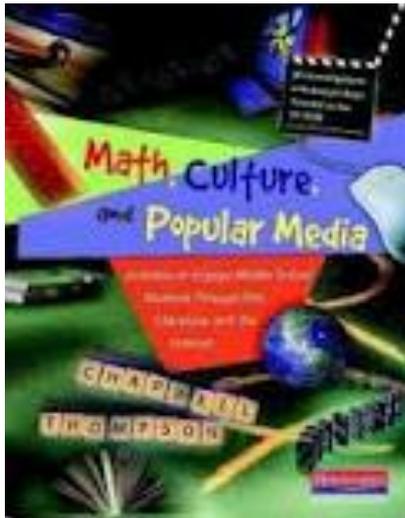
Students responded to questions about their experience with CRM at their field site schools. Of the 16 students:

- More than half the students (56%) worked in schools with all minority (non-white) students or a very diverse population
- Unfortunately, 2/3 of the Cooperating Teachers and Student Teachers did not teach any CRM over the 8 – week student teacher experience
- Cooperating Teachers did however incorporate culture into other subject areas such as Social Studies and Language Arts
- All respondents (12 students) said they would incorporate CRM if they could

More Results from Student Teachers

- The number one reason that kept student Teachers from incorporating CRM was the school district's math curriculum
 - The curriculum was too full and no time for CRM
 - CRM missing from curriculum
- It is promising that 50% of the students said they are very likely to incorporate CRM when they become teachers
- Many students believe CRM can motivate young children and help them learn math better

Next Steps

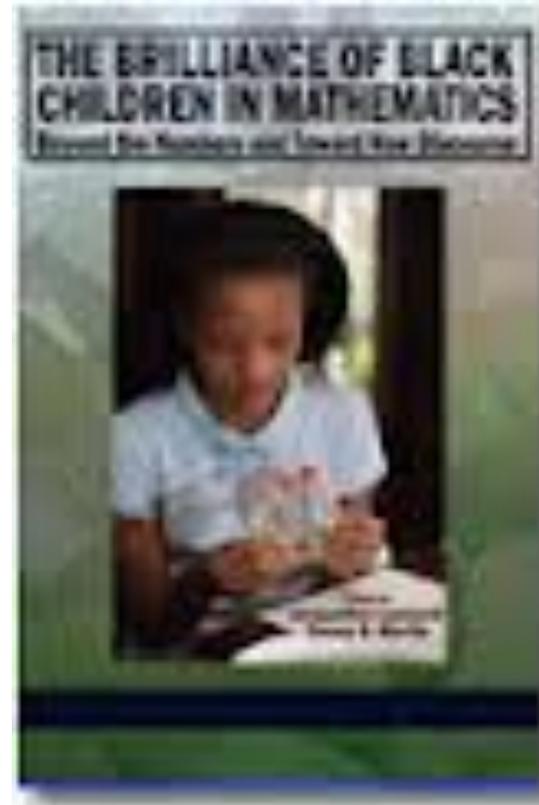


- Sixteen students completed follow-up surveys about the role of culture and diversity in their student teaching experience.
- Two beginning teachers will receive resource materials to assist them in their role of teaching CRM.
- The two teachers will continue to provide feedback on how the course assignments, discussions and resources helped them teach CRM.

The Brilliance of Black Children in Mathematics: Beyond the Numbers and Toward New Discourse

Editors: **Jacqueline Leonard**
And **Danny B. Martin**

**Chapter 6: Advancing a
Framework for Culturally
Relevant Cognitively
Demanding Mathematics
Tasks by Lou E. Matthews,
Shelly M. Jones and
Yolanda A. Parker**

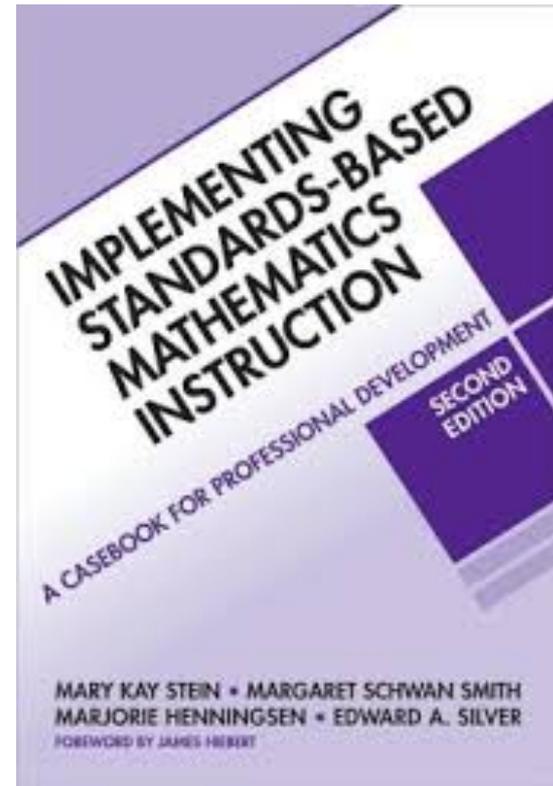


Cognitively Demanding Mathematics Tasks

Cognitive Demand...

“The kind and level of thinking required of students in order to successfully engage with and solve the task.”

Stein, Smith, Henningsen, & Silver, (2000)



Culturally Relevant Cognitively Demanding Mathematics Task

Discuss with a partner or small group, how to modify the following problem to become more culturally relevant (or make up your own problem)

- You can recycle five aluminum cans to make one new one. How many new cans would you be able to eventually make from 250 aluminum cans? Based on your family's aluminum can usage, estimate how long it would take your family to recycle 250 aluminum cans. Why is recycling important to our environment?
- If you think this problem is already culturally relevant, explain why.

Higher Level Cognitively Demanding Mathematics Tasks
(from Stein et al. 2000)

Procedures with Connections Concepts, Meaning and Understanding

"Require some degree of cognitive effort" (p.16). Require use of procedures to develop deeper understanding of mathematics concepts versus narrow focus on algorithms. Promotes use of multiple representations to develop this meaning. Successful completion of the task requires engagement with conceptual underpinnings of task.

Doing Mathematics

"Require considerable cognitive effort" (p.16). Solution process is not obvious and require complex, nonalgorithmic thinking strategies which reflect understanding of mathematical concepts. Solution process may be unpredictable and tasks encourage a variety of strategies. Require students to draw from "relevant knowledge and experiences and make appropriate use of them in working through the task" (p.16). Encourages students to examine task structure, solution and strategy limits.
...



Procedures with Connections to Concepts, Meaning and Understanding of Mathematics, Self, Culture and Community

Doing mathematics for the purpose of becoming empowered intellectually, culturally, politically and socially.



Features of Cognitively Demanding, Culturally Relevant Mathematics Tasks

Task is a mathematically rich, higher-level cognitively demanding, embedded in cultural activity.

Mathematics task explicitly requires students to inquire (at times problematically) about themselves, their communities, and the world about them.

Mathematics task draws from students' community and cultural knowledge. May draw from connections to other subjects and issues.

Task features an empowerment (versus deficit or color-blind orientation) toward students' culture. Task may explicitly seek to add to this knowledge through mathematical activity.

Task asks students to engage and overcome the discontinuity and divide between school and their own lives - home and school.

Task is real-world focused, requiring students to make sense of world through mathematics. The explicit goal of the task is to critique society-that is, make empowered decisions about themselves, communities and world.

**Framework for
Culturally Relevant,
Cognitively Demanding
Mathematics Tasks**

An extension of the Stein et al. (2000) framework
to include features of Culturally Relevant Mathematics

*(A) Procedures with connections
to concepts, meaning and
understanding of mathematics,
culture and community*

*(B) Doing mathematics for the
purpose of becoming empowered
intellectually, culturally, politically
and socially.*

Assessment Rubric of Culturally Relevant, Cognitively Demanding Mathematics Tasks

Description	Degree in Task Structure		
	high	Moderate	low
Mathematics task explicitly requires students to inquire (at time problematically) about themselves, their communities, and the world about them.			
May draw from connections to other subjects and issues.			
Mathematics task draws from students' community and cultural knowledge.			
Task may explicitly seek to add to this knowledge <u>through</u> mathematical activity.			
Task is mathematically rich and cognitively demanding, embedded in cultural activity.			
Tasks asks students to engage the discontinuity and divide between school and their own lives – home and school.			
Task is real-world focused, requiring students to make sense of world through mathematics.			
The explicit goal of the task is to critique society—that is, make empowered decisions about themselves, communities and world.			

Teachers' Use of the Framework

The students:

- Eleven graduate students/in-service teachers

The assignment:

- Select five tasks that are “higher level, cognitively demanding” that will be modified into a culturally relevant middle grades mathematics task.

The Tasks:

- 55 CRM tasks were created that seemed to fall into one of the following contextual categories: 1) use of technology, 2) charitable giving and volunteerism, 3) student part-time work, 4) getting good grades, 5) issues with voting, 6) visual and performing arts, and 7) community connections.

So You Think You Can Draw

- Your sister loves street art. You would like to recreate one of her favorite pieces for her birthday. You decide to create a poster board replica of this piece even though you're not an artist. Suddenly a deeper side of the image strikes you.
- This is going to be easy! You notice the tip of his nose at $(0,0)$, the bottom lip at $(0,-2)$ Where is his right eye, ...the bottom of his chin,the large patch of grass? What is the domain and range? Explain your reasoning. Try creating a replica on poster board.

photograph © copyright 1994 Ted Mikalsen

Artwork ©1994 Dave Kinsey (aka Büst) in Atlanta, GA. Photographer © 1994 Ted Mikalsen. Used with permission from www.graffiti.org



References

- Ladson-Billings, G. (1994). *The Dreamkeepers: Successful teachers of African American children*. San Francisco, CA: Jossey-Bass, Inc.
- Leonard, J. (2008). *Culturally Specific Pedagogy: Strategies for Teachers and Students*. New York, NY: Routledge.
- Martin, D.B. (2009). Liberating the production of knowledge about African American children and mathematics. In *Math Teaching, Learning and Liberation in the Lives of Black Children*. New York, NY: Routledge.
- Matthews, L., Jones, S., & Parker, Y.A. (2012). Advancing a framework for culturally relevant, cognitively demanding mathematics tasks. In J. Leonard & D. Martin (Eds.), *The brilliance of Black children in mathematics: Beyond the numbers and toward a new discourse*.
- Nieto, S. (2010). *The Light in Their Eyes: Creating Multicultural Learning Communities*. New York, NY: Teachers College Press.
- Stein, M. K., Smith, M. S., Henningsen, M. A., & Silver, E. A. (2000). *Implementing standards-based mathematics instruction: A casebook for professional development*. New York, NY: Teachers College Press.
- Tate, W.F. (1995). Returning to the root: A culturally relevant approach to mathematics pedagogy. *Theory Into Practice*, 34(3), 166-173.



I will upload my Powerpoint presentation to the NCTM Conference Speaker Pages

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