EXAMINING MATHEMATICS COACHING

Examining Mathematics Coaching (EMC)

John Sutton, Clare Heidema, and Arlene Mitchell

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Research Partners

MONTANA STATE UNIVERSITY

RMC RESEARCH

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Session Outline

- Project Description
- Research design to examine mathematics coaching
- Professional Development Topics
- Defining coaching knowledge
- Instruments to measure coaching effectiveness

Personnel

Montana State University

- David Yopp, PI
- Beth Burroughs, Co-PI
- Jennifer Luebeck
- Mark Greenwood

RMC Research

- John Sutton, Co-PI
- Clare Heidema
- Arlene Mitchell
- Lyn Swackhamer

Project Director: James Burroughs

Description

- EMC is a 5-year research and development project examining the effects of a coach's "knowledge for coaching" on a diverse population of K-8 teachers.

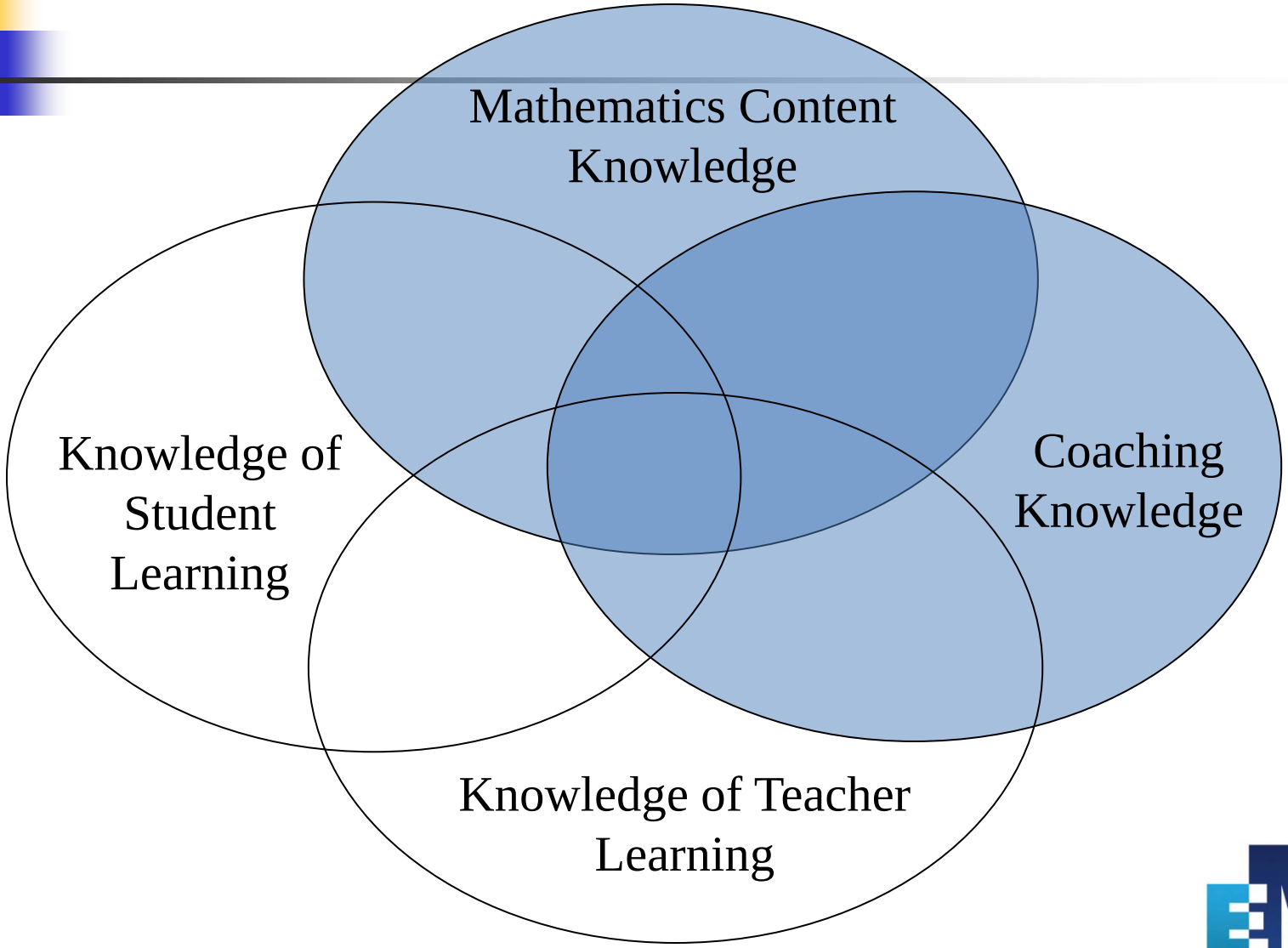
- It addresses the DR K-12 challenge:

  How can the ability of teachers to provide Science, Technology, Engineering, and Mathematics (STEM) education be enhanced?

The Examining Mathematics Coaching Project (EMC)

- Investigating knowledge that contributes to successful coaching in two domains
  - Coaching Knowledge
  - Mathematics Content Knowledge
- The influence of these knowledge domains is examined in two ways:
  - investigating correlations between assessments of coach and teacher knowledge and practice in each domain
  - by investigating causal effects of targeted professional development for coaches

Knowledge Domains



Why Study This?

- Coaching is a promising model for enhancing K-8 mathematics teachers' abilities to provide quality mathematics education.
- Coaching can be implemented at any point in a teacher's career (as opposed to mentoring).

Why Study This?

- Schools across the nation are using mathematics specialists (including mathematics coaches) yet there is limited research proving what makes it effective.
- A comprehensive understanding of the effectiveness of coaching does not exist.

Why Study This?

- Moreover, no studies have demonstrated what types and depths of knowledge effective coaches hold.
- At the same time, implementing coaching involves considerable cost and logistical effort for schools.

EMC Goals

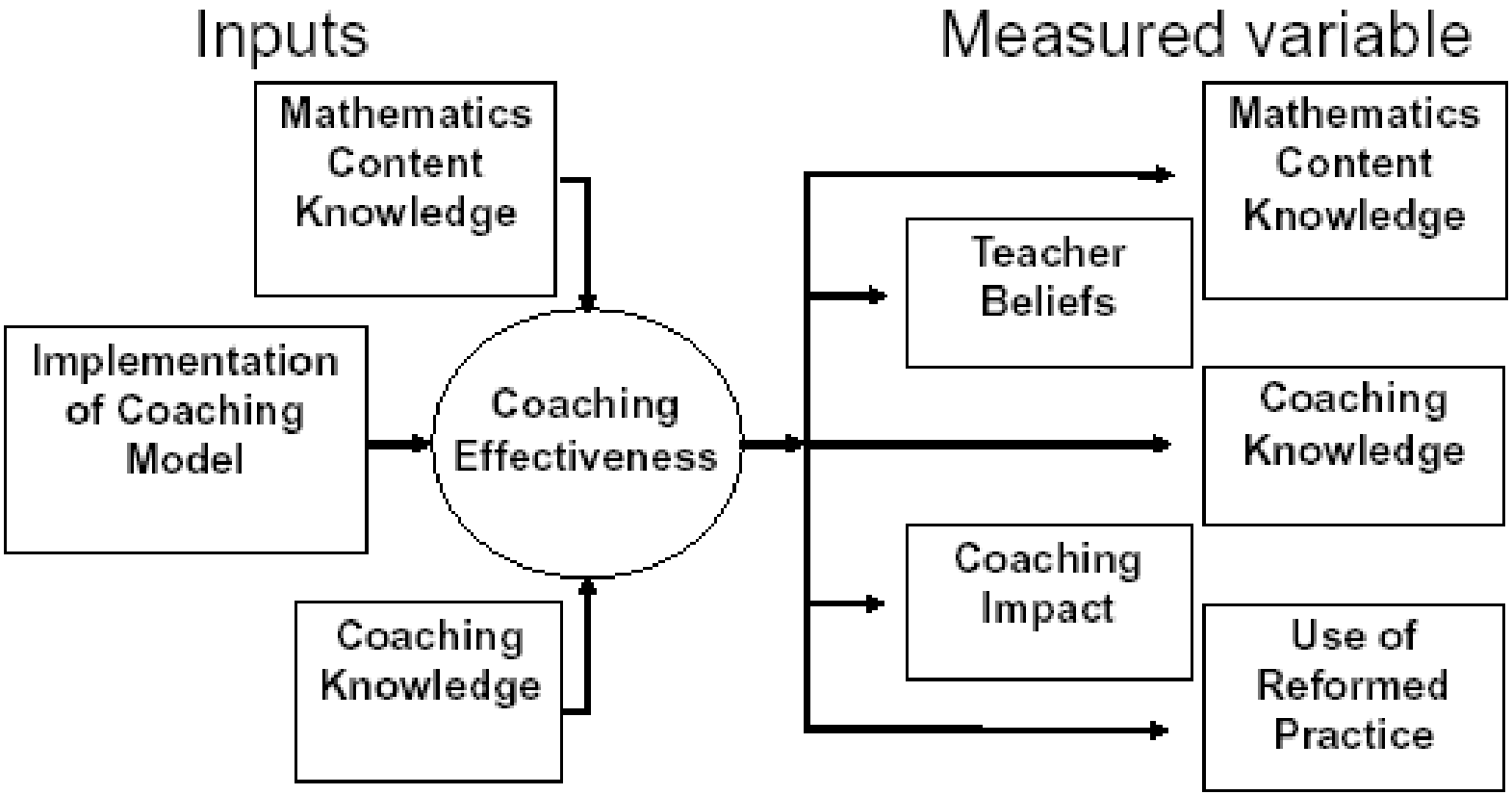
- Determine the degree to which:
  - Coaching knowledge contributes to coaching effectiveness.
  - Mathematics content knowledge contributes to coaching effectiveness.

- Contribute to research:
  - Coaching knowledge
  - Impacts on teachers' knowledge, attitudes, and classroom practices.

EMC Research Hypothesis

- Mathematics classroom coach effectiveness is linked to several domains of knowledge.
- Coaching knowledge contributes significantly to a coach's effectiveness
  - measured by the positive impact on teacher practice, attitudes, and beliefs.

Logic Model


Inputs
Measured variable
Mathematics Content Knowledge
Implementation of Coaching Model
Coaching Effectiveness
Coaching Knowledge
Teacher Beliefs
Coaching Impact
Mathematics Content Knowledge
Coaching Knowledge
Use of Reformed Practice

Research Design and Questions

Non-experimental design:

- Does **coaching knowledge** and **mathematics content knowledge** influence coaching effectiveness?

Experimental design:

- Does **professional development** for coaches in improve their coaching effectiveness?

- Are effects of targeted professional development on explained by increases in coaching knowledge and mathematics content knowledge?

Research Design

	Group 1	Group 2
Year 1 2009-10	Provide orientation to EMC coaching model.	
Year 2 2010-11	Provide PD on Mathematics Content Knowledge. Summer 2010 Web-based PD School Year	Web-based PD School Year 2010-11
Year 3 2011-12	Web-based PD School Year 2011-12	Provide PD on Coaching Knowledge. Summer 2011 Web-based PD School Year
Year 4 2012-13	Provide PD on Coaching Knowledge Summer 2012 Web-based PD School Year	Web-based PD School year 2012-13
Year 5 2013-14	Web-based PD School Year 2013-14	Provide PD on Mathematics Content Knowledge. Summer 2013 Web-based PD School Year

Mathematics Professional Development Topics

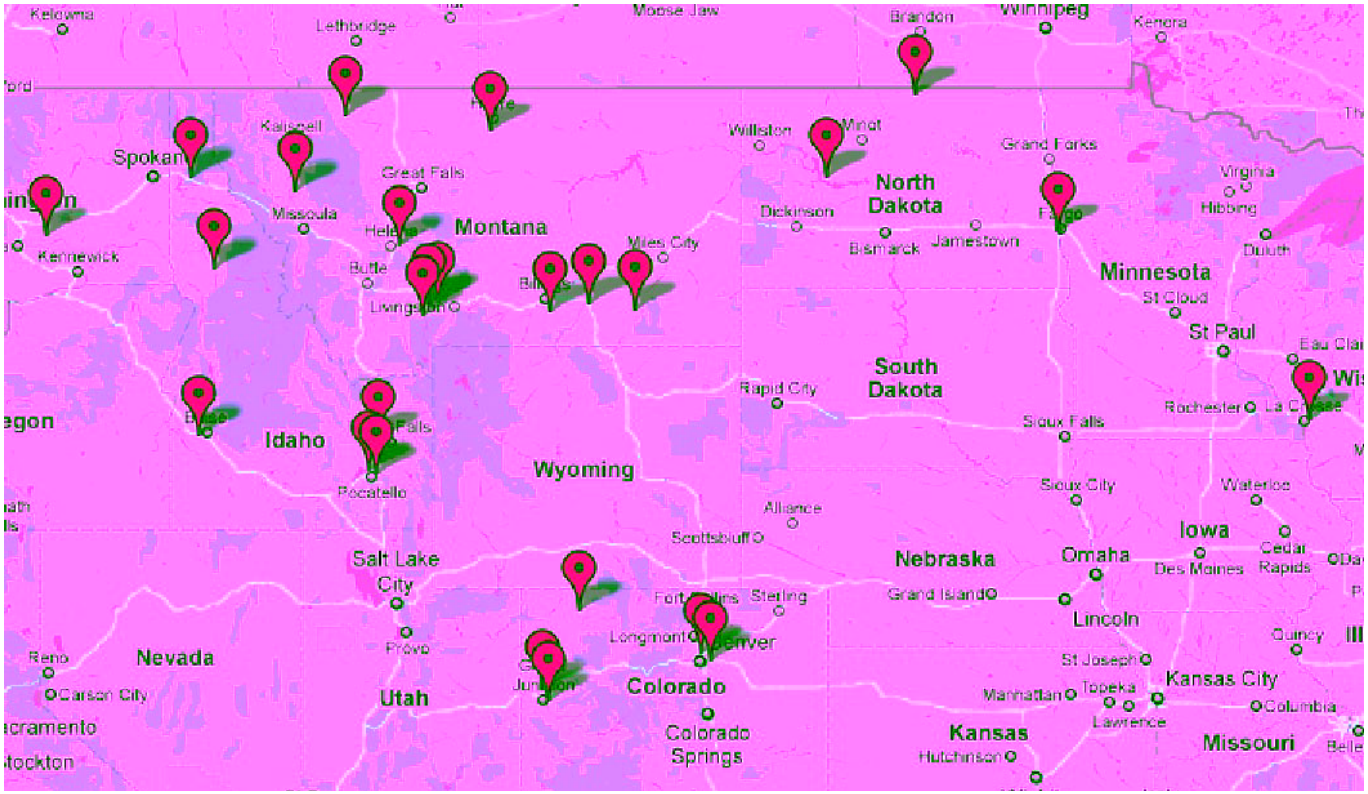
Day 1: Number Sense	Day 2: Computation	Day 3: Fraction Concepts	Day 4: Percents and Decimals	Day 5: Proportional Reasoning
•Types and uses of numbers •Set/subset and part/whole relationships •Number displays and relationships •Counting	•Methods and contexts for addition and subtraction •Methods and contexts for multiplication and division •Mental arithmetic	•Representations •Area model •Set model •Number line model •Computational patterns and properties with fractions	•Representations •Computational patterns and properties with percents and decimals •Applications •Fraction, decimal, and percent equivalences	•Mental methods with fractions, decimals, and percents •Ratios/rates •Solving proportions •Scale drawings •Applications

Coaching Professional Development Topics

Day 1: Instructional Coaching Skills	Day 2: How Teachers Learn	Day 3: Coaching and Communication	Day 4: Content-Focused Coaching	Day 5: How Students Learn
•The coach's role •Conference set-up and scheduling •Making relational connections •Goal-setting with teachers •Building support from administrators	•Adult learning •The teacher development process •Creating a partnership mindset •Keys to effective professional development	•Content-focused conversations •Reflective questioning and active listening •Observing and modeling instruction •Providing feedback	•Standards-based practices for skill proficiency, concept development, and problem solving •Mathematical processes •Activity/inquiry-based instruction	•Cooperative learning •Formative assessment •Classroom discourse strategies •Nonlinguistic representations

EMC Participants

- 59 coach participants and 177 teacher participants located in Montana, Idaho, Colorado, North Dakota, Washington, and Wisconsin



EMC Participants

- At least three K-8 teachers/coach.
- At least eight coaching sessions/year.
- Follow the EMC Coaching Model.
- Complete various research tools at the end or beginning of each school year.
- Teachers observed each spring.
- Access to student achievement data.

EMC Coaching Model

Coaching Model	•**Pre-conference** of at least 15 minutes focused on planning for upcoming lesson with emphasis on teacher's stated goals, objectives, and needs •**Observation** or model of a lesson •**Post-conference** of at least 30 minutes reflecting on planned teacher actions Coaching will focus on aspects of standards-based teaching as defined by NCTM process and content standards, not on generic pedagogy such as classroom management
Content Focus	Number and Operation; ratio and proportion
Frequency	Three teachers per coach provide data points for research. Teachers are coached at least 8 times per academic year and at least four times within the content focus
Quality Assurances	Coach and teacher reflection instruments, coach skill inventory, and teacher needs inventory ensure consistent implementation of coaching across schools Self-identified teacher needs are used in planning and goal setting, and progress toward these goals is monitored and reflected on by coaches

Mathematics Coach: EMC Definition

- A mathematics coach is
  - on-site professional developer
  - focusing on research-based, reform-based, and standards-based instructional strategies and mathematics content
  - includes the why, what, and how of teaching mathematics.

Delphi Study

- An iterative process where experts identify and refine the constructs being studied
- Three phase process:
  - *Phase I*: Identification – Identify knowledge areas;
  - *Phase II:* Definition – Define knowledge areas; and
  - *Phase III:* Validation – Validate the knowledge areas and definitions

Defining Coaching Knowledge

- Engaged national experts and practitioners (including Mark Driscoll, Diana Erchick, Terry Goodman, Loretta Heuer, Ted Hull, Jim Knight, Maggie McGatha, Amy Morse, and Liz Sweeney);
- Identified 8 components of coaching knowledge; and
- Collectively defined each knowledge area.

Coaching Knowledge

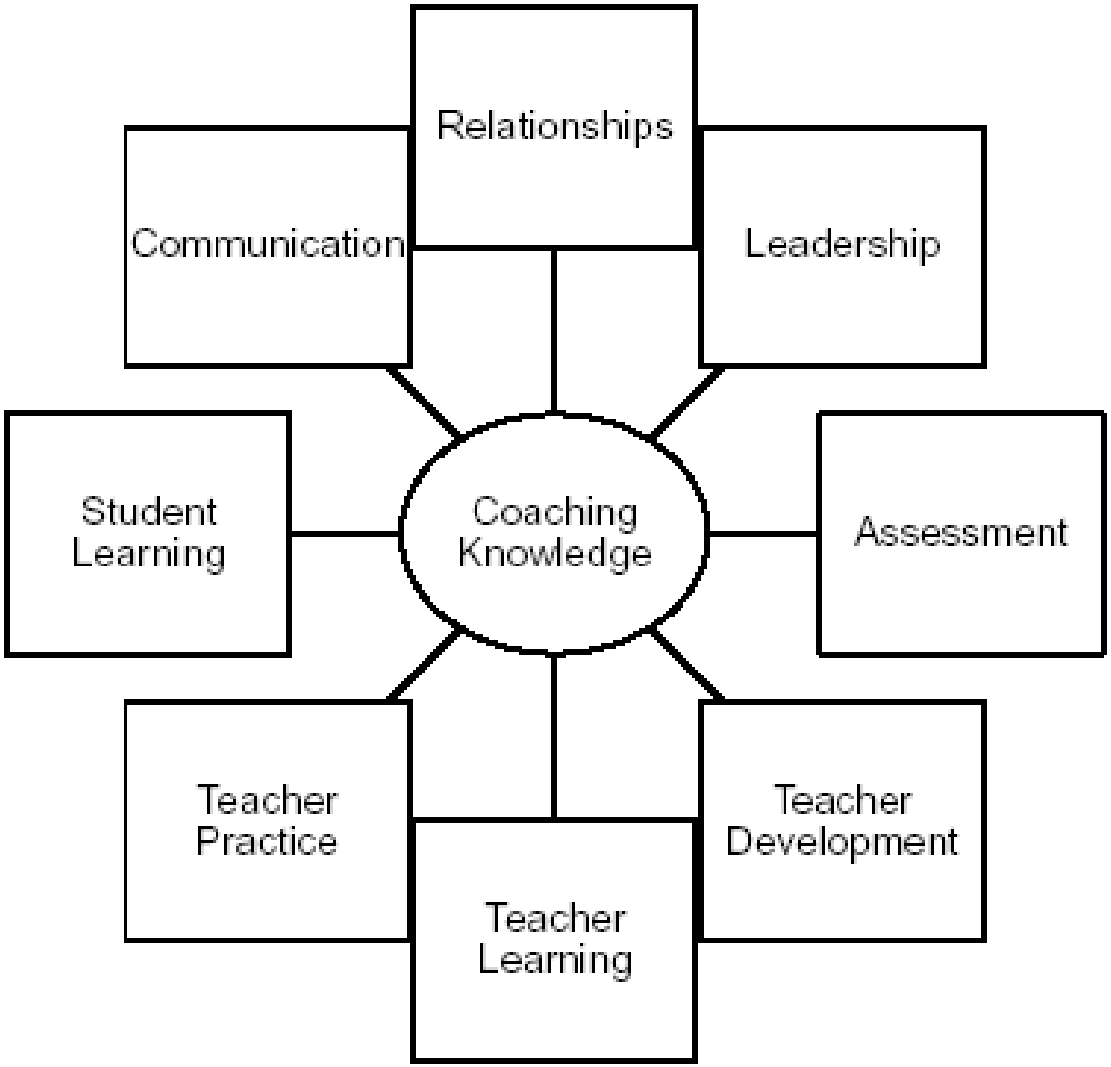


Table Activity

At your table, examine the working definitions of coaching knowledge.

- In a small group, examine at least one definition and answer two questions.

- One person should be prepared to share responses with the whole group for each definition discussed.

Table Activity

- What aspects or features of the definition are surprising or unexpected for you?
- How might these definitions influence and/or inform your work?

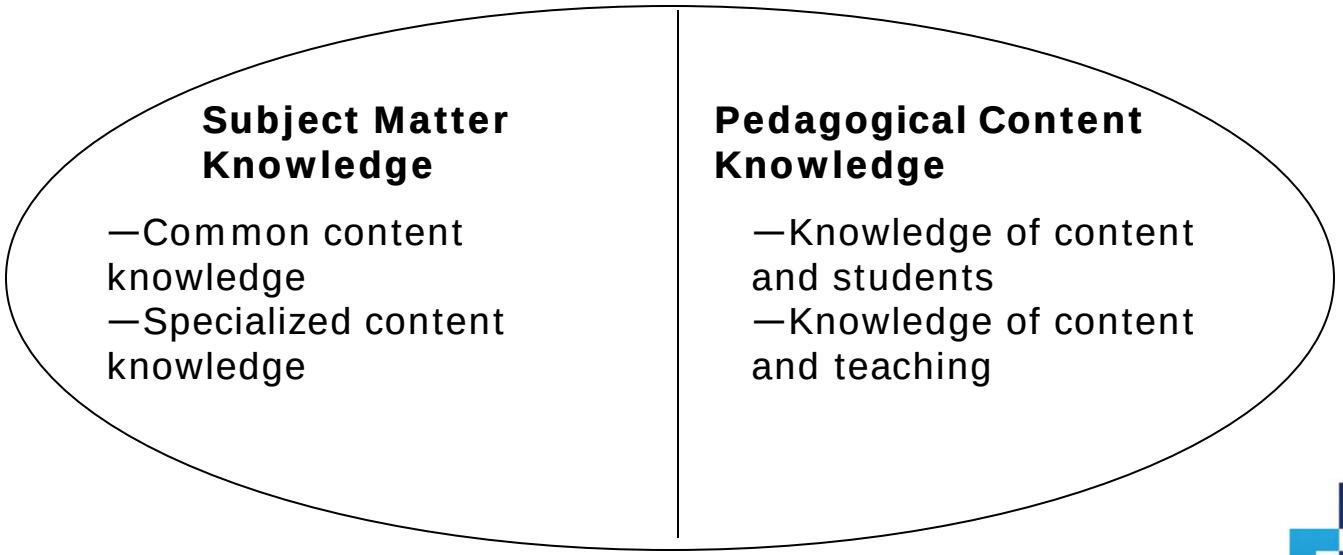
Coach & Teacher Instruments

Tool	Who	Purpose
Mathematics Knowledge for Teaching (MKT)	Coach Teacher	Document changes in mathematics content knowledge needed for teaching.
Coach and Teacher Reflections (CTRI)	Coach Teacher	Document the quality, content, and details of coaching sessions. Examine perception of coaching impact on instruction.

Mathematics Knowledge for Teaching

Study of Instructional Improvement / Learning Mathematics for Teaching Project at the University of Michigan

Instrument to assess mathematics content knowledge for teaching



Mathematics Knowledge for Teaching

Design questions (e.g., quiz)

Which of these lists would be best for assessing whether students understand ordering decimal numbers.

a. 0.5 7 0.01 11.4

b. 0.60 2.53 3.12 0.45

c. 0.6 4.25 0.565 2.5

d. These lists are all equally good for assessing whether students understand how to order decimal numbers.

Coach and Teacher Reflections

Coach

- Time spent and type of interaction
  - Pre-lesson conference
  - Lesson observation
  - Post-lesson conference
- Reflection on coaching sessions
  - Coaching relationship
  - Topics discussed
  - Impact

Teacher

- Number of visits
- Reflection on coaching sessions
  - Coaching relationship
  - Topics discussed
  - Impact

Coach and Teacher Reflections

My coach and I discussed significant and worthwhile mathematical content.

Not at all				To a great extent
1	2	3	4	5

Coach & Teacher Instruments

Tool	Who	Purpose
Coaching Knowledge Survey (CKS)	Coach	Assess coaching knowledge.
Coaching Skills Inventory (CSI)	Coach	Self-assess coaching skills.

Coaching Knowledge Survey

	Reflective of my coaching							
	Not at all	Somewhat						Very much
	1	2	3	4	5	6	7	8
I coach newer teachers more than the experienced teachers.								

Coaching Skills Inventory

How confident do you feel coaching teachers on encouraging student participation?

Not at all confident				Very confident
1	2	3	4	5

Teacher Research Tools

Tool	Who	Purpose
Teacher Needs Inventory (TNI)	Teacher	Planning tool to provide focus for coaching sessions.
Teacher Survey (TS)	Teacher	Examine teacher attitudes, beliefs, and perceptions about mathematics teaching.
Classroom Observation	Teacher	Document classroom practice

Teacher Needs Inventory

How confident do you feel using cooperative learning?

Not at all confident — Very confident

1	2	3	4	5
I would not like to partner with coach on this topic.		Not sure if I would like to partner with coach on this topic.		I would like to partner with coach on this topic.
[ ]		[ ]		[ ]

Teacher Survey

During the last 12 months, how often did you engage in each of the following activities <u>related specifically to the teaching and learning of mathematics</u>?

e. Observed demonstrations of teaching techniques.

Not at all	Once or twice per year	Once or twice per month	Once or twice per week	Almost daily

Observation

Observation includes a brief description of the day's lesson, the classroom setting in which the lesson took place (space, seating arrangement, etc.), and relevant details about the students and teacher. Using the Inside the Classroom Observation Protocol, the observation focuses on:

- Lesson Design and Implementation
- Content
- Classroom Culture

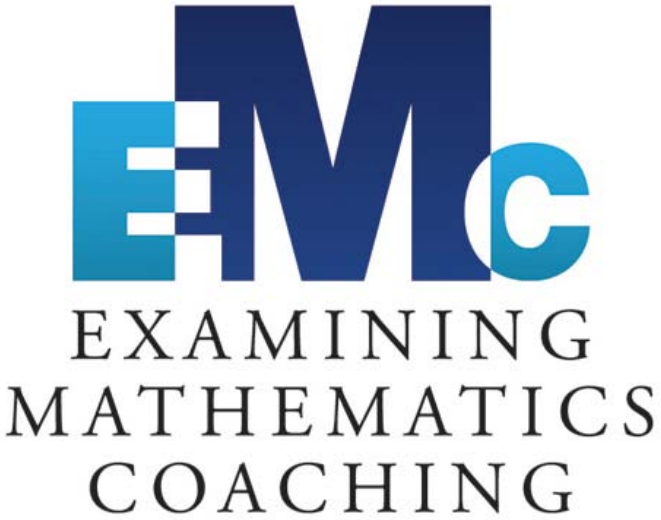
EMC Instruments

- Handouts - Sampler
  - Coaching Skills Inventory
  - Teacher Needs Inventory
  - Coach and Teacher Reflections
- Permission to use if requested
  - Provides EMC opportunity to monitor applications outside project

Examining Mathematics Coaching

- Questions
- Insights
- Ideas
- Comments

THANK YOU!



Contact Us:

John Sutton, Co-PI, sutton@rmcdenver.com
Clare Heidema, heidema@rmcdenver.com
Arlene Mitchell, mitchell@rmcdenver.com
Phone: (800) 922-3636
Web: www.math.montana.edu/~emc/