Findings From the First Year of a K-6 Mathematics Coaching Project

NCTM Research Preession
Atlanta, Georgia  March 2007

Diana Erchick
erchick.1@osu.edu
Lisa Douglass
douglass.47@osu.edu

Patti Brosnan
brosnan.1@osu.edu
Melva Grant
grant.121@osu.edu

Denise Forrest
forrest.7@osu.edu
Kim Hughes
khughes@netwalk.com
Welcome!

- About the title of our session
- Introductions
- Studies being presented
  - Program Evaluation Components
  - Additional Pilot Studies
- Structure for the session
Mathematics Coaching Program: The Journey

**What** do we need to do to improve student mathematics achievement?

- Use Research-Based, Reform-Based Methodologies
  - Inquiry, Discovery, Guided Discovery
  - Problem-Based, Student Centered, Cooperative Learning
  - Cognitively Guided Instruction
  - Focus on Process Standards and Student Thinking

**Who** have we been most committed to working with?

- Students in urban and rural settings
- Teachers in urban and rural settings, especially those in districts with limited PD budgets and support.
Mathematics Coaching Program: The Journey

Why are the research-based methods not being used?
- Lack of knowledge, lack of confidence, lack of support?
- Time, my room, my kids, my materials, no support.

What do we need to do to get teachers to use these methodologies?
- Improve Teacher Content Knowledge
- Improve Teacher Pedagogical Content Knowledge
- Erase the barriers: Time, my room, my kids, my materials, no support.

How do we get this to happen?
- Long-Term, High-Quality, Job-Embedded Professional Development and Technical Support
Mathematics Coaching Program

• Mathematics Coaches
  – Mathematics Specialists assigned to an elementary school
  – Provide job-embedded professional development to teachers
  – Team teach with classroom teachers using best practices

• MCP - The Goal
  – How do we get these ideas in this classroom, with this teacher, with these students, with this curriculum, and with these materials.

• Research Contributions
  – How is high-quality job-embedded professional development related to student mathematics achievement?
  – How does work centered on mathematics coaches as professional development providers result in teacher and coach learning?
  – In what ways do teachers transfer their professional learning into classroom practice?
MCP Structural Model

Technical Assistance Team: Project PI's and Facilitators

- School-Based Mathematics Coaches District Hires
  - Teachers in Coach's Building
    - Students
- School-Based Mathematics Coaches District Hires
  - Teachers in Coach's Building
    - Students
- School-Based Mathematics Coaches District Hires
  - Teachers in Coach's Building
    - Students
MCP Conceptual Framework

- **Content knowledge:** Limited to rigorous
- **Societal norms:** Cultural ignorance to cultural awareness
- **Classroom norms:** Externalized authority to shared authority
- **Equity & Diversity:** Umbrella focus to individual focus
- **Process:** Static application to dynamic integration
- **Classroom interactions:** Teacher-centered to student-centered
- **Task selection:** Rigid procedural focus to richly connected and integrated conceptual/procedural focus
- **Assessment:** Judgmental focus to informative focus
Context for Research

- **Mathematics Coaching Program (MCP)**
  - State Funded Pilot Program
  - 34 Low-Performing Schools (urban, urban-fringe, rural)
  - Coaching Project Started in January

- **Presented Studies**
  - Student Content Knowledge
  - Coach and Teacher Mathematics and Pedagogical Content Knowledge
  - Teacher and Student Work as Reported by Coaches
  - Coach Development as Leaders
Student Mathematics Content Knowledge (Brosnan)

• Instrumentation
  – Pre/Post Test: Half Length Released Ohio Achievement Tests at each grade level 3 and 4. Pre/Post Tests given in January and May
  – Full Ohio Achievement Tests Grades 3-4 Given in March

• Quantitative Data
  – Third graders improved by 8.2% on Pre/Post
  – Fourth graders improved by 14.2% on Pre/Post
  – OAT shows 9.6% gain from previous third grade results.

• Qualitative Data
  – Extended Response Items: answered, more articulate, conceptual and procedural development, and greater understanding
Student Mathematics Achievement

- **State Average**
  - March 2005: 70.4
  - March 2006: 74.9
  - Percent increase for schools statewide: 6.4%

- **MCP Average**
  - March 2005: 55.4
  - March 2006: 60.5
  - Percent increase for MCP schools: 9.2%
Student Mathematics Achievement

Percent Increase from Year 0 to Year 1

- **State**
- **Non-MCP**
- **MCP**

Percent Increase

The Ohio State University
Mathematics Coaching Program 2006-2007
Extended-Response Problem

• Twelve students wrote their names and the number of letters in their names on cards as shown.

  Tommy
  5

  Elli
  4

• Use the line to construct a line plot of the information on the students’ cards. Use X to show the data.

  2  3  4  5  6  7  8
10. Twelve students wrote their names and the number of letters in their names on cards as shown.

<table>
<thead>
<tr>
<th>Name</th>
<th>Number of Letters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grant</td>
<td>5</td>
</tr>
<tr>
<td>Ali</td>
<td>3</td>
</tr>
<tr>
<td>Courtney</td>
<td>8</td>
</tr>
<tr>
<td>Kim</td>
<td>3</td>
</tr>
<tr>
<td>Owen</td>
<td>4</td>
</tr>
<tr>
<td>Heidi</td>
<td>5</td>
</tr>
<tr>
<td>Katie</td>
<td>5</td>
</tr>
<tr>
<td>Mark</td>
<td>4</td>
</tr>
<tr>
<td>Linda</td>
<td>5</td>
</tr>
<tr>
<td>June</td>
<td>4</td>
</tr>
<tr>
<td>Abdul</td>
<td>5</td>
</tr>
<tr>
<td>Connie</td>
<td>6</td>
</tr>
</tbody>
</table>

Use the line to construct a line plot of the information on the students' cards. Use X to show the data.

Find the median, mode and range of the data on the cards.

- **Median:** 5
- **Mode:** 5
- **Range:** 5

I found the median by crossing off the numbers until I got my answer.

I found the mode by counting which one had the most.

I found the range by taking the bigger number and smaller number and subtracted them. 4-0=4
Learnings From Student Mathematics Content Knowledge

• Use within-grade full-length achievement tests as pre-tests at each grade level 3-6.
• Develop extended response item sets across the five content standards for each grade level 3-6.
• Turn the ‘blip’ into a positive trend.
Coach and Teacher Content and Pedagogical Knowledge (Erchick)

• Learning about Mathematics Pedagogy (LAMP)

• Sample LAMP Item:
Miss Jones put the following picture on the overhead and asked her students to identify all of the rectangles.

A  B  C  D  E  F  G

• Jose picked A, B, and D. Is he correct or not? Explain your reasoning.
• Name or describe each of the non-rectangles from among the figures A-G.
• What mathematical concepts are being addressed in this problem?
## Comparing Coach and Teacher Pre-Program Responses to the Rectangle Item

<table>
<thead>
<tr>
<th></th>
<th>Teacher (random sample) pre-program responses</th>
<th>Coach pre-program responses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Item a.  Was Jose correct?</strong></td>
<td>• 67% of the teacher responses were correct with one &quot;it depends on the definition of a rectangle&quot;</td>
<td>• 68% of the coach responses were correct</td>
</tr>
<tr>
<td><strong>Item b. Which are not rectangles?</strong></td>
<td>• 56% of the teacher responses were correct</td>
<td>• 64% of the teacher responses were correct</td>
</tr>
</tbody>
</table>
LAMP Scores

<table>
<thead>
<tr>
<th>Percent Score</th>
<th>Pre Test</th>
<th>Post Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cont Coach</td>
<td>60%</td>
<td>70%</td>
</tr>
<tr>
<td>Ped Coach</td>
<td>40%</td>
<td>50%</td>
</tr>
<tr>
<td>Total Coach</td>
<td>60%</td>
<td>70%</td>
</tr>
<tr>
<td>Cont Teacher</td>
<td>40%</td>
<td>50%</td>
</tr>
<tr>
<td>Ped Teacher</td>
<td>20%</td>
<td>30%</td>
</tr>
<tr>
<td>Total Teacher</td>
<td>40%</td>
<td>50%</td>
</tr>
</tbody>
</table>
Sample of Coach and Teacher Qualitative Growth: Content

Geometry example, part C, what concepts…?

• Pre-test: “Basic geometry math concepts are being addressed here. Understanding shapes and their identity”

• Post-test: “Recognize or identifying shapes via their attributes: vertices, angles, closed/open shapes, comparing”
Insights from Coach and Teacher Content and Pedagogy Instruments

• The need for MCP to attend to coach mathematics and pedagogical content knowledge, as opposed to methods of coaching, is understandable.

• Continue development and use of the LAMP instrument.

• Find more ways to determine exactly what the coaches are doing in their daily coaching work.

• Find more ways to determine exactly what the teachers and students are doing in the coached classrooms.
Coaches Written Descriptions of Teachers’ Changes (Grant & Hughes)

Participants:
- 9 MCP coaches (urban & rural districts; two 5-6 Intermediate buildings; seven elementary buildings)

Data Sources:
- Audio-taped focus group discussions
- Transcriptions of individual coach interviews
- Classroom observations
- Qualitative survey instrument
Research Study Details

Research question:
• How do coaches describe teachers’ changes?

Additional Goals:
• Create an instrument and/or protocol to get rich descriptions of teacher change, consistently.
• To gather data about what is happening in the classroom and what the coaches are doing in their daily work.
Preliminary Findings

- Coaches’ definition of change differed from investigators’
- Describing teacher’s change is challenging
- Emergent themes used by coaches to describe teachers’ changes
  - Instructional strategies
  - Professional discourse
  - Teacher’s reflection
Emerging Questions

• Are we really getting the “best” stories?
• How can coaches’ descriptions of change be used to inform their work with teachers?
• What types of changes tend to be self-sustaining and/or generative?
Transitioning from Teacher to Mathematics Leader, From the Coaches Point of View (Forrest and Douglass)

• Participants:
  – 9 MCP coaches from 2 facilitator groups (8 elementary and 1 intermediate).

• Data sources:
  – Autobiographical statement describing coach as learner of mathematics, teacher of mathematics, and coach of mathematics.
  – Periodic coach reports
  – Large and small group observation records
  – Interview
  – MCP Assessments: pedagogical content knowledge, mathematical content knowledge, and mathematical dispositions
Phrases coaches use to describe their role as mathematical leader

#1 Helping teachers by pulling materials, manipulatives, and other resources

#2 Modeling how mathematics can be taught a different way

#3 Working with kids on mathematics: math clubs, math night, tutoring, and test preparation

#4 Providing information to teachers about teaching mathematics differently
Where coach language places them on the pedagogical continuum

Classroom interactions

Before starting the MCP.

Coach as learner
Coach as teacher
Where coach language places them on the pedagogical continuum

Classroom interactions

Before starting the MCP.

Coach as learner

Coach as teacher

After MCP.

Coach as teacher
Where coach language places them on the pedagogical continuum

### Classroom interactions

<table>
<thead>
<tr>
<th></th>
<th>Before starting the MCP.</th>
<th>After MCP.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coach as learner</strong></td>
<td><img src="teacher-centered.png" alt="Teacher Centered" /></td>
<td><img src="teacher-centered.png" alt="Teacher Centered" /></td>
</tr>
<tr>
<td><strong>Coach as teacher</strong></td>
<td><img src="teacher-centered.png" alt="Teacher Centered" /></td>
<td><img src="teacher-centered.png" alt="Teacher Centered" /></td>
</tr>
<tr>
<td><strong>Coach as coach</strong></td>
<td><img src="teacher-centered.png" alt="Teacher Centered" /></td>
<td><img src="teacher-centered.png" alt="Teacher Centered" /></td>
</tr>
</tbody>
</table>
Where coach language places them on the pedagogical continuum

Task selection

Before starting the MCP.

Coach as learner

Coach as teacher
Where coach language places them on the pedagogical continuum

Task selection

Before starting the MCP.

Coach as learner

Coach as teacher

After MCP.

Coach as teacher

Elements of Mathematical context

Pedagogical

Student

Rigid, procedural focus

Richly connected and integrated conceptual/procedural focus
Where coach language places them on the pedagogical continuum

Task selection

Before starting the MCP.

Coach as learner

Coach as teacher

After MCP.

Coach as teacher

Coach as coach

Rigid, procedural focus

Richly-connected and integrated conceptual/procedural focus
Where coach language places them on the pedagogical continuum

<table>
<thead>
<tr>
<th>Interactions</th>
<th>Teacher centered</th>
<th>Student centered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coach as learner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coach as teacher</td>
<td>Yellow</td>
<td></td>
</tr>
<tr>
<td>Coach as teacher</td>
<td></td>
<td>Blue</td>
</tr>
<tr>
<td>Coach as coach</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Task selection</th>
<th>Rigid, procedural focus</th>
<th>Richly connected and integrated conceptual/procedural focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coach as learner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coach as teacher</td>
<td>Yellow</td>
<td></td>
</tr>
<tr>
<td>Coach as teacher</td>
<td></td>
<td>Blue</td>
</tr>
<tr>
<td>Coach as coach</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
To be continued…

• These data represent the coach point of view, and other perspectives need to be considered.

• How can the facilitator role support the coaches’ movement on the continuum?
Your Turn

• What questions emerge for you from these studies?
• Based on your experience in teaching and research, what ideas do you have about:
  – What can make our current research more robust?
  – Additional research studies you believe we need?
  – What would help the MCP from a program perspective?
Mathematics Coaching Program
The Ohio State University

Please do not cite without authors’ permission