What Does the Research Say About Mathematics Coaching? An Update

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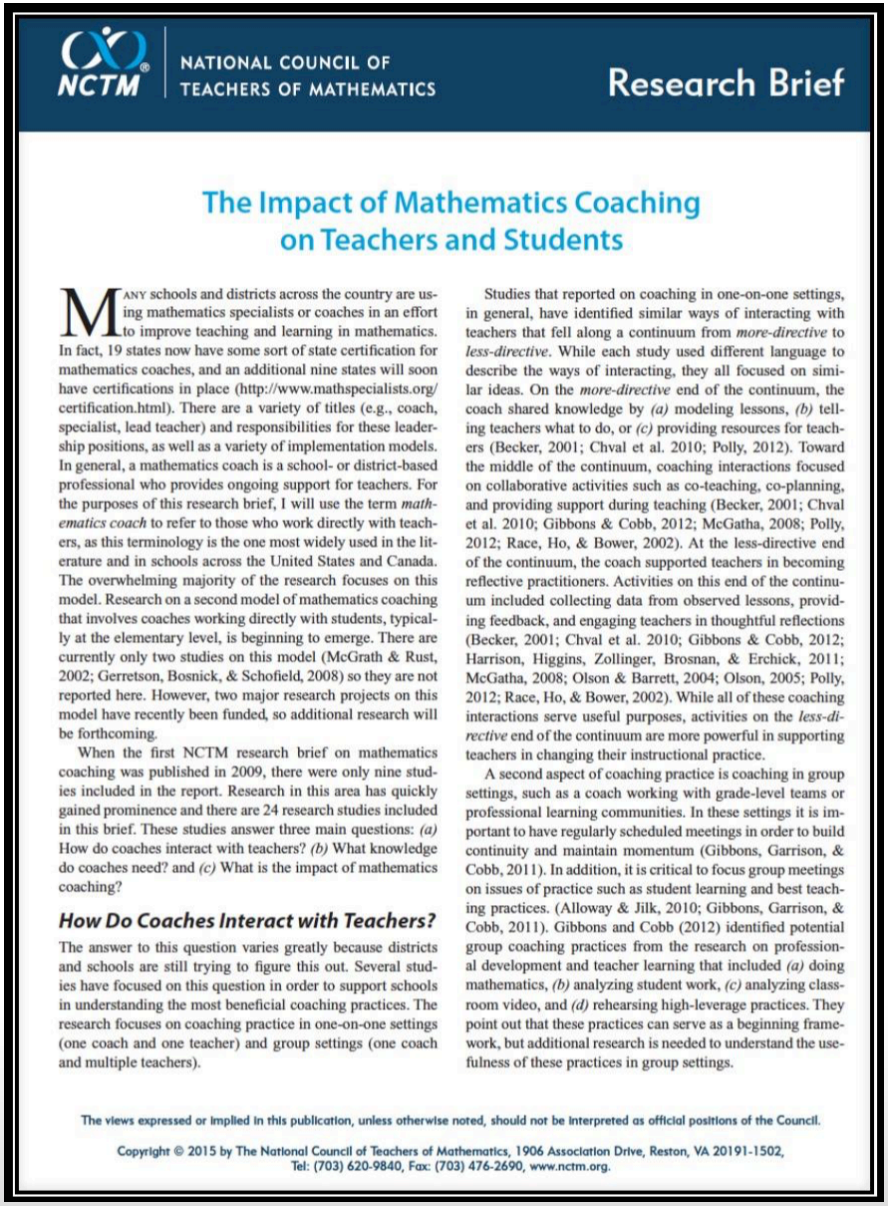
- 2009 NCTM Research Brief – 9 studies
- 2015 NCTM Research Brief – 24 studies



NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Research Brief

The Impact of Mathematics Coaching on Teachers and Students

Many schools and districts across the country are using mathematics specialists or coaches in an effort to improve teaching and learning in mathematics. In fact, 19 states now have some sort of state certification for mathematics coaches, and an additional nine states will soon have certifications in place (http://www.mathspecialists.org/certification.html). There are a variety of titles (e.g., coach, specialist, lead teacher) and responsibilities for these leadership positions, as well as a variety of implementation models. In general, a mathematics coach is a school- or district-based professional who provides ongoing support for teachers. For the purposes of this research brief, I will use the term *mathematics coach* to refer to those who work directly with teachers, as this terminology is the one most widely used in the literature and in schools across the United States and Canada. The overwhelming majority of the research focuses on this model. Research on a second model of mathematics coaching that involves coaches working directly with students, typically at the elementary level, is beginning to emerge. There are currently only two studies on this model (McGrath & Rust, 2002; Gerretson, Bosnick, & Schofield, 2008) so they are not reported here. However, two major research projects on this model have recently been funded, so additional research will be forthcoming.

When the first NCTM research brief on mathematics coaching was published in 2009, there were only nine studies included in the report. Research in this area has quickly gained prominence and there are 24 research studies included in this brief. These studies answer three main questions: *(a)* How do coaches interact with teachers? *(b)* What knowledge do coaches need? and *(c)* What is the impact of mathematics coaching?

How Do Coaches Interact with Teachers?

The answer to this question varies greatly because districts and schools are still trying to figure this out. Several studies have focused on this question in order to support schools in understanding the most beneficial coaching practices. The research focuses on coaching practice in one-on-one settings (one coach and one teacher) and group settings (one coach and multiple teachers).

Studies that reported on coaching in one-on-one settings, in general, have identified similar ways of interacting with teachers that fell along a continuum from *more-directive* to *less-directive*. While each study used different language to describe the ways of interacting, they all focused on similar ideas. On the *more-directive* end of the continuum, the coach shared knowledge by *(a)* modeling lessons, *(b)* telling teachers what to do, or *(c)* providing resources for teachers (Becker, 2001; Chval et al. 2010; Polly, 2012). Toward the middle of the continuum, coaching interactions focused on collaborative activities such as co-teaching, co-planning, and providing support during teaching (Becker, 2001; Chval et al. 2010; Gibbons & Cobb, 2012; McGatha, 2008; Polly, 2012; Race, Ho, & Bower, 2002). At the less-directive end of the continuum, the coach supported teachers in becoming reflective practitioners. Activities on this end of the continuum included collecting data from observed lessons, providing feedback, and engaging teachers in thoughtful reflections (Becker, 2001; Chval et al. 2010; Gibbons & Cobb, 2012; Harrison, Higgins, Zollinger, Brosnan, & Erchick, 2011; McGatha, 2008; Olson & Barrett, 2004; Olson, 2005; Polly, 2012; Race, Ho, & Bower, 2002). While all of these coaching interactions serve useful purposes, activities on the *less-directive* end of the continuum are more powerful in supporting teachers in changing their instructional practice.

A second aspect of coaching practice is coaching in group settings, such as a coach working with grade-level teams or professional learning communities. In these settings it is important to have regularly scheduled meetings in order to build continuity and maintain momentum (Gibbons, Garrison, & Cobb, 2011). In addition, it is critical to focus group meetings on issues of practice such as student learning and best teaching practices. (Alloway & Jilk, 2010; Gibbons, Garrison, & Cobb, 2011). Gibbons and Cobb (2012) identified potential group coaching practices from the research on professional development and teacher learning that included *(a)* doing mathematics, *(b)* analyzing student work, *(c)* analyzing classroom video, and *(d)* rehearsing high-leverage practices. They point out that these practices can serve as a beginning framework, but additional research is needed to understand the usefulness of these practices in group settings.

Mathematics Coaching Research

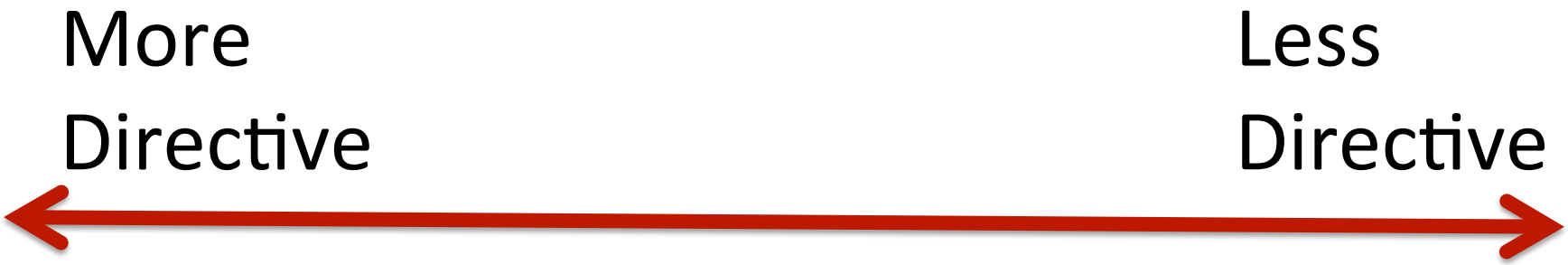
1. How do coaches interact with teachers?
2. What knowledge do coaches need?
3. What is the impact of mathematics coaching?

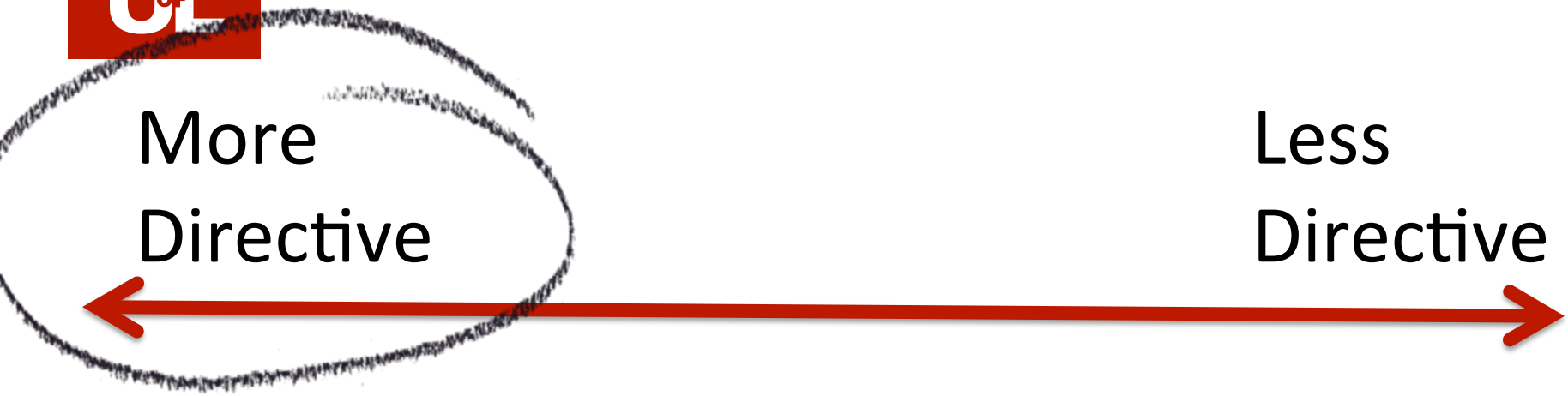
How Do Coaches Interact with Teachers?

- One-on-One
- Groups (PLC or grades)

How Do Coaches Interact with Teachers?

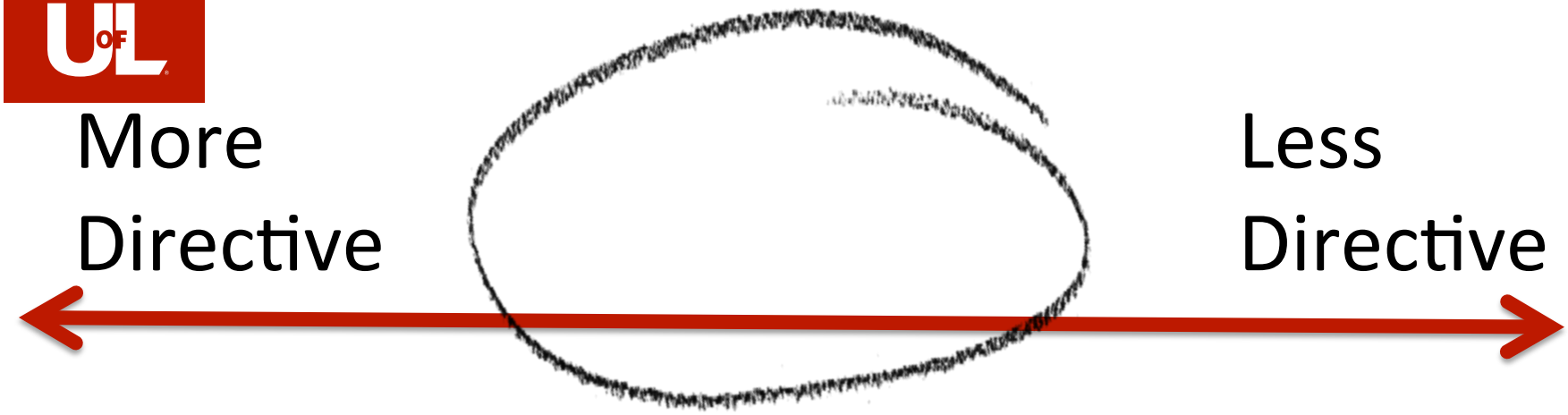
- One-on-One Settings





- Modeling Lessons
- Telling Teachers What to Do
- Finding Resources for Teachers

Becker, 2001; Chval, Arbaugh, Lannin, van Garderen, Cummings, Estapa, & Huey, 2010; Polly, 2012.



- Co-teaching
- Co-planning
- Providing Support during Teaching

Becker, 2001; Chval, Arbaugh, Lannin, van Garderen, Cummings, Estapa, & Huey, 2010; Gibbons & Cobb, 2012; McGatha, 2008; Polly, 2012; Race, Ho, & Bower, 2002.

More Directive

Less Directive

- Collecting Data from Observed Lessons
- Providing Feedback
- Engaging Teachers in Thoughtful Reflections

Becker, 2001; Chavl, Arbaugh, Lannin, van Garderen, Cummings, Estapa, & Huey, 2010; Gibbons & Cobb, 2012; Harrison, Higgins, Zollinger, Brosnan, & Erchick, 2011; McGatha, 2008; Olson & Barrett, 2004; Olson, 2005; Polly, 2012; Race, Ho, & Bower, 2002.

How Do Coaches Interact with Teachers?

- **Group Settings**
  - Important to have regularly-scheduled meetings to build community & maintain momentum (Gibbons, Garrison, & Cobb, 2011)
  - Critical to focus meetings on issues of practice such as student learning and best teaching practice (Alloway & Jilk, 2010; Gibbons, Garrison, & Cobb, 2011)

How Do Coaches Interact with Teachers?

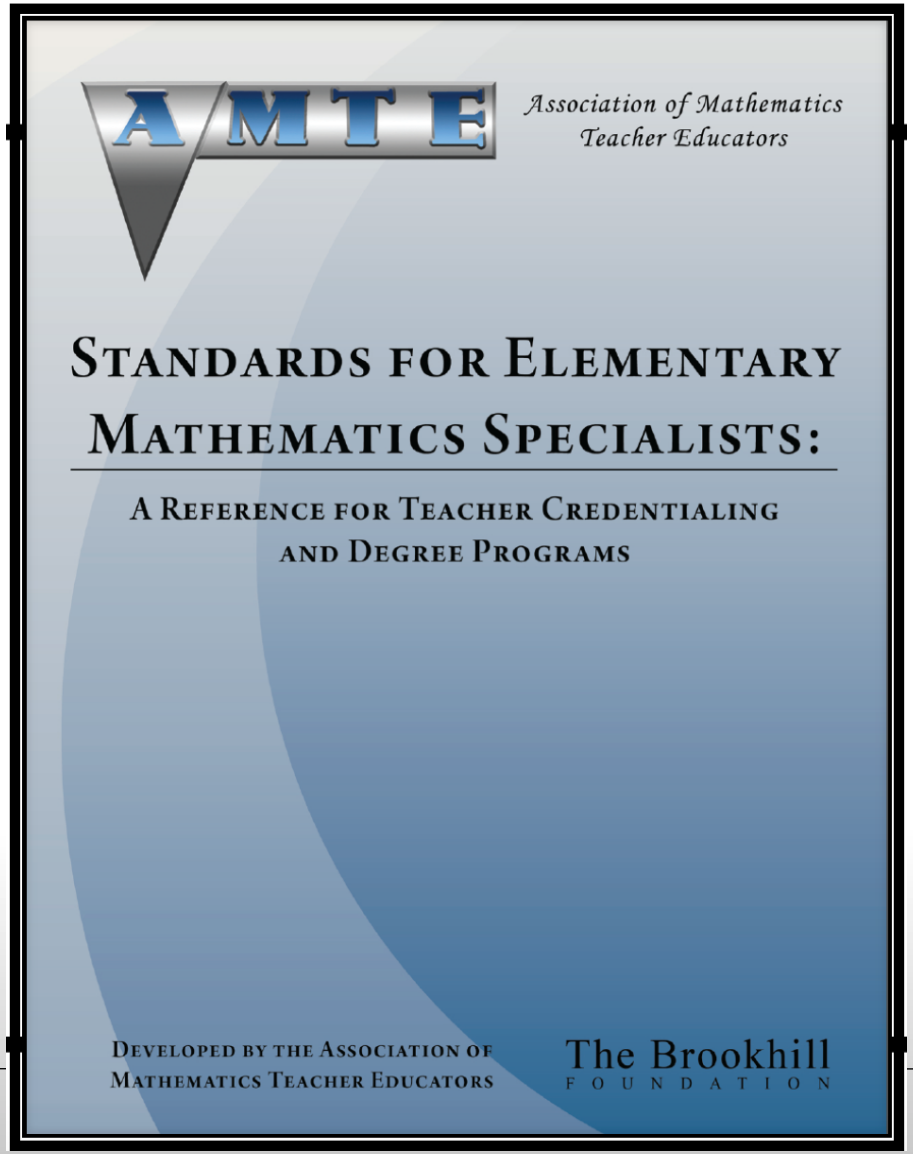
- **Group Settings**
  - Potential Group Coaching Practices
    - doing mathematics
    - analyzing student work
    - analyzing classroom video
    - rehearsing high leverage practices

Gibbons and Cobb, 2012

What Knowledge Do Coaches Need?

- Content
- Pedagogy
- Leadership

What Knowledge Do Coaches Need?



What Knowledge Do Coaches Need?

- AMTE Standards for EMS
  - Content Knowledge for Teaching
  - Pedagogical Content Knowledge for Teaching Mathematics
  - Leadership Knowledge and Skills

What Knowledge Do Coaches Need?

- Understand trajectories of teacher development in order to provide differentiated experiences for teachers (Baldinger, 2014; Gibbons, 2013; Sutton, Burroughs, & Yopp, 2011)
- Create long-term goals for teachers' development (Gibbons, 2013)

What Knowledge Do Coaches Need?

Coaches should have a deep knowledge of instructional practice and theory so they can support teachers in

a. assessing their own practice (Gibbons, 2013);

b. making connections between theory and practice (Alloway & Jilk, 2010; Sutton, Burroughs, & Yopp, 2011).

What Knowledge Do Coaches Need?

- Adequate preparation so they possess the knowledge necessary to be effective coaches (Campbell & Malkus, 2013).

What Is the Impact of Mathematics Coaches?

- Improving Teacher Practice
- Improving Student Achievement

What Is the Impact of Mathematics Coaches?

- Instructional Practice
  - Questioning (Polly, 2012; Race, Ho, & Bower, 2002)
  - Student Engagement (Balfanz, MacIver, & Byrnes, 2006; Race, Ho, & Bower, 2002)
  - Teaching for Understanding (Becker & Pence, 2003; Neuberger, 2012)

What Is the Impact of Mathematics Coaches?

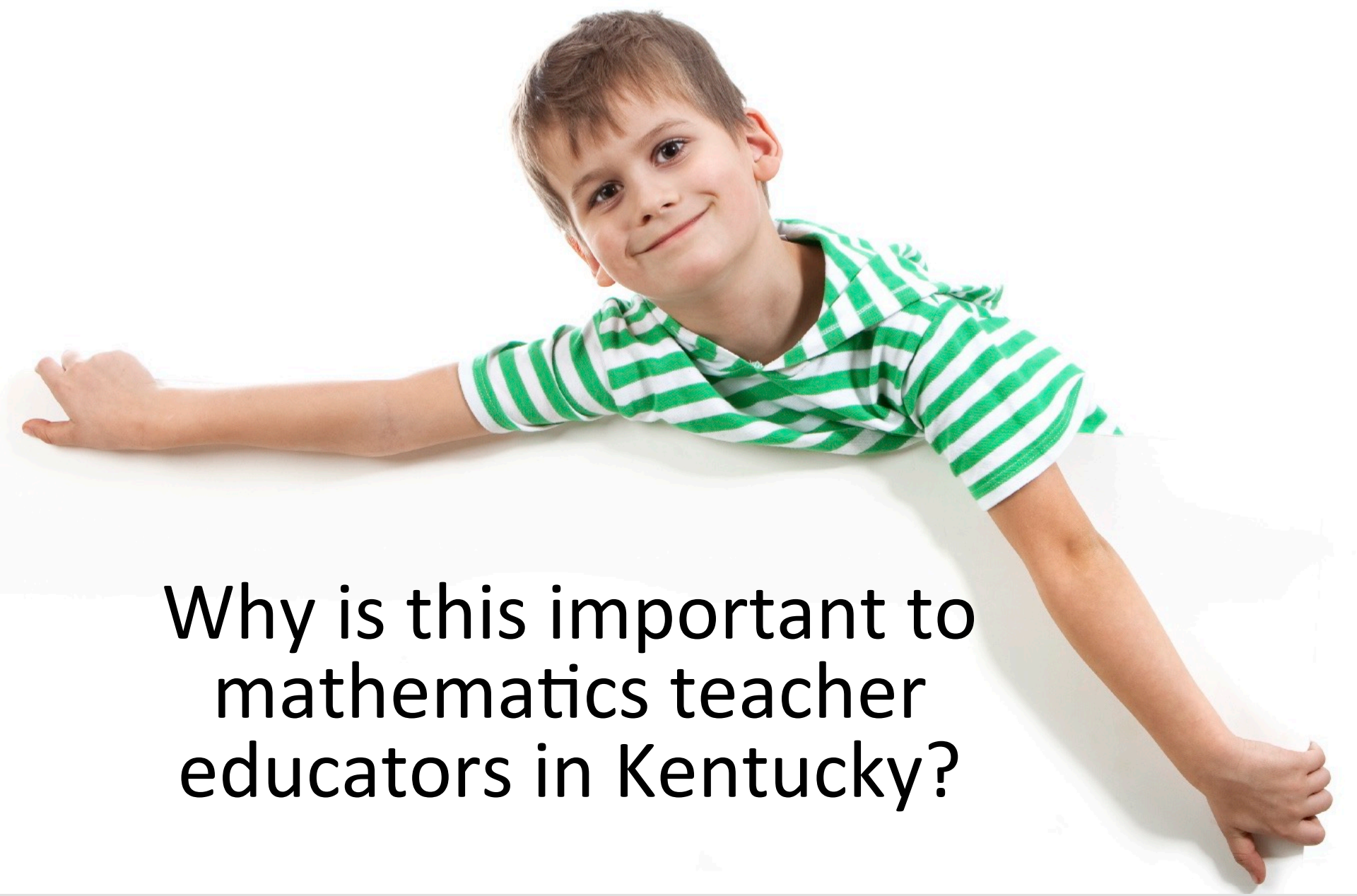
- Instructional Practice
  - Cooperative Learning (Balfanz, MacIver, & Byrnes, 2006; Becker & Pence, 2003)
  - Classroom Discourse (Balfanz, MacIver, & Byrnes, 2006; Race, Ho, & Bower, 2002)
  - Technology (Becker & Pence, 2003)

What Is the Impact of Mathematics Coaches?

- Student Achievement
  - Achievement on state level assessments increased during the first and second years of a coaching program (Conaim, 2010; Zolligner, Brosnan, Erchick, & Bao, 2010).
  - Achievement after four years of a coaching program showed even stronger results (Balfanz, MacIver, & Byrnes, 2006; Brosnan & Erchick, 2010; Campbell & Malkus, 2011)

What Is the Impact of Mathematics Coaches?

- Student Achievement
  - Pass rates in Algebra and Geometry classes increased from 40% to 70% after the implementation of coaching (Alloway & Jilk, 2010)

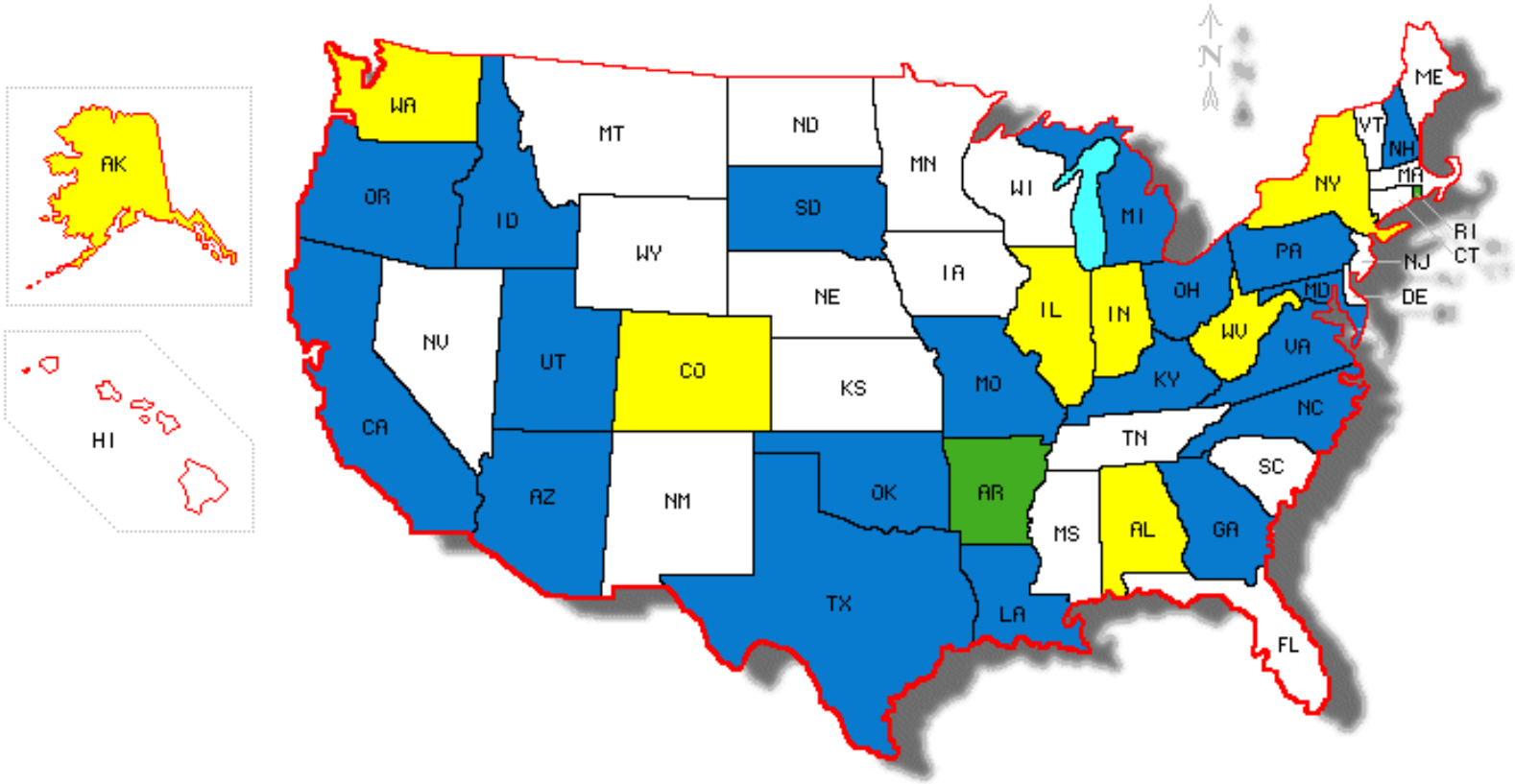


Why is this important to mathematics teacher educators in Kentucky?

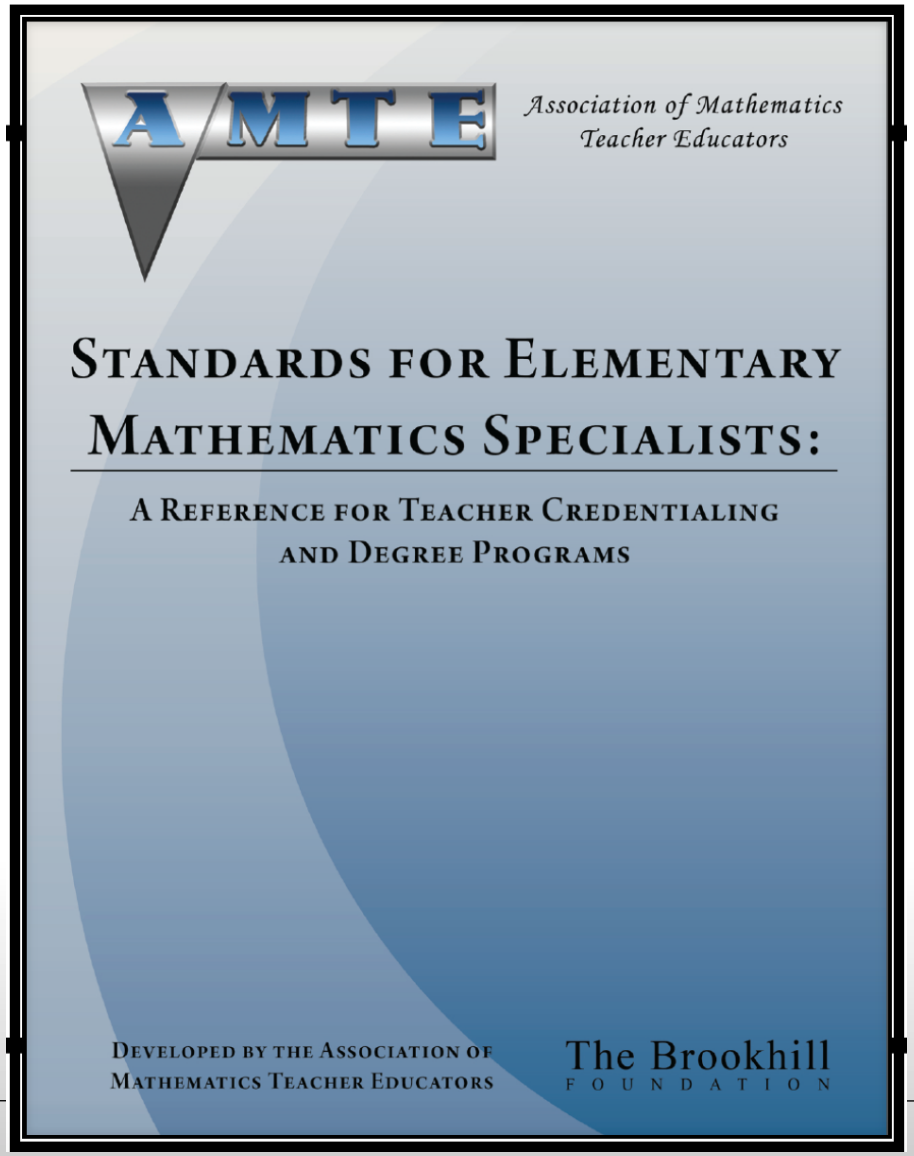
- Developing Programs
- Professional Development
- Research

Elementary Mathematics Specialist Certification

- With Certification
- In Final Stages
- In Process



EMS Program Development



School Partnerships

Mathematics Coaching Research

1. How do coaches interact with teachers?
2. What knowledge do coaches need?
3. What is the impact of mathematics coaching?


EXPLORE
EXPERIMENT
PROJECT
ASK
EXPERIMENT
EXAMINE
IMPACT
THINK
INFORMATION
PROOF
EDUCATION
LEARNING
ASK
MISSION
LINK
EXAMINATION
KNOWLEDGE
TEACHING
SCIENCE
DATA
ASK
LEARNING
RESEARCH
EXPERIMENT
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EXPERIMENT
LINK
INFORMATION


What about you and your institution?
How might you use the research on mathematics coaching in your programs, professional development or research?


Tak
Obrigado
감사합니다
Gracias
Merci
شكرا لك
Thank you
Danke
謝謝
Ευχαρι
Grazie
ありがとう