Examining Mathematics Coaching

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SESSION AGENDA

- Description of Examining Mathematics Coaching (EMC) project
- Professional Development
- Consumers of Coaching
- Valid and Reliable Instruments
- Early Findings
Mathematics Coaching

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

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# Mathematics Content Institute

<table>
<thead>
<tr>
<th>Day</th>
<th>Topic</th>
<th>Summary</th>
</tr>
</thead>
</table>
| Day 1 | Number Sense        | • It is important to select appropriate representations of numbers or numerical problems based on context.  
• Factorization, divisibility and divisibility rules are based on mathematical structure. |
| Day 2 | Computation         | • The properties of numbers and operations on numbers create structure that underlies computational methods, including algorithms.  
• Multiplicative thinking is a skill to develop with all students.  
• Models can be used to solve contextual problems, decide what operation is involved, and give meaning to number sentences. |
| Day 3 | Fraction Concepts   | • Unitizing is the basis for fraction understanding.  
• There are various models for representing fractions and these complement each other and enrich the meaning of fractions. |
| Day 4 | Operations with Fractions | • Models for fractions and their operations reveal structure that underlies computational methods.  
• Various mathematical connections link ratios and fractions. |
| Day 5 | Proportional Reasoning and Percent | • Multiplicative reasoning is a fundamental component of proportional reasoning.  
• Proportional situations can be represented by a variety of models, and certain models promote sense-making in solving proportions. |
## Coaching Knowledge Institute

| Day 1 | How Teachers Learn (Setting the Stage for Standards-Based Instruction) | • Teacher development  
• Teacher learning |
|-------|-------------------------------------------------------------------|--------------------------------------------------|
| Day 2 | Teacher Practices and Student Learning: Content-Focused Coaching and How Students Learn | • Teacher practices  
• Student learning |
| Day 3 | Teacher Practices and Student Learning, Part II | • Teacher practices  
• Student learning |
| Day 4 | Professional and Interpersonal Communication for Coaches | • Communication  
• Assessment |
| Day 5 | Instructional Coaching Knowledge (“Feet on the Ground”) | • Relationships  
• Leadership |
# 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. |
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.
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.
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.
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.
Coaching is a reflective process.

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

An effective consumer of coaching is willing to examine her or his own mathematics content knowledge.
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.
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)
## Domains and Instruments

<table>
<thead>
<tr>
<th>Domain</th>
<th>Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics Teacher Efficacy (MTE) Teacher attitudes and beliefs</td>
<td>Teacher Survey (TS)</td>
</tr>
<tr>
<td>Coaching knowledge</td>
<td>Coaching Knowledge Survey (CKS)</td>
</tr>
<tr>
<td>Coach perceptions of coaching effectiveness and impact of that coaching</td>
<td>Coach Reflection and Impact Survey (CRIS)</td>
</tr>
<tr>
<td>Teacher perceptions of coaching effectiveness and impact of that coaching</td>
<td>Teacher Reflection and Impact Survey (TRIS)</td>
</tr>
<tr>
<td>Coaching skills</td>
<td>Coaching Skills Inventory (CSI)</td>
</tr>
<tr>
<td>Teacher reported needs for coaching mathematics</td>
<td>Teacher Needs Inventory (TNI)</td>
</tr>
<tr>
<td>Reform- and standards-based teaching practices</td>
<td>Inside the Classroom-Classroom Observation Protocol (ITC-COP)</td>
</tr>
</tbody>
</table>
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
COACHING SKILLS INVENTORY

Areas explored include:
- Coach/Teacher relationships
- Coaching skills
- Mathematics content
- Mathematics-specific pedagogy
- General pedagogy
- Background & practices as an educator
# EMC Coaching Skills Inventory

## I. Coach/Teacher Relationships

<table>
<thead>
<tr>
<th></th>
<th>Not at All Effective</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How effective do you feel observing lessons and giving teachers feedback?</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2. How effective do you feel creating environments where teachers reflect openly on their instructional practices?</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3. How effective do you feel helping teachers set goals and objectives aimed at improving their instruction?</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4. How effective do you feel creating an environment of open discussion and constructive criticism with teachers?</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
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/inquiry-based lessons
- Classroom environment
- Conceptual understanding of mathematics
- Mathematics content knowledge
- Classroom management
## EMC Teacher Needs Inventory

### IV. MATHEMATICS CONTENT KNOWLEDGE

<table>
<thead>
<tr>
<th>Question</th>
<th>Not at all Confident</th>
<th>Very Confident</th>
<th>Regarding this topic, …</th>
</tr>
</thead>
<tbody>
<tr>
<td>15. How confident are you with the mathematics you teach?</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>16. How confident are you with the mathematics beyond the mathematics that you teach, meaning the next grade level?</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>17. How confident do you feel planning lessons that include fraction concepts?</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>18. How confident do you feel planning lessons that include number sense and operations?</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
EMC Teacher Needs Inventory

How confident do you feel using cooperative learning?

<table>
<thead>
<tr>
<th>Not at all confident</th>
<th></th>
<th></th>
<th>Very confident</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

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.

[ ] | [ ] | [ ]
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
EMC Coach & Teacher Reflections

Areas explored include:

- Interactions with the coach / teacher
- Frequency of various activities:
  - pre-lesson conference,
  - observation,
  - post-lesson conference,
  - modeling a lesson, etc.
EMC Coach & Teacher Reflections

Areas also explored:
- Mathematics content
- Mathematical concept and inquiry
- Classroom environment/culture
- Reflection and planning
- Impact on teacher practice
## EMC Coach Reflection & Impact

### Mathematics Content

<table>
<thead>
<tr>
<th></th>
<th>Not at All</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>The teacher and I discussed significant and worthwhile mathematical content.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>b.</td>
<td>The teacher and I discussed mathematical content at the grade level(s) she/he teaches.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>c.</td>
<td>The teacher and I discussed ways to increase the level of cognitive demand of the mathematical content being taught.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>d.</td>
<td>The teacher and I discussed mathematical content beyond the grade level(s) she/he teaches.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
### EMC Teacher Reflection & Impact

#### Reflection and Planning

<table>
<thead>
<tr>
<th>Statement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>o. My coach and I set goals and objectives aimed at implementing ideas</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>and addressing issues we discussed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p. My coach and I were reflective about my students’ learning.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>q. My coach and I were reflective about my teaching practices.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>
CHALLENGES

- Staffing changes within schools and districts
- Schedule observations for teachers
- Coaches wanting PD before scheduled institute
- Online Professional Development/Support
- Student Achievement Data
- Research Team Leadership
FINDINGS

- PD provided uniformly superior offering of content and process enhancement for the coaches.

- Students of teachers who worked with coaches participating in the EMC Project increased their test scores slightly more than students of other teachers who did not work with coaches.

- Type A Intraclass Correlations showed observers were within one rating of each other, which is an accepted IRR analysis process.
**Findings**

- Middle school coaches have lower CKS scores than elementary coaches.

- Middle school teacher ratings were significantly higher than elementary teacher ratings on the Confidence for Teaching Mathematics scale.

- Elementary coaches had significantly higher levels of content knowledge than the elementary teachers and middle school coaches had significantly higher levels of content knowledge than the middle school teachers.
FINDINGS

- Teachers with high levels of efficacy for teaching mathematics:
  - have taken a higher number of mathematics courses for their bachelor’s degree;
  - are more engaged in activities related to mathematics teaching and learning;
  - score higher on levels of mathematics content knowledge;
  - have lower levels of anxiety for teaching mathematics; and
  - feel more prepared to teach mathematics.
FINDINGS

Mathematical content knowledge professional development had a positive impact on the coach participants:

- Statistically significant change for elementary coaches
- Non-statistically significant change for middle school coaches
EXAMINING MATHEMATICS COACHING

- Questions ???
- Insights …
- Ideas …
- Comments …
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