EXAMINING MATHEMATICS COACHING

Impact of Mathematics Coaching Knowledge on K-8 Teacher Practice

John Sutton and Clare Heidema

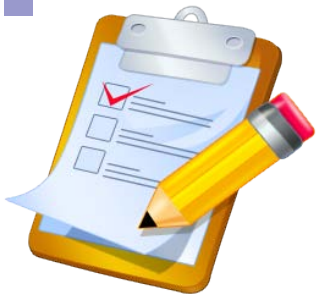
National Council of Teachers of Mathematics
Philadelphia
April 2012

Research Partners

MONTANA STATE UNIVERSITY

RMC RESEARCH

Funding By The National Science Foundation
Discovery Research K-12 Program (DR K-12),
Award No. 0918326

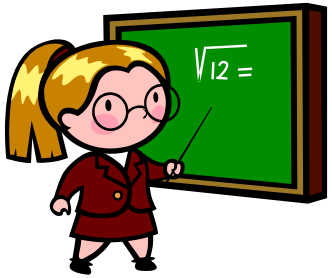


Session Agenda

- Description of Examining Mathematics Coaching (EMC) project
- Coaching process and domains of knowledge
- Behaviors and boundaries of effective mathematics coaches
- Behaviors of good consumers of coaching

MATHEMATICS COACHING

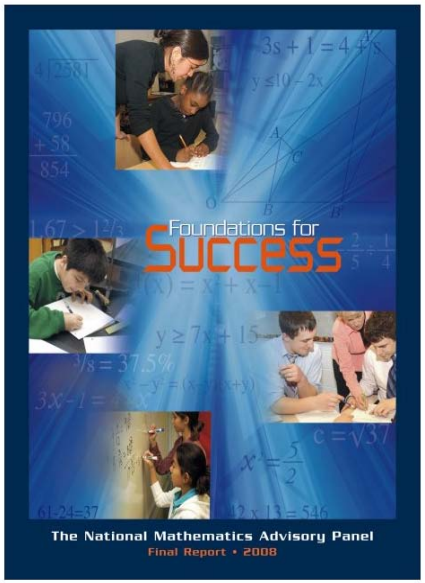
Mathematics classroom coaching
is gaining popularity as a
school-based effort
to increase
teacher effectiveness
and
student achievement.



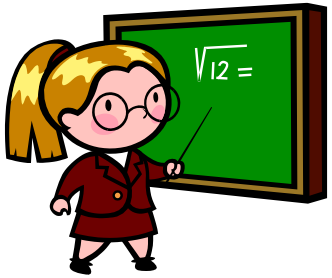
WHY STUDY COACHING?

- 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.

EXAMINING MATHEMATICS COACHING PROJECT

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

Contributors & Other 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
- Dan Jesse

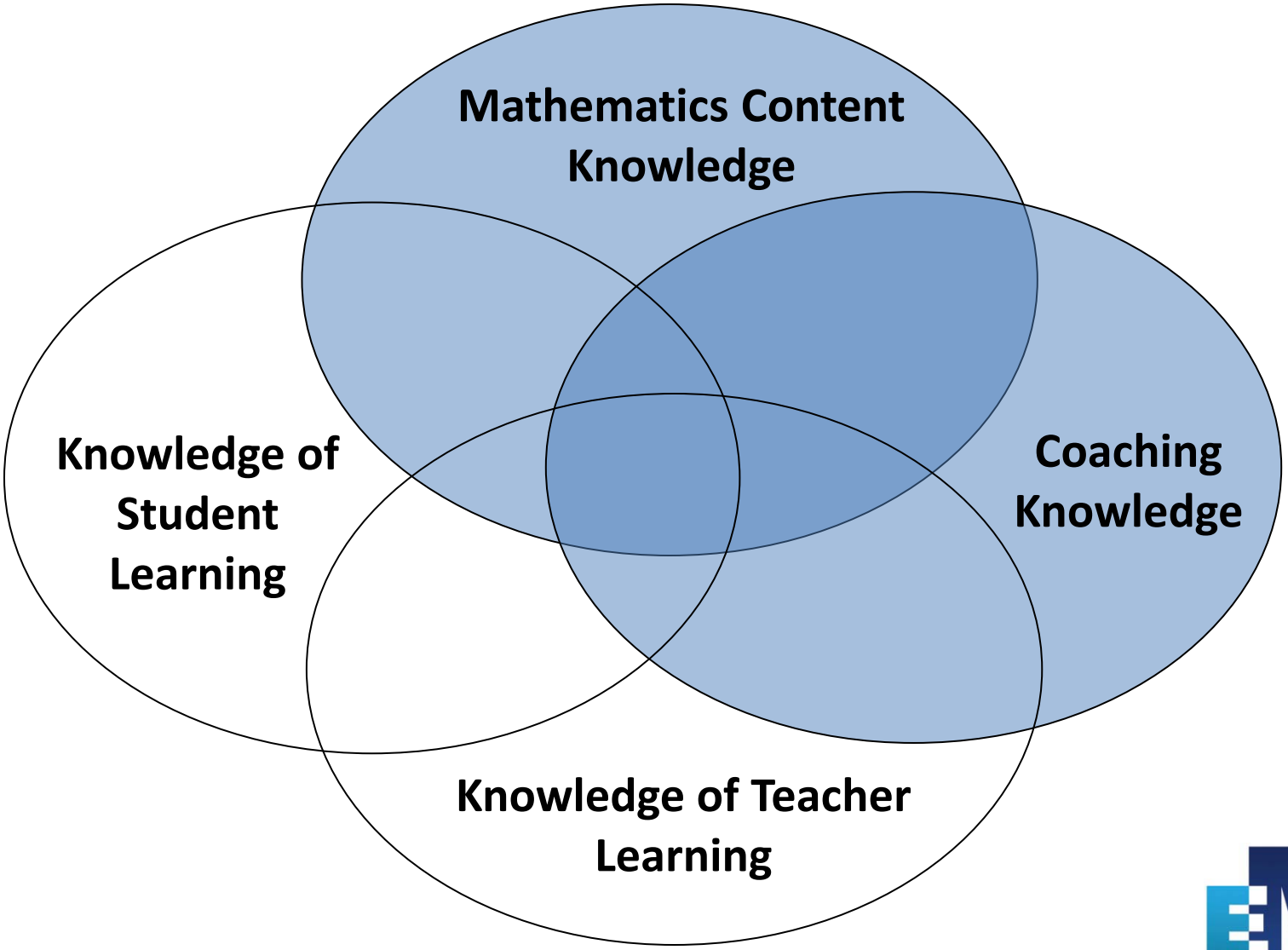
- James Burroughs, Project Director

Funded under *NSF Award No. 0918326. Any opinions expressed herein are those of the authors and do not necessarily represent the views of the National Science Foundation.*

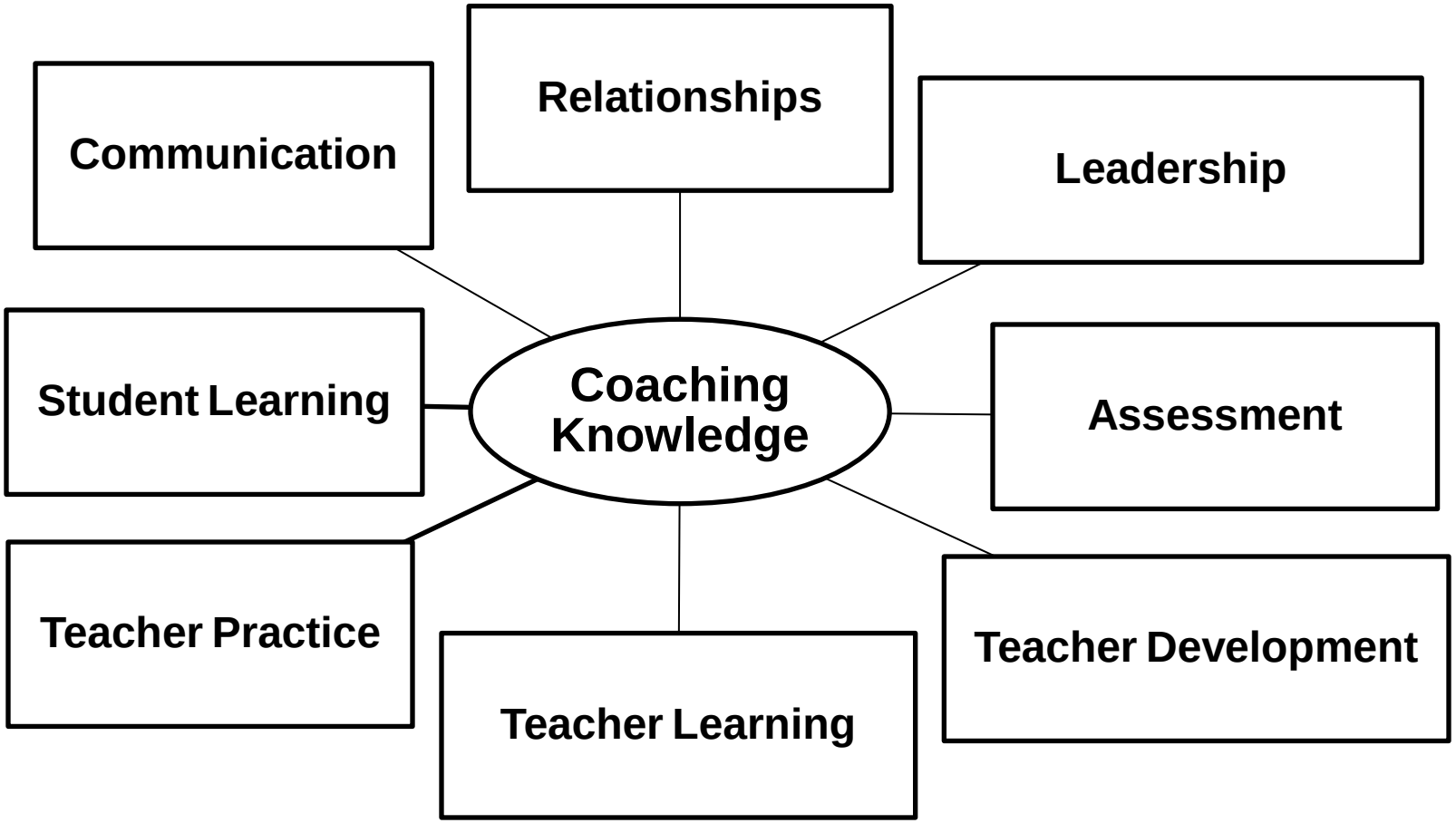
The Examining Mathematics Coaching Project (EMC)

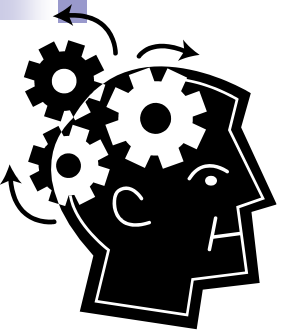
- Investigating knowledge that contributes to successful coaching in two domains:
  - Coaching knowledge
  - Mathematics content knowledge
- The influence of these knowledge domains is examined in two ways:
  - investigating correlations between assessments of coach and teacher knowledge and practice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

KNOWLEDGE DOMAINS



Coaching Knowledge Domains





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.

Crossover 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 during Summer 2010 • Web-based PD School Year	• Web-based PD during School Year 2010-11
Year 3 2011-12	• Web-based PD during School Year 2011-12	• Provide PD on Coaching Knowledge during Summer 2011 • Web-based PD School Year
Year 4 2012-13	• Provide PD on Coaching Knowledge during Summer 2012 • Web-based PD School Year	• Web-based PD during School Year 2012-13
Year 5 2013-14	• Web-based PD during School Year 2013-14	• Provide PD on Mathematics Content Knowledge during Summer 2013 • Web-based PD School Year

MATHEMATICS COACHING DEFINED

Discuss with a neighbor:

How do you define “coaching”?

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.

EMC Coaching Model

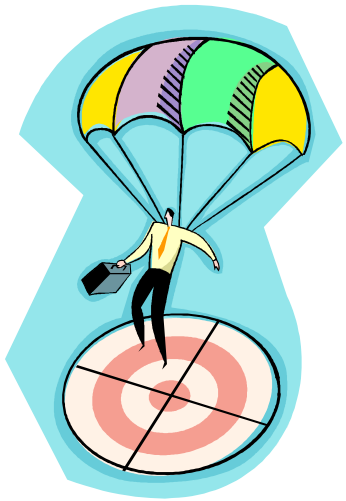
Coaching Cycle	•**Pre-conference** of at least 15 minutes focused on planning for upcoming lesson with emphasis on teacher's stated goals, objectives, and needs •**Observation** or model of a lesson •**Post-conference** of at least 30 minutes reflecting on planned teacher actions Coaching will focus 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 with at least four of those 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.

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.

Effective Coaching Practice

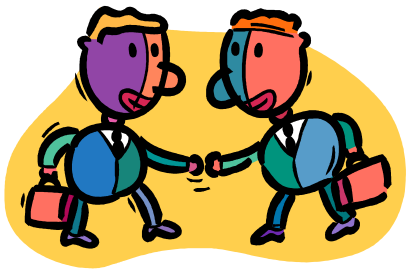


A coach should:

- Ask reflective questions
- Provide feedback and support
- Share expertise, 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

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.



Impact of Coaching

- Instruments
  - Knowledge
  - Attitudes/Beliefs
  - Practice

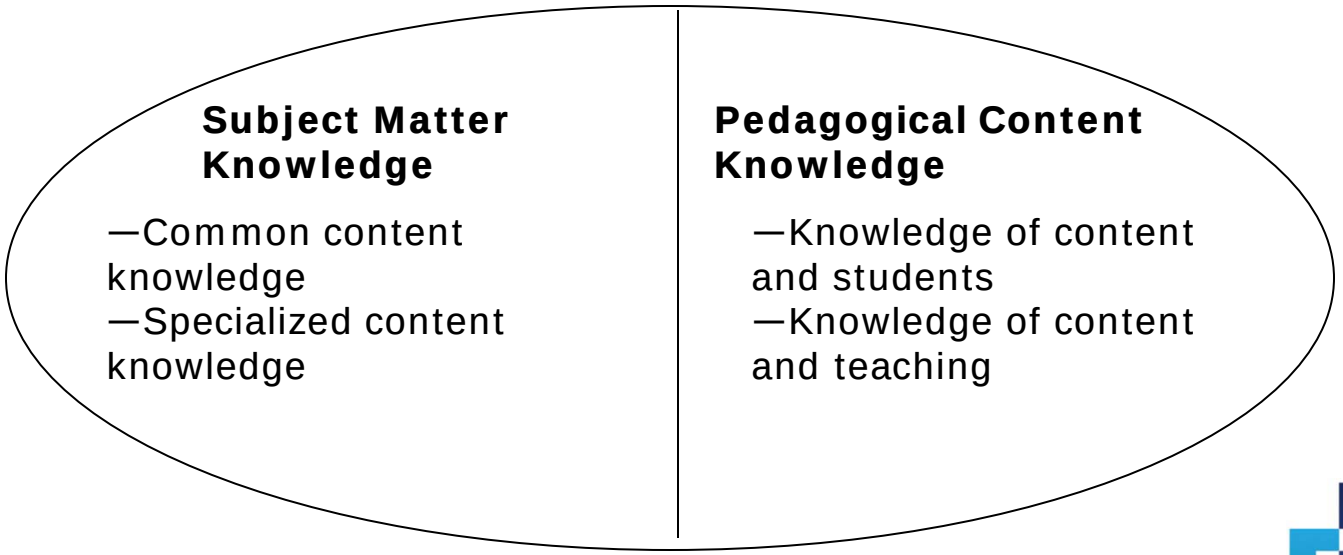
Instruments

Instrument	Target	Purpose	Status
Mathematics Knowledge for Teaching (MKT)	Coach Teacher	assessing mathematics content knowledge for teaching	
Coaching Impact Instrument (CII)	Coach Teacher	assessing coaches' and teachers' perceptions of coaching's impact on instruction	
Coach and Teacher Reflection Instrument (CRI and TRI)	Coach Teacher	monitoring and logging coaching interactions including quantity, quality and duration of coaching sessions	
Coaching Knowledge Survey (CKS)	Coach	assessing coaching knowledge	
Coaching Skills Inventory (CSI)	Coach	self-assessment of coach skills	
Inside the Classroom—Classroom Observation Protocol (ITC-COP)	Teacher	assessing classroom impacts	
Teacher Needs Inventory (TNI)	Teacher	planning tool to provide focus for coaching sessions	
Teacher Survey (TS)	Teacher	assessing teacher attitudes, beliefs and perceptions of mathematics teaching	

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 (MKT)

- Not an assessment of individual teacher's knowledge or skill – it is a tool for looking at the impact of coaching and the coaching model in the EMC design.
- Data from MKT is used to help understand how coaching affects teaching mathematics.
- The items on the MKT are challenging – they are designed to be that way.

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.

Teacher Survey

Examine teacher attitudes, beliefs, and perceptions about mathematics teaching.

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.

Never	**Very seldom**	**Some**	**Frequently**	**A lot**
Not at all	Once or twice per year	Once or twice per month	Once or twice per week	Almost daily

Inside the Classroom Observation Protocol

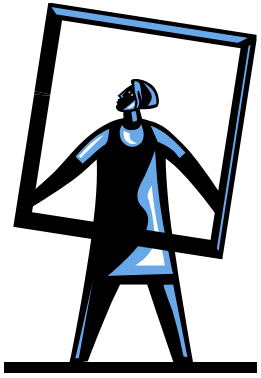
Characteristics of High Quality Mathematics Lesson:

- **Design**
- **Implementation**
- **Mathematics Content**
- **Culture**

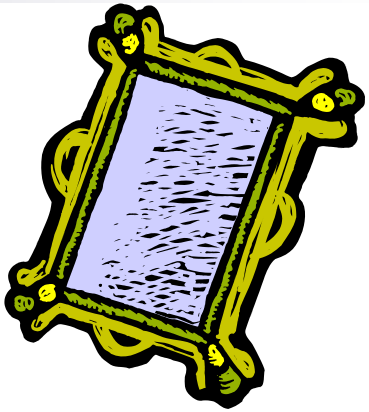
Horizon Research Inc., 2003

Looking Inside the Classroom: A Study of K-12 Mathematics and Science Education in the United States

http://www.horizon-research.com



What's Missing from the Picture?



- Burden of the **partnership, relationship**, and **collaboration** is on the coach only.

- Coaches are only as effective as their teachers will allow.

Becoming Consumers of Coaching

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

- A wise consumer of coaching makes the most of this educational investment.
- Consumer of coaching addresses the teacher's role in coaching process.

Becoming Consumers of Coaching

Discuss with a neighbor:

What might be the expectations
from teachers
who are being coached
in order
to make coaching
effective and collaborative?

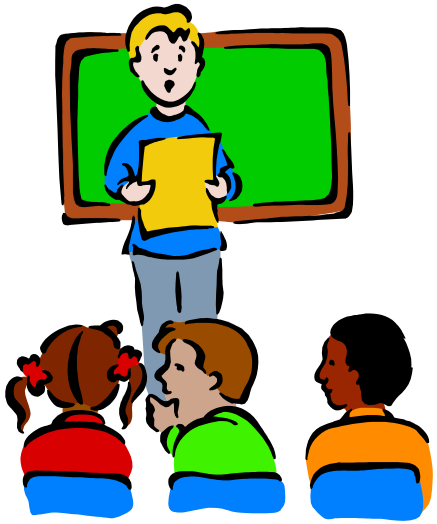
Consumer of Coaching Framework

- Feedback
- Reflection
- Classroom expectations
- Content
- Structure
- Communicating needs

Feedback

- Effective coaching requires feedback.

An effective consumer of coaching asks the coach for targeted feedback.



REFLECTION

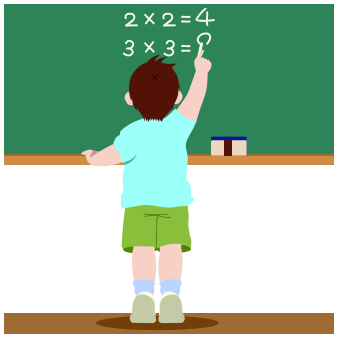
- Coaching is a reflective process.

An effective consumer of coaching is open to reflection and is an active participant in the reflective process.

Classroom Expectations

- Effective coaching requires teachers to communicate their expectations for coaches as the lesson transpires.

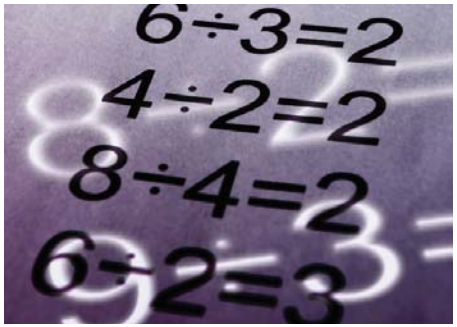
An effective consumer of coaching tells their coach what kind of classroom interaction he/she desires.



CONTENT

- Effective coaching is content-based.

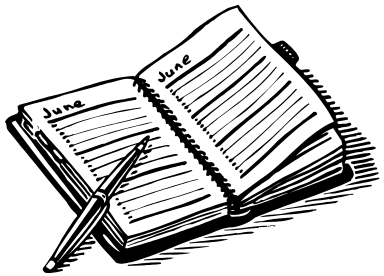
An effective consumer of coaching is willing to examine her or his own mathematics content knowledge.



Structure

- Effective coaching is structured and involves at least three components: a pre-lesson conference, a lesson observation, and a post-lesson conference.

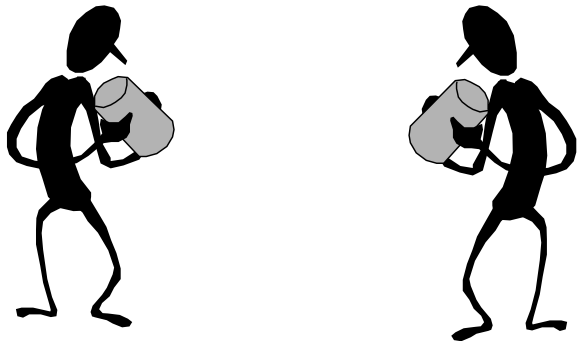
Effective consumers of coaching help coaches schedule the 3-part cycle.



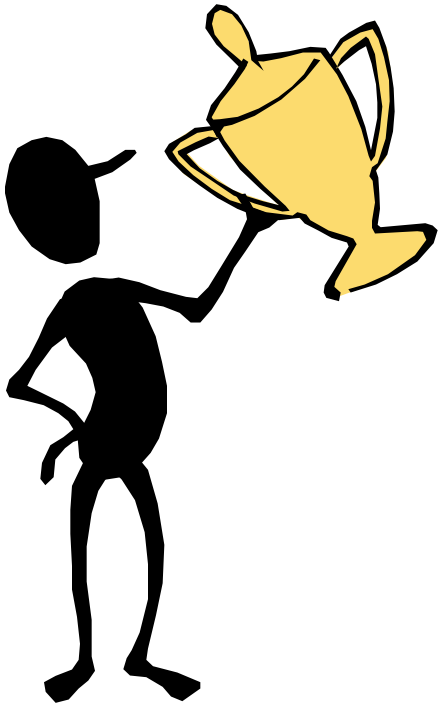
COMMUNICATING NEEDS

- Effective coaching requires teachers to communicate their needs.

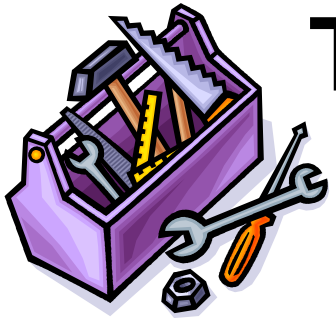
An effective consumer of coaching tells the coach what he/she needs.



Consumers Of Coaching Are Able To:



- assess their own needs;
- assess their performance;
- ask for help from others;
- provide context as needed;
- listen to and hear ideas;
- overcome anxious feelings;
- assess and communicate needs;
- assist in scheduling.



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
- Reflections (Coach and Teacher)

EMC
COACHING SKILLS INVENTORY

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

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 Coach & Teacher Reflections

… are tools for monitoring and logging coaching interactions.

- Quantity, quality, and duration of coaching sessions
- Coaches and teachers' perceptions of coaching's impact on instruction

Impact of Mathematics Coaching Knowledge on K-8 Teacher Practice

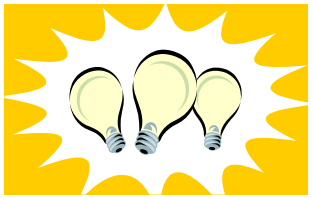
Articles

- *Mathematics Coaching Knowledge: Domains and Definitions* (NCSM Journal Fall 2011)
- *How to be a Wise Consumer of Coaching* (Journal of Staff Development, February 2011)

Questions ???

Ideas

Comments



EMC
EXAMINING
MATHEMATICS
COACHING

Contact Information:

Email: emc@math.montana.edu
Web: www.math.montana.edu/~emc/