Professional Development for Grades K-8 Mathematics Coaches

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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.
Mathematics Coach: EMC Definition

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 include the why, what, and how of teaching mathematics.
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The effectiveness of a mathematics classroom coach is linked to several domains of knowledge. **Coaching knowledge** and **mathematics content knowledge** contribute significantly to a coach’s effectiveness, as measured by positive impact on teacher practice, attitudes, and beliefs.
Create two distinct one-week professional development courses

One course should shift participants’ knowledge of mathematics content, specifically in the area of number and operation, with a focus on ratio and proportion

One course should shift participants’ knowledge of coaching, as described in the literature, addressing eight themes identified by coaching experts
Knowledge Domains

- Mathematics Content Knowledge
- Coaching Knowledge
- Knowledge of Student Learning
- Knowledge of Teacher Learning
Each coach (n = 60) is randomly assigned to Group 1 or Group 2. Group 1 coaches have mathematics content PD, followed two summers later by coaching knowledge PD. Group 2 coaches have coaching knowledge PD, followed two summers later by mathematics content PD.
Professional Development design

- 45 hours, 1 week, residential
- Participants are all coaches enrolled in the research project
- Experience in mathematics coaching varies considerably
- Mathematical knowledge varies considerably
Mathematics Content
## Mathematics Content Topics

<table>
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<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
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<tbody>
<tr>
<td>Number Sense</td>
<td>Computation</td>
<td>Fraction Concepts</td>
<td>Fraction Operations and Ratios</td>
<td>Proportional Reasoning and Percents</td>
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CCSS: Mathematical Practices K-12
Common Core State Standards

- Make sense of problems and persevere in solving them
- Reason abstractly and quantitatively
- Construct viable arguments and critique the reasoning of others
- Model with arithmetic
- Use appropriate tools strategically
- Attend to precision
- Look for and make use of structure
- Look for and express regularity in repeated reasoning.
Mathematical Themes: 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.
Mathematical Themes: 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.
Mathematical Themes: 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.
Mathematical Themes: Fraction Operations and Ratios

- Models for fractions and their operations reveal *structure* that underlies computational methods.

- Various mathematical connections link ratios and fractions.
Mathematical Themes: Percents

- 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 topics

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<th>Monday</th>
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<tbody>
<tr>
<td>Teacher Learning</td>
<td>Student Learning &amp; Teacher Practices</td>
<td>Communication for Coaching</td>
<td>Logistics of Coaching</td>
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Teaching coaches to recognize standards-based mathematics

- Develops mathematical processes (problem solving, reasoning and proof, etc.)
- Develops mathematical practices (make sense and persevere, model and use structure, etc.).
- Addresses mathematical strands of proficiency
Example: Assignment

Every new document produced uses its own terminology to express elements/characteristics of standards-based mathematics.

What similarities/differences occur between these three documents?

- Helping Children Learn Mathematics
- Mathematical practices of Common Core State Standards
- NCTM process standards
Warning! Participants tend to brush aside important differences

“\[ They\] are all the same. \]"
Understanding research on the “growth mindset”: advocating “persistence in problem solving”
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Understanding research on “learning styles”: Providing all students with the opportunity and expectation to understand mathematics using a wide variety of instructional models and representations CCSS “tools” and “structure” practices
Participants’ questions

Nearly universally, participants seek to understand details of CCSS assessment plans.
Adjustments the next time around

- Be more explicit to participants about CCSS connections in mathematics content themes and in grade-level alignment
- Challenge participants to identify and understand the depth of differences in CCSS practices from previous documents
Thank you!

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Project Variables and Measures

Mathematical Knowledge for Teaching

Mathematics Content Knowledge

Implementation of Coaching Model

Coaching beliefs, knowledge, skills, and practice

Coaching Effectiveness

Teacher Variables

Mathematics Content Knowledge

Classroom practice

Teacher anxiety, efficacy, engagement, and preparedness

Coaching emphasis

Coaching impact

Measures

Inside the Classroom Observation Protocol

Teacher Survey

Teacher Needs Inventory

Teacher Reflection and Impact Survey

Coaching Knowledge Survey & Coaching Skills Inventory