

# Developing Coaches – Developing Teachers: Making Mathematics Accessible and Equitable

**John Sutton, RMC Research Corporation**

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Research Partners



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# Contributors and Other Personnel



## Montana State University

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



## RMC Research

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

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# Session Outline

- Examining Mathematics Coaching (EMC)  
Project Description and Current Coaching Practices
- Research design to examine mathematics coaching
- Professional Development Topics



# Session Outline

- Defining coaching knowledge
- Instruments to measure coaching effectiveness
- Becoming Consumers of Coaching
- Tools and Strategies to Maximize Coaching Effectiveness

# EMC

## Project 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?*





# Mathematics Coaching

Mathematics classroom coaching is gaining popularity as a school-based effort to increase teacher effectiveness and student achievement.

# Mathematics Coaching Defined

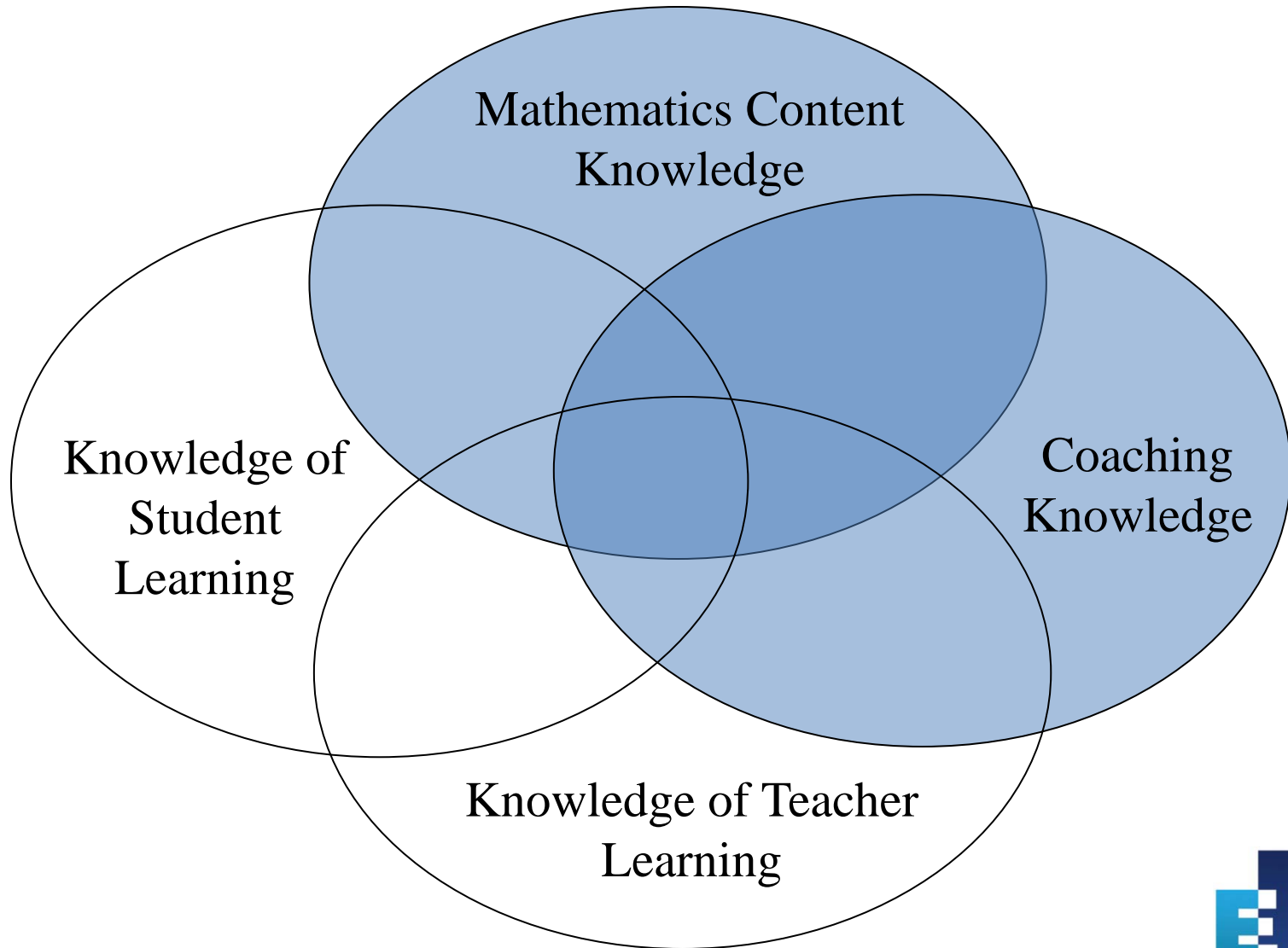
*“A mathematics coach is an on-site professional developer who enhances teacher quality through collaboration focusing on research-based, reform-based, and standards-based instructional strategies and mathematics content that includes the why, what, and how of teaching mathematics.”*

# 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 Coaching?

- 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 Coaching?

The National Mathematics Panel (2008) reports that schools across the nation are using mathematics specialists, including mathematics coaches, yet there is **limited research proving what makes coaching effective.**

# Why Study Coaching?

- There is limited understanding of coaching effectiveness, especially in mathematics.
- 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 and districts.

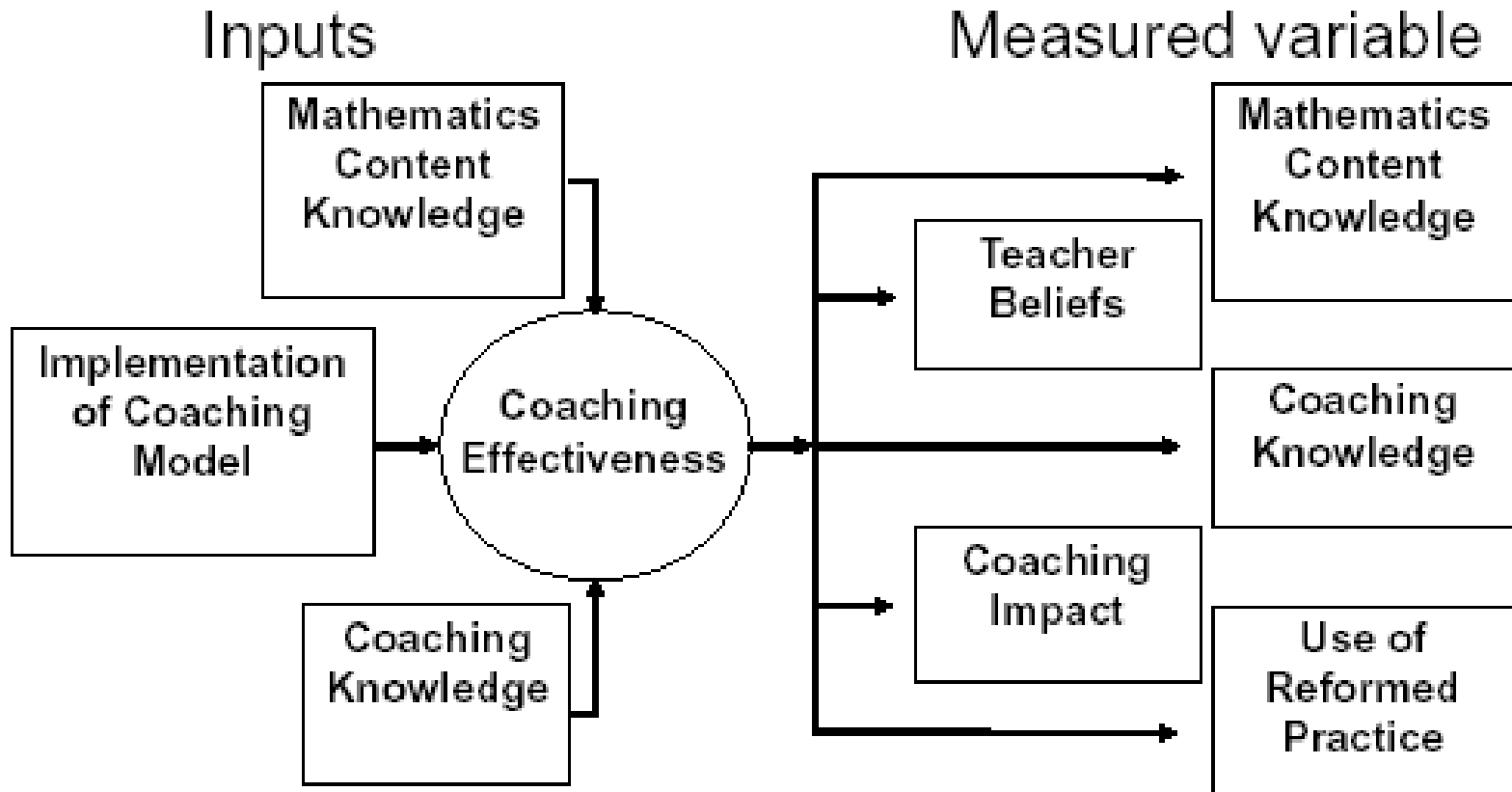
# EMC Goals

- Coaching knowledge contributes to coaching effectiveness.
- Mathematics content knowledge contributes to coaching effectiveness.
- Contribute to research on knowledge for coaching
  - impacts of coaching knowledge and mathematics content knowledge on teachers' knowledge, attitudes, and classroom practices.

# EMC Research Hypothesis

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

# Logic Model



# Research Questions

- *To what extent does the depth of a coach's knowledge in two primary domains (**coaching knowledge** and **mathematics content knowledge**) influence his or her coaching effectiveness?*
- *To what extent does **professional development** for coaches in these two areas improve their coaching effectiveness?*
- *To what extent are the effects of targeted professional development on coaching effectiveness explained by increases in coaching knowledge and mathematics content knowledge?*





# Research Design

A **non-experimental** design will answer:

*To what extent does a coach's depth of content knowledge in coaching knowledge and mathematics content knowledge influence coaching effectiveness?*

# Research Design

An **experimental** design randomly assigns coaches to one of two groups to answer:

*To what extent does professional development targeting these two knowledge domains improve coaching effectiveness?*

*To what extent are the effects of the targeted professional development explained by increases in knowledge?*

# Research Design

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

# Mathematics Content Professional Development Topics

Day 1: Number Sense	Day 2: Computation	Day 3: Fraction Concepts	Day 4: Fraction Operation and Applications	Day 5: Proportional Reasoning
<ul style="list-style-type: none"> <li>•Types and uses of numbers</li> <li>•Set/subset and part/whole relationships</li> <li>•Number displays and relationships</li> <li>•Counting</li> </ul>	<ul style="list-style-type: none"> <li>•Methods and contexts for addition and subtraction</li> <li>•Methods and contexts for multiplication and division</li> <li>•Mental arithmetic</li> </ul>	<ul style="list-style-type: none"> <li>•Representations</li> <li>•Area model</li> <li>•Set model</li> <li>•Number line model</li> <li>•Computational patterns and properties with fractions</li> </ul>	<ul style="list-style-type: none"> <li>•Representations</li> <li>•Computational patterns, misconception, and properties with fractions</li> <li>•Applications</li> <li>•Ratios/Rates</li> </ul>	<ul style="list-style-type: none"> <li>•Mental methods with fractions, decimals, and percents</li> <li>•Proportional Thinking</li> <li>•Scale drawings</li> <li>•Applications</li> </ul>

# 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
<ul style="list-style-type: none"> <li>•The coach's role</li> <li>•Conference set-up and scheduling</li> <li>•Making relational connections</li> <li>•Goal-setting with teachers</li> <li>•Building support from administrators</li> </ul>	<ul style="list-style-type: none"> <li>•Adult learning</li> <li>•The teacher development process</li> <li>•Creating a partnership mindset</li> <li>•Keys to effective professional development</li> </ul>	<ul style="list-style-type: none"> <li>•Content-focused conversations</li> <li>•Reflective questioning and active listening</li> <li>•Observing and modeling instruction</li> <li>•Providing feedback</li> </ul>	<ul style="list-style-type: none"> <li>•Standards-based practices for skill proficiency, concept development, and problem solving</li> <li>•Mathematical processes</li> <li>•Activity/inquiry-based instruction</li> </ul>	<ul style="list-style-type: none"> <li>•Cooperative learning</li> <li>•Formative assessment</li> <li>•Classroom discourse strategies</li> <li>•Nonlinguistic representations</li> </ul>

# EMC Coaching Model

Coaching Model	<ul style="list-style-type: none"><li>• <b>Pre-conference</b> of at least 15 minutes focused on planning for upcoming lesson with emphasis on teacher's stated goals, objectives, and needs</li><li>• <b>Observation</b> or model of a lesson</li><li>• <b>Post-conference</b> of at least 30 minutes reflecting on planned teacher actions</li></ul> 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

# Delphi Study

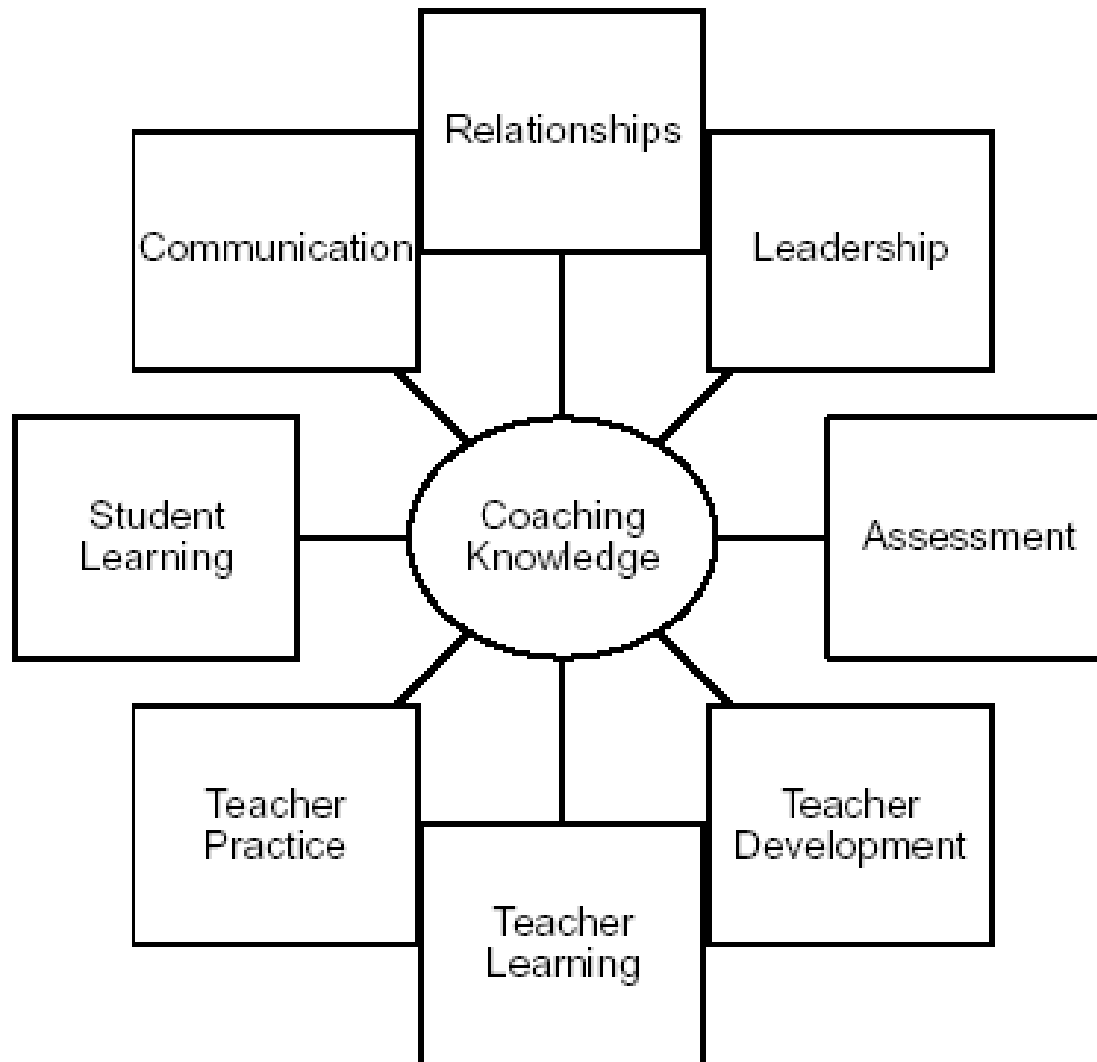
- An iterative process where experts identify and refine the constructs being studied
- Three phase process:
  - *Phase I: Identification* – Identify knowledge areas;
  - *Phase II: Definition* – Define knowledge areas; and
  - *Phase III: Validation* – Validate the knowledge areas and definitions

# Defining Coaching Knowledge

- Three phase process engaged 10 national experts and practitioners in the area of mathematics coaching.
- The Delphi panel identified 8 components of coaching knowledge.
- Experts collectively defined each knowledge area and expressed their level of agreement with the collective definitions.



# Coaching Knowledge



# Complexity of Coaching

- Coaching is a collaborative process that is done with teachers, not to teachers.
- Coaching is a joint effort from both the coach and the teacher(s) involved.
- Coaching support is useful only if the teacher and coach are prepared, and willing to listen, internalize, and respond accordingly.

# Effective Coaching Practice

A coach should:

- Ask reflective questions
- Provide feedback
- Share materials and resources
- Maintain confidentiality
- Use a coaching cycle:
  - Gather information before the lesson
  - Observe a complete lesson
  - Collect and document evidence
  - Debrief and reflect after the lesson

# Boundaries of Coaching

A coach generally does not:

- Evaluate teachers
- Take over during a lesson
- Impose specific lessons or instructional strategies
- Tutor struggling students
- Perform the support services of an aide

# Becoming Consumers of Coaching

- There is no single recipe for effective coaching.
  - Approaches to coaching vary as widely as do the teachers, coaches, and schools involved.
- Despite variations in coaching, it remains the teacher's responsibility to become ***a consumer of coaching.***

# Becoming Consumers of Coaching

A commitment to creating a collaborative and rewarding coaching relationship will help maximize the benefits of coaching.

- Coaches are only as effective as their teachers will allow.
- A wise consumer of coaching makes the most of this educational investment.

# Becoming Consumers of Coaching

To maximize the benefits of coaching, a teacher must:

- communicate specific instructional needs;
- be willing to ask for specific types of support;
- be able to listen and hear ideas; and
- take shared responsibility for cultivating a positive and productive coaching relationship.

# What Coaches Expect from Teachers

Effective Coaching	Expectations from Teachers
Is structured	Set aside time for coaching
Requires reflection	Share goals and beliefs
Requires two-way communication	Express needs and expectations



# What Coaches Expect from Teachers

Effective Coaching	Expectations from Teachers
Is content-based	Focus on improving mathematics teaching and learning
Is evidence-based	Built on identified elements from sessions and observations

# Tools to Support Coaching

The Examining Mathematics Coaching (EMC) project has developed and refined tools to help coaches and teachers in the coaching process.

- Coaching Skills Inventory
- Teacher Needs Inventory



# EMC

## Coaching Skills Inventory

...is intended to measure a coach's perspective on her or his own level of effectiveness or confidence with various coaching responsibilities.



# EMC

## Coaching Skills Inventory

Areas explored include:

- Coach/Teacher Relationships
- Coaching Skills
- Mathematics Content
- Mathematics-Specific Pedagogy
- General Pedagogy
- Background and practices as an educator

# Coaching Skills Inventory

## I. Coach/Teacher Relationships

	Not at All Effective				Very Effective
	1	2	3	4	5
1. How effective do you feel observing lessons and giving teachers feedback?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. How effective do you feel creating environments where teachers reflect openly on their instructional practices?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. How effective do you feel helping teachers set goals and objectives aimed at improving their instruction?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. How effective do you feel creating an environment of open discussion and constructive criticism with teachers?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



# EMC

## Teacher Needs Inventory

...is designed to help the teacher take ownership of the coaching process. The responses are used by the coach as a tool to help focus the coaching and increase effectiveness.



# EMC

## Teacher Needs Inventory

Areas explored include:

- Teaching Conceptual and Inquiry-Based Lessons
- Classroom Environment
- Conceptual Understanding of Mathematics
- Mathematics Content Knowledge
- Classroom Management

# Teacher Needs Inventory

## IV. MATHEMATICS CONTENT KNOWLEDGE

Regarding this topic, ...

	Confidence Level					Regarding this topic, ...		
	Not at all Confident				Very Confident	I would not like to partner with my coach.	I'm not sure I would like to partner with my coach.	I would like to partner with my coach.
	1	2	3	4	5			
15. How confident are you with the mathematics you teach?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. How confident are you with the mathematics beyond the mathematics that you teach, meaning the next grade level?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. How confident do you feel planning lessons that include fraction concepts?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. How confident do you feel planning lessons that include number sense and operations?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>





# Coach and Teacher Reflections

... are tools for monitoring and logging coaching interactions including quantity, quality, and duration of coaching sessions along with measuring coaches and teachers' perceptions of coaching's impact on instruction.



# Coach and Teacher Reflections

Areas explored include:

- Interactions with the coach and/or teacher
- Frequency of various activities (pre-lesson conference, observation, post-lesson conference, modeling a lesson, etc.)



# Coach and Teacher Reflections

- Duration of various activities (pre-lesson conference, observation, and post-lesson conference)
- Coaching Relationship

# Coach and Teacher Reflections

- Mathematics Content
- Mathematical Concept and Inquiry
- Classroom Environment/Culture
- Reflection and Planning
- Impact on Teacher Practice

# Coach Reflection & Impact

Mathematics Content	Rating					
	Not at All	1	2	3	4	To a Great Extent
a. The teacher and I discussed significant and worthwhile mathematical content.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. The teacher and I discussed mathematical content at the grade level(s) she/he teaches.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. The teacher and I discussed ways to increase the level of cognitive demand of the mathematical content being taught.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. The teacher and I discussed mathematical content beyond the grade level(s) she/he teaches.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

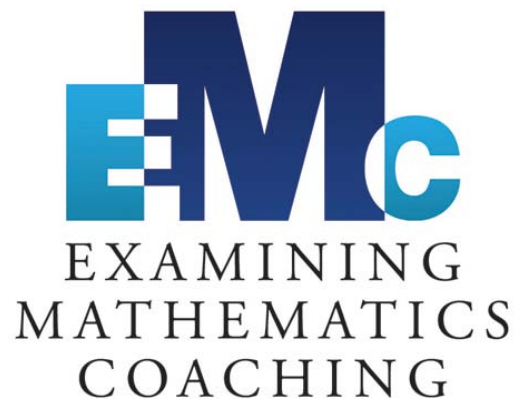
# Teacher Reflection & Impact

## Reflection and Planning

	Not at All				To a Great Extent
	1	2	3	4	5
o. My coach and I set goals and objectives aimed at implementing ideas and addressing issues we discussed.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
p. My coach and I were reflective about my students' learning.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
q. My coach and I were reflective about my teaching practices.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

# Developing Coaches – Developing Teachers

- Questions
- Insights
- Ideas
- Comments



## **Contact Information:**

John Sutton, [sutton@rmcdenver.com](mailto:sutton@rmcdenver.com)

Phone: (800) 922-3636

Web: [www.math.montana.edu/~emc/](http://www.math.montana.edu/~emc/)