Preparing K-8 Preservice Teachers to Effectively Teach All Students: A Focus on Language, Culture,

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Other Project Collaborators Include:

Overview

- Goals, Collaborators and Settings, and Theoretical Framework
- Preservice Teacher Survey and Interview Findings (Preliminary)
- Two examples of instructional modules: Critical Cases Activity & Community Mathematics Exploration
- Discussion

Key Question and Goal

- Question: How can we connect children's mathematical thinking and children's community- and family-based mathematical funds of knowledge in elementary and middle school methods courses?

- Goal: To collaborate across multiple sites to design, refine, and study instructional modules for preK-8 mathematics methods courses that explicitly develop preservice teacher competencies related to mathematics, children's mathematical thinking and community/cultural

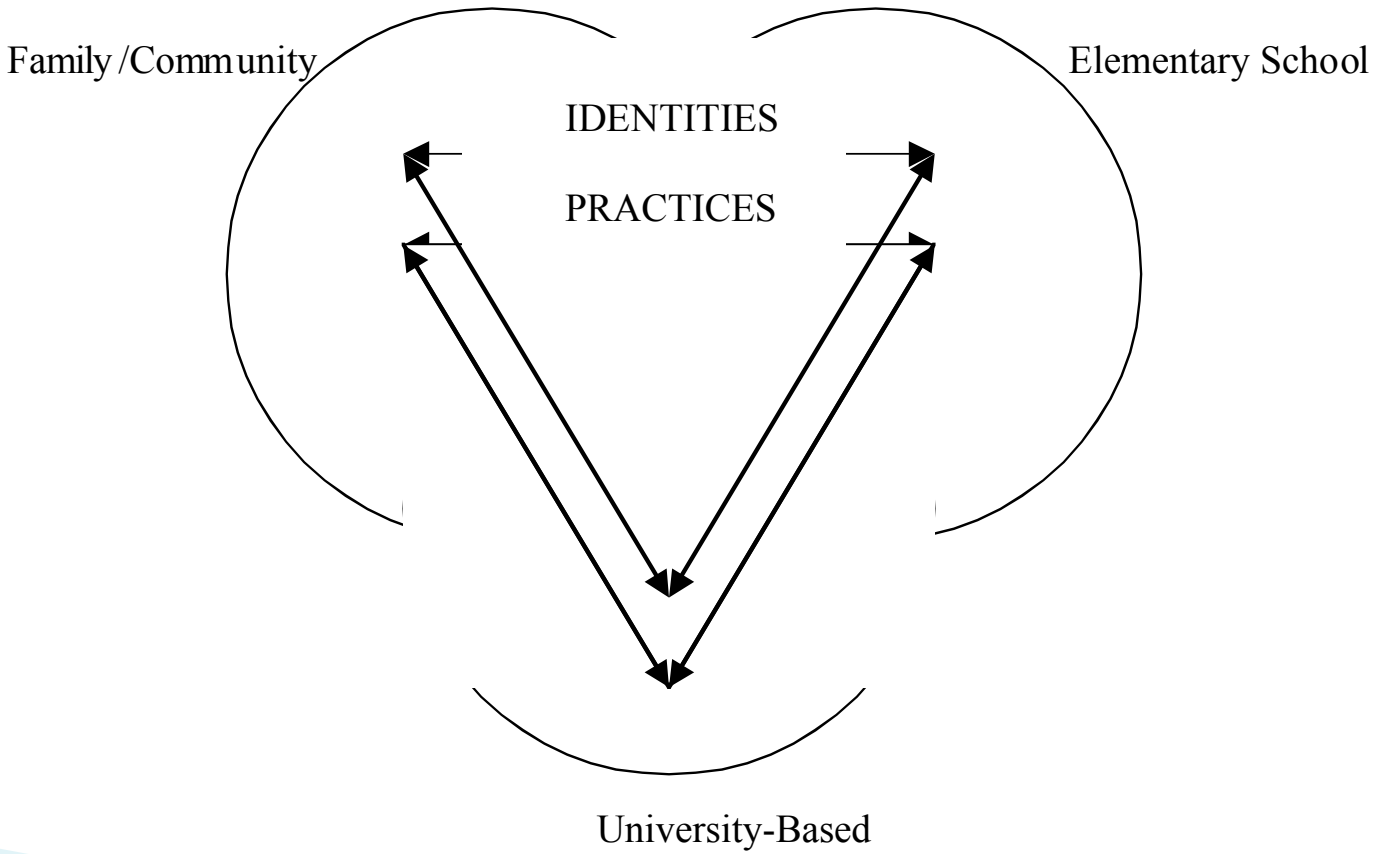
Conference with Mathematics Teacher Educators Launched Project Work

- May, 2008, in Tucson, Arizona
- 38 participants from 19 institutions
- Participants considered a conceptual framework and readings & began instructional module development and a research plan
- Work from conference laid the foundation for our project and resulted in initial drafts of activities for instructional modules.
- Starting Fall 2008, collaborators began using

Diverse Range of Teaching

- Urban
  - J. Aguirre: University of Washington Tacoma
  - M. Foote: Queens College, CUNY
- Mixture of Urban, Suburban, and Rural
  - C. Drake: Iowa State University
  - A. Roth McDuffie: Washington State University Tri-Cities
- Suburban
  - T. Bartell: University of Delaware
- Borderlands
  - E. Turner: University of Arizona

Theoretical framework for examining PSTs' knowledge, beliefs, and practices related to connecting children's mathematical thinking and children's family/community

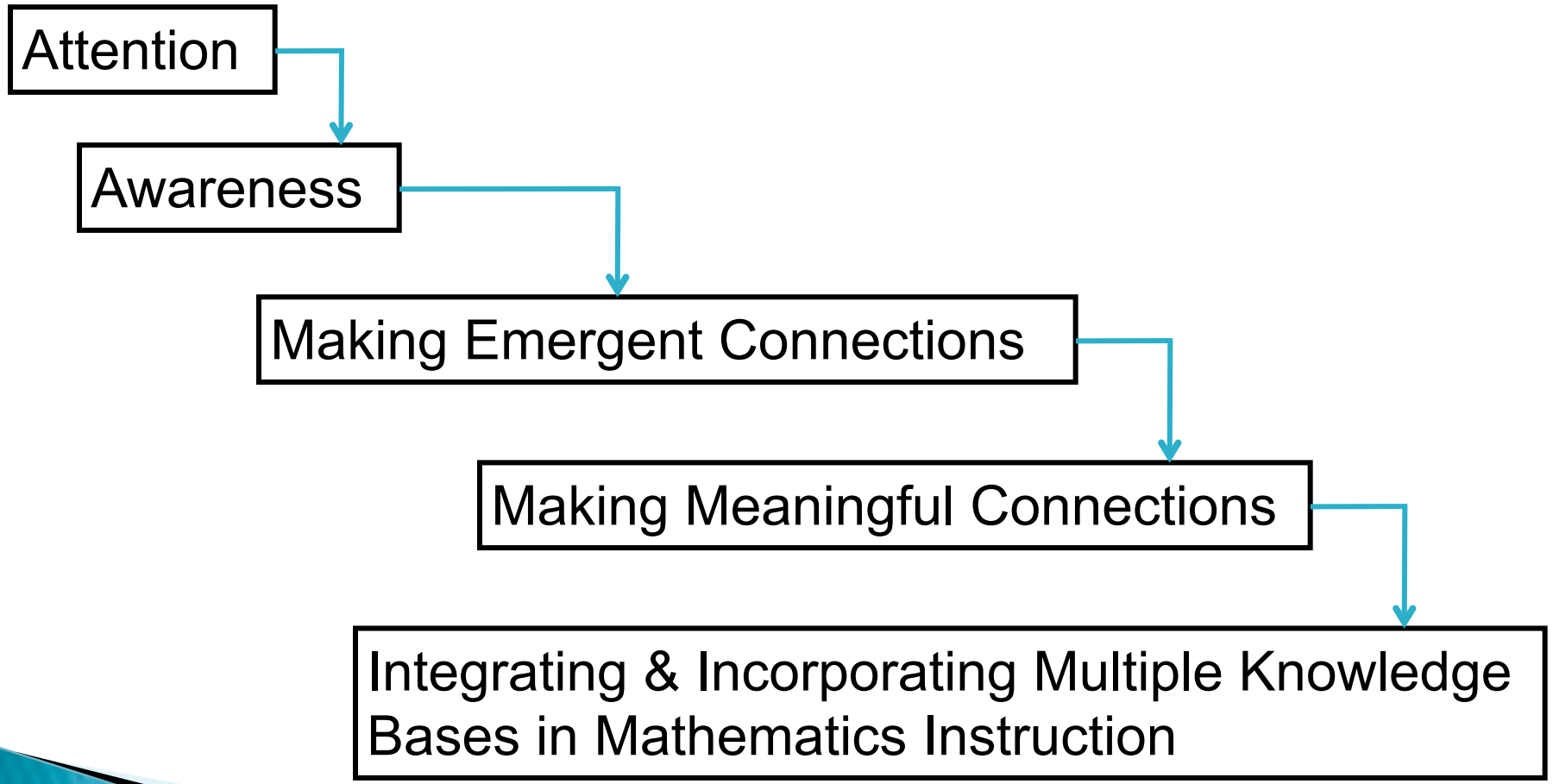


Considering Preservice Teacher

- Engaging with the mathematical practices and identities of children and families as children move across contexts and spaces

- Analyzing, reflecting, and acting on their own practices and identities as they move across contexts and spaces

Conjectured Learning Trajectory for PSTs and Early Career Mathematics Teachers



Preliminary Survey Findings

- Fall, 2008 and Spring, 2009
- Seven institutions
- 266 pre-semester respondents; 174 post-semester respondents

- Development of pre-service teachers from pre- to post
- Development of survey over time

Development of PSTs and Survey

- "Children can draw on their families' mathematical knowledge and practices in solving word problems."
  - Move from mixed responses (mostly "agree") to more "strongly agree" and very few "disagree" or "strongly disagree"
  - Conjectured PST Development: Greater confidence, more specific practices/ideas, reduced deficit orientation
  - Survey development: Added a "Please explain your response" box for Fall, 2009 implementation

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  - Confusing questions; Responses very mixed
  - Survey development – Eliminated question
- "Home and community activities are good contexts for posing and solving mathematical problems."
  - Nearly all "Agree" or "Strongly Agree", even at the

Survey Results in WSU 2008-9

- Pre/post survey data was collected at the commencement and conclusion of Elementary Mathematics Methods classes in 2008 and 2009

- A snap shot of the questions and PST responses from the Tri-Cities Campus indicate there is a spectrum of responses ranging from

Question #1 (Likert scale question): Getting to know students' families and becoming familiar

	Pre	Post
Strongly Disagree	0%	0%
Disagree	7.1%	0%
Agree	28.6%	16.7%
Strongly Agree	64.3	83.3%

Taking a closer look…

In addition to Likert response questions, PST's were asked a series of Likert scale questions with the addition of comments as well as some open-ended items to help clarify their responses

A snap shot of sample questions and

Question #2 (Likert scale question with the

Children's home language can be barriers for making sense of and solving mathematical problems. (2008)

Student #1: No Clear Difference

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Pre: Agree – "if the parents don't have the knowledge they cant help no matter what language they speak, but if they speak something other than traditional language of the country those parents may struggle in the ability to gain access to resources to help their child" (Deficit model- language barrier and knowledge barrier are seen to hinder parents' ability to be a resource)

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Post: Agree- "if parents can't read the word then they

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Post: Strongly Disagree -"Children's home language can help students solve problems, not hinder them" (Acknowledges students'

Question #3 (Open-ended Item):

How, if at all, do the socio-cultural identities of the students you teach impact your decisions about creating and teaching math? (2008)

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Post: "…. I am able to recognize that my students socio-cultural identities will play a major role in their ability to access the information presented so I will develop my lesson to target and support their needs, giving them many opportunities to develop their mathematical knowledge." (Deeper level of incorporating knowledge of student's culture and/

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Pre: “I have always been one of those kids who just got it and zoned out when the teacher kept talking so I have to stay focused and make sure that I am looking (at the) problem from from multiple perspectives so each student can find a way that works for them.” (Focused on self as sharer of knowledge- does not acknowledge students as a resource/source of knowledge)

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Post: "I try to use names of people from the same ethnicity of my students and objects or themes they

Current Instructional Modules

A. Critical Case Analysis

PSTs use multiple lenses to critically analyze and evaluate mathematics lessons (video clips and/or written cases).

B. Community Mathematics Exploration

PSTs identify mathematical practices and mathematical funds of knowledge in students' communities and build on them in a standards-based mathematics lesson.

C. Studying Mathematical Competence

PSTs analyze how mathematical competence is evidenced and supported in two settings: a classroom mathematics lesson and an individual problem solving-based interview.

D. Curriculum Spaces (under development)

PSTs analyze mathematics curriculum materials to identify potential opportunities (or spaces) for accessing, building on,

Critical Cases Analysis: A Description

- PSTs prepare by reading relevant articles (e.g., participation and questioning) and/or by engaging in the mathematics tasks involved in the case.
- PSTs form small groups and view video cases through one of three lenses:
  1. The task/ problems used;
  2. The teacher:
  3. Student participation and understanding.
- PSTs analyze and reflect individually and then discuss the case in small groups from their assigned lens.
- Groups each report their findings to the whole class (e.g., oral discussion, group posters) and class engages in discussion across the lenses.

Norms and Expectations for

- Each group focuses on their lens and responds to prompts given.
- Group may choose to "assign" specific prompts within their group.
- While watching the video, takes notes for specific quotes, actions, interactions to evidence findings.
- During discussion, ground comments and findings in specific evidence (avoid only making statements of "impressions").
- When groups share with the whole class, each group shares 1 finding and then another group

Cases Reflect Range of Teaching

Sources for cases include (see resource list):

- CGI (Cognitively Guided Instruction) books and professional development videotapes
- Children's Mathematics (Carpenter et al., 1999)
- Thinking Mathematically (Carpenter et al., 2003)
- Annenberg's Media "Teaching Math K-4 Video Library" (available on-line

Sample Case: Amazing Equations

(Annenberg Video Library, Available Online)

- 1st & 2nd Grade Urban Elementary Class.
- Racially/Ethnically Diverse Classroom
- Addition and Subtraction; Problem Solving
- Teacher asks students (in groups) to write and illustrate their own story problem with an answer that equals 20.
- Video clips (14 minutes) shows excerpts from the lesson launch (whole class), explore (children working in groups), and summary

Benefits for PSTs' Learning

Found improved attention to, awareness of, and making emergent connections between/among:

- Children's Funds of Knowledge
- Mathematics Content
- Children's Mathematical Thinking
- Task Analysis (for mathematics content and to anticipate thinking and learning)
- Participation Structures and Interaction Patterns that were different from "Teacher at the Front"

Benefits for PSTs' Learning: Children's Funds

- Discussed how asking children to write and illustrate a problem provided openings for children to connect the math to their experiences and their lives (e.g., members of their family, going to the store or playground, problems about roaches).
- Noticed how children communicate in many ways (words, pictures, gestures, manipulatives, equations, and multiple representations) and the value of providing

Challenges for PSTs

- Resisting over-simplification of issues and looking for the "quick fix" (e.g., thinking that the main point is to change the name of the park/store to match the park/store in the community).
- Understanding complex issues such as the role of identity, competence, and status in learning mathematics.
- Avoiding essentializing and/or perpetuating negative views of children from some groups (e.g., When roaches came up in the video, did this affirm some PSTs' views that children of poverty live with roaches and/or live in unsanitary

Benefits: From the teacher educator perspective

- Opportunity for including multiple goals for PSTs learning. For example, for the Amazing Eq Case:
  - Role of children's language and home/community experiences in learning (in line with project goals)
  - Launch, Explore, Summary Lesson Structure
  - Composing quantities and relationships between addition and subtraction
  - So focusing on project's goals did not mean adding another activity – just adding purpose
- Using the 3 lenses pushed students to go beyond noticing only the teacher and his/her talk and

Challenges: From the teacher educator perspective

- Finding ways to make sure that all of these goals are achieved and all lenses are attended to:
  - Do the PSTs gain understandings for these multiple foci?
  - Is it too much at once? If so, what is lost?
- Finding cases and video clips that provide opportunities to discuss and connect mathematics content, children's thinking, and children's funds of knowledge.
- Following the discussion from each of the lenses, several MTEs struggled to facilitate a summary of the discussion to highlight important issues:

Changes and work in progress…

- Add a 4th lens to focus more on participation/ interactions – 4 lenses will be: (1) Tasks; (2) Teaching; (3) Students & learning; & (4) Classroom interaction & participation patterns.
- Align prompts for Critical Cases with Studying Mathematical Competence (the field-based observation activity) for better coherence and focus between the two activities – increasing opportunities to scaffold growth in attention and awareness for these foci.
- Focus on designing summary questions.
- Devote more time to draw on project partners'

Community Mathematics

- Purpose: to identify mathematical practices and mathematical funds of knowledge in students' communities.
- Data Sources: (e.g. interviews, observations, pictures, maps, menus)
- Analysis
- Math Problem/Lesson Development

	Iowa State	Univ. of Arizona	CUNY: Queens College	Univ. of Delaware	UW Tacoma	WSU Tri-Cities
Visits	X	X	X	X	X	X
Interviews	Optional	Optional	X	X	Optional	Optional
Guided-Tour	Optional	Optional	X	Optional	Optional	Optional
"virtual" tour			X	Optional		
Pose a math problem	X	X	X		X	X
Present Findings	X	X	X	X		
Math Lesson			X		X	X

Lavandería/Laundromat

- Guided Tour of community by parent
- Social hub of the community
- Interviewed and observed mothers at the site (math practices, estimation)
- Developed standards-based Math Lesson
  - High cognitive demand activity
  - Problem-solving

La Lavanderia / The Laundromat

Ud. vive con sus tres hermanos, sus dos padres, y su abeula. Cada semana, su familia tiene muchas ropias sucias para lavar – hoy, de facto, Uds. tienen 10 cargas!

Ud. se va a la lavanderia con su madre para ayudarle. Ella quiere saber cuanto costaria para lavar (no sacar) toda la ropa. Le puedes ayudar? Cuantas soluciones hay? Cuanto es lo maximo y lo minimo que Uds. van a pagar? (Ya tienen detergente).

Despues de lavar…ahora Ud. y su madre tienen 10 cargas de ropa mojada. Cuanto costaria secar la ropa? (Por lo medio, cada carga necesitaria 45 minutos de secar).

Use numeros, palabras, dibujos, manipulativos, etc. para mostrar sus trabajos y soluciones de su grupo.

You live with your three siblings, your two parents, and your grandmother. Every week, your family has lots of dirty laundry that needs to be washed – today, in fact, you have 10 loads of laundry!

You go to the laundromat to help your mother. She wants to know how much it will cost to wash (not dry) all the clothes. Can you help her? How many solutions are there? What is the maximum and minimum that you might pay? (You already have the detergent).

After the washing…now you and your mother have 10 loads of wet laundry. How much will it cost to dry all the loads? (On average, each load of laundry will need 45 minutes to dry).

Use numbers, words, drawings, manipulatives, etc. to show your group's work and solutions.

Extension Posible:

Cada person en su familia hace 1 ½ cargas de ropa sucia por semana, y Ud. no tiene detergente. Cuantas cargas necesitas lavar? Cuanto es lo minimo y lo maximo que pagarias por lavar y secar toda la ropa?

Possible Extension:

Each person in your family makes 1 ½ loads of dirty laundry per week, and you don't have any laundry detergent. How many loads of laundry do you need to wash? What is the minimum and maximum amounts that you will pay to wash and dry all the clothes?

Enviro Safe Coin Lavanderia

Precios de Lavar (Washing Prices)

La máquina de una carga / Single load washer: $1.75/load
Las máquinas de dos cargas / Double load washer: $3.00/load
Las máquinas de tres cargas / Triple load washer: $4.00/load

Precio de Secar (Drying Price)

$.25/15 min.

Precio de Detergente (Detergent Price)

$.75/carga ($.75/load)

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PSTs challenging deficit views

- "When one of the resource room teachers heard about our Community Math lesson project, she exclaimed that it was a great opportunity to "show them how to fix some of their problems. Maybe you can somehow make a lesson that will make parents care about their kids." We felt passionately that this bias against the community was unfair – clearly parents in the Sunny Hill community care deeply about their children. As such, we wanted our lesson to be a tiny step in the opposite direction; we wanted our project to recognize (and even celebrate) students' families and values rather than

Benefits for PSTs' Learning

- "seeing math everywhere"
- New and more nuanced views of the community
  - as a math resource
  - complex spaces
- Enhanced view of students' math funds of knowledge

Challenges for PSTs

- Tensions:
  - Access to the community
  - Perceived community resistance
  - Hard to connect to math or children's mathematical thinking

Benefits for Teacher Educators

- Leverages key progress toward project goals of developing an integrated teaching knowledge base and set of practices that privilege mathematics and community-based funds of knowledge.

- Produces transformative experiences in mathematics instruction

  - Expanding PSTs' views about mathematics and mathematical practice

Challenges for Teacher Educators

- Logistics
  - Community access, physical location
- Pre-preparation
- Explicit connections to mathematics and children's mathematical thinking
- Supporting PSTs movement toward making meaningful connections

Changes and works in progress for

- Connect exploration to a standards-based mathematics lesson

- Assignment Preparation:
  - Provide supports for PSTs to introduce/discuss project with community members
  - Use CME math lessons as exemplars

- Provide options to maximize flexibility given

Benefits and Challenges for Discussion: Think, Pair/Group, Share

- Given the multiple goals that we are trying to achieve that aim to link math content, children's mathematical thinking, and children's funds of knowledge, how can we privilege these three foci in this work?
  - Do we need to connect all areas in activities?
  - Do we need to take on components individually and then try to put them together later (or assume that PSTs will put parts together later)?

- Have you tried other activities/experiences that you could share that link these three things?

For More Information…

- http://mathconnect.hs.iastate.edu

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