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# A Look Inside Mathematics Coaching: Roles, Content, and Dynamics

*Rejoice Mudzimiri*
University of Southern Mississippi
*Elizabeth A. Burroughs*
*Jennifer Luebeck*
Montana State University
*John Sutton*
RMC Research Corporation
*&*
*David Yopp*
University of Idaho
USA

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**Abstract:** Mathematics classroom coaching is used across the United States as a means for improving instruction, with the ultimate goal of improving student learning. The job assignments of coaches can vary widely across schools and districts. Regardless of the various forms that coaching

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can take, there is the consistent expectation that a coach's day-to-day work will positively influence classroom instruction. The study reported here attempts to gain a more complete picture of the job of an elementary mathematics coach based on the observation of seven coaches in five different districts for a day. We report the variety of ways we observed elementary mathematics coaches interact with teachers, and what roles and responsibilities they take on. Our analysis of these data led us to create a template for conducting observations of mathematics classroom coaching, which could be used by researchers seeking to conduct studies about coaching or by administrators seeking to document the day-to-day work of coaches.
**Keywords:** mathematics coaching; qualitative research

**Una mirada al interior del entrenamiento en matemáticas: roles, contenidos y dinámicas**
**Resumen:** entrenamientos en el área de matemáticas se utilizan extensivamente Estados Unidos con el objetivo final de mejorar el aprendizaje de los estudiantes. Las asignaciones de trabajo de los entrenadores varían ampliamente entre escuelas y distritos. Independientemente de las diversas formas que puede tomar los programas de entrenamiento, existe la expectativa que el trabajo de los entrenadores va a influir positivamente la enseñanza en los salones de clase. Este estudio intenta obtener una imagen más completa del trabajo de los entrenadores de matemáticas utilizando observaciones de siete entrenadores en cinco distritos diferentes. Presentamos la variedad de formas que observamos entrenadores de matemáticas elementales interactuando con docentes, los roles y responsabilidades asumen. Nuestro análisis de estos datos nos llevó a crear una plantilla para la realización de observaciones de entrenamientos de matemáticas, que podría ser utilizada por investigadores o por administradores tratando de documentar el trabajo diario de los entrenadores.
**Palabras clave:** entrenamientos de matemáticas; investigación cualitativa

**Um olhar dentro da formação em Matemática: funções, conteúdos e dinâmicas**
**Resumo:** treinamentos na área da matemática são usados extensivamente nos Estados Unidos com o objetivo final de melhorar a aprendizagem dos alunos. Atribuições de trabalho treinadores variam muito entre as escolas e distritos. Independentemente das várias maneiras que os programas de treinamento podem ter, há uma expectativa de que o trabalho dos treinadores vai afetar positivamente o ensino em sala de aula. Este estudo tenta obter uma imagem mais completa do trabalho dos treinadores de matemática por meio de observações de sete treinadores em cinco distritos diferentes. Apresentamos a variedade de formas que os treinadores de matemática interagem com os professores, os papéis e as responsabilidades assumidas. Nossa análise desses dados levou-nos a criar um modelo para fazer observações de formação matemática, que poderia ser usado por pesquisadores e administradores que tentam documentar o cotidiano de trabalho dos treinadores.
**Palavras-chave:** formação de matemática; pesquisa qualitativa

## Introduction

A *coach* can be defined as a teaching professional who works collaboratively with a classroom teacher to improve that teacher's practice, with the goal of affecting student learning (Sutton, Burroughs, & Yopp, 2011). Coaching is a popular approach to improving elementary mathematics teaching, as noted by the National Mathematics Advisory Panel (2008). However, how classroom coaching is implemented within the day-to-day job assignments of coaches can vary widely across schools and districts. Killion (2009) identifies 10 different roles most often taken on by classroom coaches. The most prominent role, and the one of most interest in this study, is the role of the

coach in supporting instruction. In this scenario, the coach works side by side with teachers in their classrooms, identifying potential areas of classroom improvement and working with teachers to enact that improvement. Within this role, the approach taken to identify and enact instructional improvement can vary widely, influenced in part by the coaching model (or philosophy) that a particular coach adopts. Most classroom coaching models employ a three-part coaching cycle, including a pre-lesson conference, a lesson observation, and a post-lesson conference, also known as a debriefing (Carr, Herman, & Harris, 2005).

Regardless of the various models that coaching can employ, there is a consistent expectation that a coach's day-to-day work will positively influence classroom instruction. Because implementing coaching involves considerable cost and logistical effort for schools, research that examines mathematics classroom coaching is timely and relevant, with immediate policy implications for districts who employ classroom coaches and teacher educators who prepare and support coaches through professional development efforts. The study reported here attempts to gain a more complete picture of the job of an elementary mathematics coach based on observation and "shadowing" of seven coaches in five different districts. We offer the results of our analysis to further clarify what it means to be a coach and to lay the groundwork for further studies about coaching or observations of coaches.

## Review of Literature

In the following section we discuss the need for mathematics coaching, the variety of roles adopted by mathematics coaches, and the importance of developing a refined definition of elementary classroom mathematics coaching.

### Why Mathematics Coaching?

With research evidence suggesting that teacher knowledge is linked to student achievement (Hill, Rowan, & Ball, 2005), there has been a consistent focus on improving teacher knowledge in recent years. This movement was launched over a decade ago when Darling-Hammond (1999) noted that "no other intervention can make the difference that a knowledgeable, skilled teacher can make in student achievement" (p. 5). Soon after, the National Commission on Mathematics and Science Teaching for the 21st Century (2000) cited improving mathematics and science teaching as "the most direct route to improving mathematics and science achievement for all students" (p. 7).

These claims, with support from new initiatives such as the U.S. Department of Education's Mathematics and Science Partnerships, led to a broad spectrum of professional development opportunities to help teachers learn about new curricula and best practices with the goal of ultimately improving classroom instruction. At the same time, researchers were promoting innovative and school-based professional learning experiences that challenged the norms of traditional professional development for teachers. Such norms included

> occasional workshops, typically lasting less than a day, each one focusing on discrete topics (such as classroom management, computer-based instruction, student motivation, assessment, the teaching of phonics, and so on), with their connection to the classroom left to teachers' imaginations. (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009, p. 9)

Professional development has been shown to be less effective when it is removed from teachers' classrooms and not directly related to the issues they face every day. The result is a lack of impact on the teachers' instructional practices (Neufeld & Roper, 2003) and, consequently, their students' learning experiences.

Darling-Hammond et al. (2009) offer research-based design principles to alleviate the shortcomings of traditional professional development. They suggest that teacher learning experiences should:

1. be intensive, ongoing, and connected to practice;
2. focus on student learning and address the teaching of specific curriculum content;
3. align with school improvement priorities and goals; and
4. build strong working relationships among teachers (pp. 9–11).

Many professional development projects in recent years have incorporated innovative and school-based experiences designed to meet these objectives, and many of those experiences have involved coaching. Mathematics classroom coaching naturally embodies these principles as an on-site professional development model for mathematics teachers that is intensive, ongoing, and targeted to help teachers address issues they face in their own classrooms.

There is emerging research evidence to suggest that mathematics coaching has a positive impact on student achievement. Obara and Sloan (2009) report positive results in student achievement in a middle school that used mathematics coaching as compared to schools without coaching programs. Campbell and Malkus (2010, 2011) reported a positive impact of elementary mathematics coaches on student achievement across grades 3, 4, and 5 over a period of three years as the mathematics coaches gained experience. These promising findings affirm the value of mathematics coaching.

## Models for Coaching Practice

There are an increasing number of well-established coaching models that may influence a mathematics coach's philosophy about his or her role in working with individual teachers and within a school system. Barlow, Burroughs, Harmon, Sutton, and Yopp (2014) identified three models that are widely used by mathematics classroom coaches. In this section we present brief synopses of these models based on our interpretation of the primary coaching text associated with each model: *Cognitive Coaching* (Costa & Garmston, 2002), *Content-Focused Coaching* (West & Staub, 2003), and *Instructional Coaching* (Knight, 2007).

### *Cognitive coaching*

Cognitive coaching (Costa & Garmston, 2002) uses a mediation approach to coaching with an emphasis on the teacher's self-directed growth. The method is based on the assumption that behavior is produced by an individual's thought and perception. Cognitive coaches mediate to influence teachers, relying on the coach's use of listening, paraphrasing, and questioning. A cognitive coach would pay close attention to what a teacher is saying, might paraphrase what a teacher said to help the teacher identify a personal goal in a process of self-assessment, and might probe gently to support the teacher in gaining clarity in his or her thinking by prompting, "Say a little more about …." The cognitive coaching process is enhanced by using a three-phase cycle of a pre-lesson conference, a lesson observation, and a post-lesson conference: "Coaches cannot know what to look for in an observation unless they have met with the teacher before a classroom visit" (Costa & Garmston, 2002, p. 45).

### *Content-focused coaching*

Content-focused coaching (West & Staub, 2003) is a content-specific approach with emphasis on students' learning of a particular subject, and teachers' plans, strategies, and methods are discussed in that context. West and Staub assert that coaches need skills in diagnosing both the stated and unstated needs of the teachers with whom they work. They focus on a teacher's content knowledge and disposition toward mathematics; teachers' pedagogical knowledge, pedagogical

content knowledge, and underlying beliefs about learning; teachers' abilities in diagnosing students' thinking; and teachers' habits of planning and engaging with curriculum materials.

A content-focused coach makes student mathematical learning the central focus of coaching sessions. In coach-teacher interactions, emphasis is placed on designing lessons. Whenever possible, the coach brings evidence about student learning such as student comments, examples of student thinking, student assessment data, and samples of student work to the coaching session. As with cognitive coaching, content-focused coaching uses the three-phase cycle of a pre-lesson conference, a lesson observation, and a post-lesson conference.

*Instructional coaching*

Instructional coaching (Knight, 2007) emphasizes a partnership approach to coaching. Knight proposes seven principles (equality, choice, voice, dialogue, reflection, praxis, and reciprocity) as the theoretical foundation for instructional coaching, which, like cognitive coaching, relies on the coach's ability to understand the teacher's point of view and listen actively in coaching conversations. Knight proposes that "how well a person connects or fails to connect emotionally with others profoundly affects the quality of relationships that person experiences" (Knight, 2007, p. 79).

As with the other coaching models, there is the expectation of a pre-lesson conference, a lesson observation, and a post-lesson conference. Instructional coaching focuses on what Knight calls "the big four" in classrooms: behavior, content, instruction, and formative assessment. Knight also emphasizes that the data collected should be related to interventions that the coach and teacher have agreed to try out. Finally, Knight emphasizes focusing on the positive:

> While intuitively a [coach] might think that the most important part of observing a lesson is to find areas of weakness that need to be improved, in reality, the most important part of the observation may be to look for things the teacher does well. (2007, p. 122)

Clearly there is overlap across these three coaching models; an obvious example is the incorporation of a pre-lesson conference, lesson observation, and post-lesson conference. The differences lie primarily in the philosophical approach to the coaching relationship. Cognitive coaches are mediators who help teachers uncover and recognize their own solutions. Content coaches focus on teacher knowledge and student evidence, while instructional coaches prioritize partnership and relationship.

## Roles of Mathematics Coaches

A particular model may offer a framework for coaching, but the issues present in a school or district determine how that model is enacted. Obara and Sloan (2009) reported on a mathematics coach working with three sixth-grade teachers to assist in the implementation of a newly adopted curriculum. Their findings suggest that a coach's role and duties may be poorly defined and call for further research in this area suggesting that studies "centered on mathematics coaches who have held these positions over a period of several years…could shed some light on the most effective use of their time and resources" (p. 23). Campbell and Malkus (2011) similarly identified issues related to coaching roles that were not examined in their own work, including:

> how coaching practices were implemented or influenced practice in these schools; how these coaches varied in their focus, organization, priorities, coaching knowledge, and skills; how these coaches interacted with their teachers; how teachers' existing instructional practices meshed or conflicted with the instructional ideal of their coaches; or how these local school administrators and teachers perceived the role and value of a coach. (p. 451)

They noted that "field investigations are needed if we are to understand how to maximize the potential of coaching as site-based professional development supporting student learning and

teacher enhancement" (p. 451). In particular, there is a need for qualitative examination of what coaches do, in the day-to-day sense. The present study aims to address this need as it expands the knowledge based regarding the roles of coaches, the content of coaching sessions, and the dynamics of coaching interactions.

## Purpose of the Study

Examining Mathematics Coaching (EMC)[1] is a research and development project examining the effects of a coach's knowledge for coaching on the classroom practice, mathematics knowledge, and attitudes of K-8 teachers. The findings reported here are from a study affiliated with this broader EMC project.

The EMC research hypothesis is that the effectiveness of a mathematics classroom coach is linked to several domains of knowledge, and that coaching knowledge and mathematics content knowledge are two of those domains. (Sutton et. al., 2011) conducted a Delphi study and identified eight aspects of coaching knowledge: assessment, communication, leadership, relationships, student learning, teacher development, teacher learning, and teacher practice. Full definitions for these knowledge aspects are provided in that article.

In the present study we analyze observational data about the practice of coaches in a variety of school settings in order to answer the research question: In what ways do elementary mathematics coaches interact with teachers, and what roles and responsibilities do they take on? Specifically,

1. What roles do mathematics coaches assume in carrying out their jobs, both in one-on-one interactions with teachers and within the larger school setting?
2. What types of content – mathematical and otherwise – are addressed during coaching sessions, and in what context?
3. What professional and interpersonal dynamics can be observed during coaching interactions?

Underlying these research questions is the hypothesis, shared by researchers in the EMC Project, that coaching will improve teacher practice, which in turn affects student academic performance.

## Methodology

This study employed a qualitative research design using observational methods (Maxwell, 2013). A qualitative approach is appropriate for exploring and characterizing the variety of coaching approaches that can be observed in a limited sample. The study intentionally clustered observations around the three constructs highlighted in the research questions: roles assumed by coaches as they interact with staff in multiple settings, content addressed during coaching sessions, and dynamics of coaching interactions. These constructs have been identified as important components of coaching in current literature and in the mathematics coaching models described earlier. These features—roles, content, and dynamics—are also intertwined with the eight aspects of coaching knowledge identified by (Sutton et al.,2011). These aspects, summarized in Table 1, form the lens through which coaching practice was observed in the present study.

1 This material is based in part upon work supported by the National Science Foundation under Award No. 0918326. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

Table 1
*Eight Aspects of Mathematics Coaching Knowledge*

| A coach knows: | |
|---|---|
| **Teacher Learning**<br><br>• How to engage teachers in the coaching process.<br>• How teachers acquire knowledge of content, pedagogy, and pedagogical content, in general and for specific individuals.<br>• How to recognize the discrepancy between vision and practice. | **Teacher Development**<br><br>• How to support teachers' development in terms of content, pedagogy, beliefs, and management.<br>• How to support individual teachers' development.<br>• How to recognize and understand teachers' motivations and barriers to learning. |
| **Teacher Practice**<br><br>• How to discern teacher beliefs.<br>• How to enhance teaching practice based on research. | **Student Learning**<br><br>• How to support teachers in applying mathematical processes (discourse, exploration, engagement) to classrooms.<br>• How to help teachers manage the learning environment and improve student learning. |
| **Assessment**<br><br>• How to assess teacher needs and use that assessment to set goals for coaching.<br>• How to assess student thinking and use that knowledge to set goals for coaching.<br>• How to help teachers effectively use assessment in their classrooms. | **Communication**<br><br>• How to communicate professionally about students, curriculum, and classroom practice.<br>• How to mediate a conversation, by pausing, paraphrasing, probing, inquiring, and asking reflective questions.<br>• How to use nonverbal communication and listen actively.<br>• How to communicate in problem-resolving conversations. |
| **Relationships**<br><br>• How to support teaching and content.<br>• How to communicate in a way that establishes trust, rapport, and credibility.<br>• How to establish positive interpersonal environments.<br>• How to foster relationships that respect various cultural influences. | **Leadership**<br><br>• How to be strategic about setting goals and objectives for teachers and students.<br>• How to use, evaluate, and influence the school's vision.<br>• How to evaluate the utility of educational policies.<br>• How to address challenges.<br>• How to promote the coaching process. |

**Participant Selection**

The sample for this study was purposefully chosen from a pool of coaches who are affiliated with the EMC Project in some way and have established trust with project personnel. The cross-section represents different school districts in four Western states and includes coaches with differing job titles.

To maximize the breadth of findings, we used criterion sampling, a technique that involves purposefully selecting cases to meet predetermined criteria (Patton, 2002). In this study, the researchers identified four categories into which a coach's job assignment might fall: district coach, multiple-sites coach, building-level coach, or teacher-coach (see Table 2). We then identified potential participants who fit these categories, believing that how a coach's position is defined likely influences his or her day-to-day work. Though not deliberately planned, the resulting sample offered geographic diversity, increasing the likelihood that our results represent a broader range of coaches than those in just one program or district. In each district, mathematics coaching is embedded in the overall school improvement plan (as opposed to an intervention implemented to address a specific problem).

Table 2

*Coaching Positions and Assignments*

| | **Job Position** | **Scope of Assignment** |
|---|---|---|
| **District Coach** | A district-level staff person | Engages with other coaches, teacher leaders, or teachers throughout a district |
| **Multiple-Sites Coach** | A building-level staff person at two or more sites (e.g., both middle schools in a district) | Engages with teachers in two or more buildings within a district |
| **Building-Level Coach** | A building-level staff person | Engages with teachers in a single school building |
| **Teacher Coach** | A teacher with release time for coaching duties | Engages with teachers in the building where the coach also teaches, or coaches in a different building |

Part of the selection process involved identifying coaches who would be comfortable being closely followed as they carried out their work. One of the initially identified coaches declined to participate due to discomfort with being observed. Ultimately, seven mathematics coaches participated in the study: one district coach, two multiple-sites coaches, three building-level coaches, and one teacher-coach. The coaches were from four different states, with coaching experience that varied from 0 to 7 years. Profiles of each participant are provided in the discussion of results.

## Observations

The study employed a data collection process whereby an observer "shadowed" a coach engaged in daily activities for a one-day period (or, in one case, two consecutive partial days). The coaches chose an observation date that represented a "typical" day in their job assignment. This "shadowing" approach allowed detailed observations data to be collected within constraints imposed by funding, travel restrictions, and teacher schedules. The five observers assigned to the seven mathematics coaches were each closely affiliated with the EMC Project and possessed in-depth knowledge of coaching models and programs. Each observer had conducted dozens of standardized classroom teacher observations and participated in annual observer reliability training for the project.

To prepare for this study, the observers met for approximately 90 minutes to reach consensus on how they would identify and capture important features of coaching during their observations. They were provided with a template listing key questions and indicators to guide the collection of observation data (see Table 3 and the Appendix). The template was used as an observer training tool, primarily as a vehicle for discussion of what to watch for and record while shadowing a coach. Observers agreed that the primary goal of the observations was not to track frequency of events, but to capture enough detail about the coach's roles and interactions with teachers to establish variation in the sample.

Issues of reliability were discussed at length. The option of having two observers shadow each coach was discarded due to the need to be unobtrusive in the school environment. Observers who were familiar to the coaches were used in an effort to ensure the authenticity of the coach's actions and the resulting data. Finally, the observation template and recording instrument served to mitigate bias and improve reliability.

## Data Collection and Analysis

Three layers of data were available for analysis. First, the observers obtained a coaching history from their assigned coaches using a structured questionnaire. They then created a set of field notes based on a template that asked them to record information at 15-minute intervals. Data collection was guided by a set of indicators provided with the template. The questionnaire, observation indicators, and observation template are provided in the Appendix. All observers also provided a written report summarizing their field notes.

The lead author then collated the combined observation data. The three categories (Roles and Responsibilities, Content of Coaching Sessions, and Dynamics of Coaching Interactions) and the indicators that describe each category (see Table 3) were applied as external codes for an initial sorting of the data (Knuth, 2002). A table was built for each category whose entries cross-referenced each of the seven coaches with observed evidence of the indicators for that category. An internal coding approach was then applied to identify the widest possible range of variation for each category. Finally, these codes were reduced to a set of features for reporting purposes. The codes and features were reviewed and verified by two co-authors. The results of this analysis are presented below.

Table 3
*Questions and Indicators Used to Guide Coaching Observations*

| **Roles and Responsibilities Assumed by Coaches** | **Content of Coaching Sessions** | **Dynamics of Coaching Interactions** |
|---|---|---|
| Coaching sessions:<br>• Location and time (e.g., between classes, break time, beginning of day, end of day)<br>• Length of the session (fly-by, etc.)<br><br>In the classroom:<br>• Coach role (e.g., co-instructor, modeling, working with students, observer)<br>• Coach role within larger school context: (e.g., administrator, colleague of teachers, teacher leader).<br><br>What the coach's interactions look like (talking with other staff, talking with administrator, etc.) | What the interaction is focused on and what is emphasized (e.g., management, pedagogy, mathematics content, needs sensing, reflection, counseling)<br><br>What is done by the coach and/or teacher to prepare for sessions (e.g., gather materials, reviewing research)<br><br>What strategies/techniques the coach employs (e.g., reflective questions, needs assessment, counseling, mentoring, instructional support) | Ways the coach and teacher communicate<br><br>What the coach and teacher communicate about<br><br>What role(s) the coach and teacher demonstrate (e.g., active, passive, collaborative, directive)<br><br>Ways that respect is demonstrated between the coach and teacher<br><br>What relationships are presented (e.g., collegial or hierarchical)<br><br>What levels and type of engagement are present in coach and teacher interactions |

## Individual Coach Profiles

Seven coaches (Dawn, Cali, Jodi, Jackie, Kathleen, Alberta, and Abigail) were shadowed for either one day or two consecutive days by one of five observers. Dawn, Cali, and Kathleen were each shadowed by separate observers, and Jodi and Jackie were shadowed by a fourth observer, and Alberta and Abigail were shadowed by a fifth observer. The following profiles summarize each of the coach observations, including quotes and specific examples where they are available. We acknowledge that due to differences in coach activities and in what could be observed, the profiles are not parallel in construction. These brief profiles introduce aspects of the coaches' contexts in order to situate the results discussed in subsequent sections.

Cali is a multiple-sites coach at two elementary schools that are a mile apart. She has an Elementary Education bachelor's degree, a master's degree in Administration, and two years of coaching experience. She has been in the school district for 10 years, during which she has served as an elementary curriculum coordinator and mathematics specialist and has also taught for six years. She participates in regular professional development for coaches that is scheduled by her district.

Cali was observed at both of her elementary school sites over two days. During a four-hour period on the first day, she met with a principal and assistant principal to prepare for a last-minute school function, met with a third-grade data team, and planned a lesson with a fourth-grade teacher. She also spent some time recording notes from the planning meeting and preparing a year-end summary for her work with the fourth-grade teacher. On the second day she was observed for eight hours at the other school. In the morning, she met with the principal, facilitated a lesson study debrief and reflection, wrote up a report on the lesson study, checked e-mails, covered a third-grade teacher's class, and had an informal check-in with the assistant principal and English language arts specialist. After lunch room duty, she prepared an end-of-year note for a teacher she had coached during the year, held a year-end reflection with a third-grade teacher, and conducted a data walk with the principal and other teachers.

Dawn is a first-year building-level coach. She holds a bachelor's degree in Elementary Education with a Mathematics concentration and a master's degree in Curriculum and Instruction. She taught for 24 years, including a year spent developing curriculum. She received coach training from the EMC Project and through a Jim Knight Instructional Coaching program.

Dawn was observed on a single day for about seven hours. She began the day with a post-lesson conference following a fourth-grade teacher's videotaped lesson, then a pre-lesson conference for the teacher's upcoming lesson. Dawn later observed the lesson and worked with students using manipulatives alongside the teacher during the lesson observation. In late morning, Dawn traveled to another school to work on a reading proposal with another coach and some teachers. After lunch, Dawn went to a third school to check on a teacher who had received iPads as part of a technology grant. While there she demonstrated a number line app on the iPad and discussed various levels and uses of apps, focusing on the need to determine which apps are really teaching mathematics and which are just enjoyable.

Dawn ended her day in a post-lesson conference with the teacher she had observed in the morning. After a brief conversation about student behavior, the two discussed how students had performed during the lesson. Dawn described the students she had worked with and asked the teacher questions such as, "How do you feel about the scaffold problem you did on the board?" and "Tell me what you thought about that discussion about estimation." They then looked at students' work from the lesson, with Dawn asking questions such as, "Any work you want to look at?" and "How do you feel about [student] not showing work?" She focused the final part of the discussion on what the teacher was going to do in the next lesson.

Jodi is a teacher-coach who has been in this dual position for two years. She holds a master's degree in Curriculum and Instruction and has participated in a mathematics-intensive program provided by the local university where she took a leadership course. Jodi has taught first grade for eight years. She has no formal training in coaching.

Jodi was observed for seven-and-a-half hours on a single day. In the morning she met with the guidance counselor to discuss ways to identify and best meet the needs of special populations for mathematics instruction. She also participated in a fire drill, checked e-mails, responded to requests, and prepared for math lab. Jodi observed a fourth-grade intervention and held a post-lesson conference with the intervention provider; she then hosted a lunch for second-grade teachers who met to discuss the afternoon's team observation of a first-grade classroom as part of "mathematics studio." After this she responded to e-mail requests from teachers and visited several K-2 classrooms. Prior to observing the first-grade studio lesson, the coach reviewed the lesson on her own. She then prepared for a lesson study discussion and for reflection on the first-grade lesson before meeting with the second-grade teachers to debrief the studio lesson.

Jackie is a building-level coach who is in her first year as a mathematics coach. She holds a bachelor's degree in Elementary Education and master's degrees in Elementary Education and

Middle-Level Mathematics. She has five years of teaching experience as a sixth-grade teacher along with two years of service as the elementary school technology coordinator. She has had no formal training as a coach but is considered a teacher leader in her district.

Jackie was observed on a single day for seven hours. For the first hours of her day, she checked e-mails, reviewed materials, and prepared for a lesson later in the day. During the second hour and a half she walked through the building visiting teachers during their plan time, discussed a summer workshop, responded to requests, and prepared for math lab. She met with the fifth/sixth-grade combined classroom teacher and aides to outline the upcoming lesson and coordinate roles, then co-taught a lesson on ratio in the fifth/sixth-grade combined classroom. After lunch and a brief planning period, Jackie interacted with a paraprofessional responsible for helping students with mathematics at multiple grade levels.

Kathleen is a first-year multiple-sites coach supporting all content in two middle schools, though she primarily works with mathematics and communication arts. She has a bachelor's degree in Elementary Education and a master's degree in Special Education. Kathleen has taught in grades 3-8, mostly mathematics and reading, for more than 25 years. She has participated in district-sponsored coaching workshops focused on instructional coaching. She meets with other coaches in the district three times a month; because this is Kathleen's first year as a coach, she also meets with her mentor once a month.

Kathleen was observed on a single day for eight hours at both schools. She started her day by meeting with the principal and vice principal of one of her middle schools. Discussion included the end-of-year seventh-grade mathematics test and other assessments, the need for liaison between the two middle schools, a fall university course Kathleen would be teaching, district planning for the next year, and how to facilitate "walkthroughs" and classroom visits between teachers. Kathleen then drove to the other middle school for a coaching session with an eighth-grade Algebra 1 teacher. In this session, Kathleen focused on the students' use of Common Core mathematical practices by using an iPad app that allowed her to monitor and track the students' use of the practices. She often took pictures (with their permission) of student work that she felt illustrated a given practice, and she took notes for later debriefing with the teacher while walking around the classroom. When another class came in to repeat the lesson, Kathleen observed the teacher instead of taking notes on the iPad about students' work. At the end of the lesson Kathleen e-mailed the teacher the aggregated iPad data and her own notes. Fifteen minutes after the class she held a 10-minute post-lesson conference with the teacher.

On her way to her office, Kathleen stopped by two seventh-grade classes and had a discussion with the principal in the hallway. Back in her office, she shared the material she had prepared for the mathematics meeting with an eighth-grade teacher who stopped by. After this encounter, Kathleen e-mailed the principal of the other middle school about funding for replacement books. She then prepared an afternoon lesson. She ended her day with an hour-long building mathematics meeting that included 10 teachers and two principals.

Alberta is a building-level coach responsible for one elementary school; however, she also supports teachers in other buildings in a mathematics intervention program. She has bachelor's degrees in Anthropology and Education and a master's degree in Literacy. She taught sixth grade for 18 years. She has received training using a model emphasizing working with adults and crucial conversations. She participates in monthly meetings with other district coaches.

Alberta was observed on a single day for almost eight hours. She began the day working on a district-wide elementary mathematics course that she was overseeing. She then worked with a parent on ways to solidify addition with a first-grade home-school student. After 30 minutes spent e-mailing and having quick conversations with teachers, she spent 45 minutes preparing materials

needed for upcoming classroom coaching sessions later in the day. At noon, Alberta met with the kindergarten teacher to review plans for the day before leading an opening activity with the kindergarten students and guiding a small group in an exploration of the concept. The post-lesson conference was postponed to the next day due to schedule changes. She then spent 30 minutes in preparation prior to her co-teaching a fifth-grade class with the classroom teacher. Again, schedule changes delayed the opportunity for a post-lesson conference.

Abigail works as a district-level coach as part of her assignment as district interventionist and mathematics resource specialist. She has a bachelor's degree in Mathematics with secondary certification, has a master's degree in Administration, and holds a principal's license. Abigail taught high school mathematics for 11 years, with four of those years as department chair and mentor within the building. She has been in her current position for seven years with coaching responsibilities in each of the years. Abigail attended a six-day cognitive coaching workshop as well as district-sponsored workshops on data-driven dialogue and professional learning communities.

Abigail was observed for a total of eight hours at one of the district's middle schools. She started the day in her office answering e-mails, attending to voicemail requests, reviewing formative assessment items for a third/fourth-grade mathematics team, and checking in with the principal. Abigail's next event was co-teaching a lesson; another instructional coach would also be present. Before co-teaching, she briefly reviewed the seventh-grade lesson on linear patterns with the teacher, and following the lesson she held a 20-minute conference with the teacher after the students had left the classroom. After lunch, Abigail spent more than an hour locating and pulling resources for a second-grade team to transition to Common Core State Standards. Her day ended by facilitating a district-level second-grade team meeting.

## Analysis of Results

The discussion of results begins with a summary of coaching activities that were observed. The intent was not to determine the frequency with which specific activities occurred but rather to capture variation in the activities of an elementary mathematics coach. The next section identifies key roles of a mathematics coach, followed by a detailed analysis of topics that arise in coaching sessions. Finally, results are reported that illuminate the dynamics of coaching interactions.

### Coaching Roles: Activities and Responsibilities

To analyze Research Question 1, we considered aspects of how coaches carried out their jobs, both in one-on-one interactions with teachers and within the larger school setting. We identified both coaching activities that the coaches were engaged in and roles and responsibilities that the coaches assumed.

A total of 13 distinct and noteworthy coaching activities emerged from the collective observations; these are documented in Table 4 and have been grouped into three categories: elements of the classroom coaching cycle, other coaching-related duties, or administrative duties. Clearly Table 4 does not represent every activity engaged in by coaches, or even the full extent of roles assumed by any one coach who was observed. However, trends are evident in the data: for example, communication in various forms is confirmed as a fundamental component of coaching. Additionally, the common feature of debriefing after lessons is a positive indicator of an instructional focus for coaching.

Table 4
*Observed Coaching Roles and Responsibilities*

| | Cali | Dawn | Jodi | Jackie | Kathleen | Alberta | Abigail |
|---|---|---|---|---|---|---|---|
| **Elements of the Coaching Cycle** | | | | | | | |
| Pre-lesson conferences | ✓ | ✓ | | | | ✓ | |
| Observing instruction | | ✓ | ✓ | | ✓ | | |
| Working with students | | ✓ | ✓ | | | | |
| Co-teaching a lesson | | | | ✓ | | ✓ | ✓ |
| Post-lesson conferences | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ |
| **Other Coaching-Related Duties** | | | | | | | |
| Covering classes | | | | ✓ | | | |
| Visiting informally with teachers | | | | ✓ | ✓ | ✓ | |
| Facilitating lesson study | ✓ | | | | | | ✓ |
| Managing grants | | ✓ | | | | | |
| Handling student assessment data | ✓ | | | ✓ | | | |
| Locating resources for teachers | | | | | ✓ | | ✓ |
| **Administrative Duties** | | | | | | | |
| Meetings (with counselors or administrators) | ✓ | | ✓ | | ✓ | | |
| Responding to e-mail/voicemail requests | | | ✓ | ✓ | ✓ | | ✓ |

Through further analysis, we closely examined each episode of a coaching-related event or activity, including such elements as location, time, and length of the episode. This analysis confirmed that coaching sessions most often take place in teachers' classrooms. Other coaching venues include both formal spaces such as offices or meeting rooms and informal spaces (e.g., the school lawn, the

hallway). Similarly, coaching takes place throughout the day, during lunchtime and breaks as well as during instructional time. However, among these observations no coaching episodes took place outside of school contracted hours. Coaching sessions varied in length from short 5-minute sessions to hour-long meetings. Our data show that coaches assume many different roles and seize opportunities to interact with teachers, and thus these observations present a picture of flexibility and the absence of a scheduled routine for a coach's day.

Coaches who were observed interacting in classrooms exhibited a variety of behaviors: modeling lessons, co-teaching, observing teachers, observing students, and working with students. In many cases, coaches also collected data, whether specific (as in the case of recording uses of specific mathematical practices) or more general notes detailing the content of the class period. All of these are classroom behaviors identified in well-established models of coaching. It is encouraging to note that except for one episode of co-teaching, all co-teaching events and teaching observations were followed by a same-day debriefing, either immediately or as soon as schedules allowed.

Coaching duties also varied widely in the greater school context: facilitating and sharing information, engaging in activities to improve lessons and instruction, providing professional development, writing or administering grants, and managing assessment-related tasks. Combining this variety of work with the multiple contexts—classroom, school, and district—in which coaching takes place illuminates three areas of particular variety in coaching. Coaches in this study engaged with a variety of audiences: with individual teachers both inside and outside the classroom; with small groups of teachers; with grade-level teams; with adult learners in professional development and classes; with administrators; and with students both individually and in groups. Coaches were expected to possess or develop a variety of skill sets and abilities: designing and leading professional learning experiences; facilitating lesson and book studies; writing proposals, reports, and curriculum; developing expertise to support specific initiatives; identifying and providing resources; and even filling traditional staff roles (e.g., substitute teacher, playground and lunch monitor). Finally, coaches needed to manage data at all levels: collecting data in classrooms; interpreting data from various assessments; and finding meaningful ways to report data to the different audiences described earlier.

## Content of Coaching Sessions

Recall that "content" refers to the topics, issues, questions, and materials that form the narrative of a coaching session; mathematics may or may not be included in that narrative. Observers' field notes regarding the content of coaching sessions were combined and analyzed from two perspectives: the focus of the session, and the strategies employed by the coaches to engage teachers during the session. In the first round of analysis, the topics and issues discussed in coaching sessions were differentiated for maximum variation. These data were then grouped under seven features, which are described with examples in the following paragraphs.

### *Mathematics content and pedagogy*

This theme denotes conversations or activities that centered on mathematics teaching and the mathematics content in a lesson. For example, a paraprofessional shared with Jackie how he asked students to build grids representing area models for multiplication. In response to this, Jackie reinforced the value of using visual models to promote conceptual understanding. As another example, during a lesson-planning session with a fourth-grade teacher, Cali and the teacher looked at the upcoming textbook lesson and concurred that the students needed a more hands-on learning experience. Cali then introduced the idea of using bar models and asked the teacher how this could be done.

*Reflection on instruction*

Four of the coaches (Cali, Dawn, Jodi, and Kathleen) engaged teachers in reflection. Observed episodes largely consisted of coaches and teachers reflecting on previous lessons, although in one case Cali reflected on progress throughout the entire year with a third-grade teacher. In most scenarios, coaches tended to direct the reflection through questioning, except for Kathleen's post-lesson conference in which the eighth-grade teacher posed a reflection question for the coach. Reflective prompts included:

- What are some of our predictions that came true? (Cali in a post-lesson conference)
- At the end of the day, what will you expect the students to know? (Dawn in a pre-lesson conference)
- How do you think it went? (Jodi in a post-lesson conference)
- What is your takeaway from this lesson? (eighth-grade teacher to Kathleen during a post-lesson conference).

In some cases, more than one teacher worked together on a lesson with the coach as facilitator. Cali conducted one group-lesson debriefing and reflection session, and Jodi facilitated both a pre-planning and debriefing session with a group of second-grade teachers and one first-grade teacher.

*Students*

Student thinking and actions entered coaching conversations in a variety of ways, particularly during post-lesson conferences. During a lesson planning session with a fourth-grade teacher, Cali described behaviors of students she had worked with in the previous lesson. In another case, a fourth-grade teacher discussed different students' needs with Dawn during a pre-lesson conference and examined individual student work during a post-lesson conference. In a similar context, second- and first-grade teachers participating in group lesson planning facilitated by Jodi discussed their students' in-class performance during the observed lesson.

*Classroom management and culture*

Discussions on this theme were often integrated into coaching sessions. Dawn led a debriefing following a video lesson in which the fourth-grade teacher noticed that she "manages students by ignoring." Abigail acknowledged classroom management issues by asking, "When students are not attending to problems, what can you do?" In a conversation with a first-grade teacher, Jodi probed about how much independence the teacher allowed in her classroom.

*Curriculum issues*

Examples of curriculum discussions were varied. Dawn spoke with a fourth-grade teacher about the Common Core and how algorithms for division do not appear until fifth grade. During a post-lesson conference with Jodi, a first-grade teacher noted that it was extremely hard to find the time to reteach since pacing was very tight and provided little wiggle room. A seventh-grade teacher shared her excitement with Kathleen about a probability game she had just taught to her students, and they then discussed how the students interacted with the game. A paraprofessional indicated to Jackie the desire to return to a computer-based drill program, and in response, Jackie noted the program's drawbacks including limited time and access to computers.

*Resources and professional development*

This theme also encompasses a variety of actions. In some cases, coaches directly provided factual information, such as when Jackie told a teacher what manipulatives would be available for her to use. In other scenarios coaches expand teachers' knowledge, as when Dawn educated a teacher about useful iPad apps. Because Jackie was designing a summer professional development

workshop, she paid informal visits to a sixth-, third-, and fourth-grade teacher to discuss their professional development needs.

*Feedback and goal-setting*

Coaches most often provided feedback by sharing opinions about instructional successes or needs based on their observations. For example, Kathleen told an eighth-grade teacher, "Your openness to learning is awesome; it is a joy to be here." Goal-setting also fell into this category, as when Cali and a third-grade teacher considered their goals for future coaching interactions.

Coaches engaged in a variety of other interactions with teachers, and though they did not occur enough to be identified as features, we found their variety noteworthy. Some interactions focused on future plans for individual teachers. For example, during a lesson planning session with a fourth-grade teacher, Cali began the conversation about possible future roles for the teacher, and Jackie's meeting with a third-grade teacher about professional development needs led to a conversation about the teacher's move to the middle school the following year. Other interactions occurred as "real-time coaching," or interactions that took place during the course of teaching a lesson. For instance, during a fourth-grade conference, Jodi asked the teacher, "What expectations are there regarding how students show their thinking?"

## Strategies Used by Coaches

A second level of analysis examined strategies that were used in coaching sessions to promote effective professional development and engage teachers in meaningful professional learning. We identified three types of strategies, and note that most coaches used more than one type of strategy within a single coaching session. We use the term "relational strategies" to refer to strategies that demonstrated the coach was paying attention to the one-on-one bond between the coach and teacher as individuals. We identify "exchange of information" as any strategies where the coach was either providing or gathering information from the teacher with whom she was working. Finally, the term "facilitating teacher learning" indicates those strategies focused on planning, enacting, or improving a lesson or specific teaching need.

Many coaching strategies could be interpreted as belonging to more than one category. The following list indicates our interpretation of the strategies captured in our data set according to the three types described above:

- Relational: promoting trust; goal-setting; mentoring; reflective questioning (and, on occasion, nonreflective questioning).
- Exchange of information: gathering needs assessment data; finding specific resources; providing expertise; interpreting and reporting data; citing research.
- Facilitating teacher learning: facilitating teacher learning communities; providing input and feedback through pre- and post-lesson conferences; reflective and nonreflective questioning as tools for lesson debriefing.

## Dynamics of Coaching Interactions

A third analytical perspective examines the dynamics of observed interactions between the coaches and teachers in this study. Table 3 suggests six potential indicators related to the dynamics of coaching interactions. Observers were able to identify evidence supporting four of these indicators through their shadowing experience. Two indicators—"ways that respect is demonstrated" and "levels and types of engagement"—could not be captured under the constraints of the protocol used in this study. The subjectivity of these indicators makes them difficult to capture in a short-term observation. This section presents findings related to the remaining four

indicators, which address ways in which coaches and teachers communicate and the relational roles they assume.

*Forms of coach-teacher communication*

Communication was carried out face-to-face, using e-mail, and via telephone. Face-to-face encounters most often occurred in pre- or post-lesson conferences or during a lesson, but they also took the form of informal classroom visits by the coach or informal office visits by the teachers. During the brief observation period, all seven coaches communicated with multiple teachers face to face.

*Substance of coach-teacher communication*

Most exchanges between coaches and teachers were relevant to the coach's instructional support role. Professional exchanges not directly related to content or pedagogy also took place. For instance, Cali spoke with a teacher about potential future roles and activities, and Dawn and one of her teachers expressed their disappointment that the school's principal was leaving. Other exchanges of a personal nature were related neither to the teaching profession nor elementary mathematics and were not included as data for this study.

*Stances adopted during coach-teacher communication*

Unlike the first two indicators described in this section, this indicator relies on a subjective interpretation of whether the coach was active, passive, collaborative, or directive. From the observer notes and reports, we are not able to accurately interpret whether the coach or teacher was active or passive in the interaction.

We did find evidence that coaches are both collaborative and directive in their interactions. Our use of these terms is not dichotomous, and our data provides examples where coaches use directive comments in a collaborative setting. Instances of collaboration were frequent: For instance, when Cali was planning a lesson with a fourth-grade teacher, they collaboratively studied an upcoming lesson. During the same session the coach asked the collaborative question, "What do we want to take away about models as we plan the next steps?" Dawn exhibited collaboration during a post-lesson conference by asking to look at student work with a fourth-grade teacher, and Jodi engaged in co-planning a lesson with a second-grade teacher.

All seven coaches demonstrated directive tendencies during the coaching sessions, indicated mainly through the kind of questions they asked teachers during the sessions. Directive prompts tend to influence the tone and direction of the coaching conversation. Examples include:

- Did you notice anything you missed in your teaching in the video?
- What content standards from the Common Core were you aiming at?

While these questions do promote reflection and can lead to rich conversations, they are also examples of a coach taking the lead in a conversation or debriefing.

*Relational balance of coach-teacher communication*

Like the question regarding roles assumed by coaches and teachers in their conferences, this indicator involves more subjectivity. We analyzed the flow of discourse to identify a coaching relationship as either hierarchical or collegial. In all cases, we found that teachers deferred to coaches as the experts. Though there is no evidence that the teachers being coached felt they were being supervised or evaluated, there is evidence to suggest that the coaches are not peers but are expected to be more knowledgeable than the teachers whom they coach. For example, in an interaction between Dawn and one of her teachers, the teacher asked, "Did I do anything mathematically wrong?" Ultimately, the relationship between coaches and teachers tended to be more hierarchical than collegial. Even in the case of the teacher-coach with a dual assignment, the coaching

relationship was observed as hierarchical rather than as a discussion among peers. It may be that the explicit designation as "coach," even if that coach is also a teacher, influences the hierarchical relationship.

## Discussion and Implications

In this study we observed seven coaches in five different districts in order to examine what it means to be a mathematics classroom coach and to explore how elementary mathematics coaches carry out their job assignments on a day-to-day basis. The findings of this study suggest that the roles and responsibilities assumed by elementary mathematics coaches, the activities they engage in, and the content of their sessions with teachers vary widely in response to the shifting contexts, audiences, and tasks that arise throughout the day. Evidence from observations shows that coaches work "in the moment" based on teacher and administrator requests, and as a result, they alter their routines frequently.

We identified seven features that capture the substance of coaches' one-on-one sessions with teachers: mathematics content and pedagogy, reflection on instruction, students, classroom management and culture, curriculum issues, resources and professional development, and feedback and goal-setting. These content areas fall within the scope of recommendations put forward by the authors of popular coaching texts. These seven features only begin to capture the full variety of topics and issues addressed in coaching sessions, and they do not include situations where coaches must respond to specific needs of individual teachers.

Analysis revealed that coaches use a combination of directive and collaborative approaches when working with teachers, and they use these approaches interchangeably. Coaches tend to be viewed by their teachers in a hierarchical context, with the coach as the expert. This result represents a divergence of perspectives held by coaching experts: West and Staub (2003) do not shy away from a coaching model that appears more hierarchical, while this is not the case for Knight (2007) or Costa and Garmston (2002).

Our results suggest that both coaches and teachers benefit from time and opportunity to work "shoulder to shoulder" in the context of planning and instruction. Data also indicate that context and competing demands have a drastic influence on what gets accomplished in coaching, regardless of the coach's job title or assignment. Combined, these two findings have implications for policy. Effective coaching requires that school and district administrators prioritize time spent in classrooms and in one-on-one interactions with teachers. In particular, effective coaches need latitude to conduct consistent and ongoing observations of instruction, along with the planning and debriefing that surround those observations. Similarly, coaches would benefit from systematic observation and feedback as they carry out their job assignments.

### An Observation Protocol for Coaching

Those who conduct research on coaching would benefit from using an observation tool that respects the fluid nature of a coach's job assignment. Based on our analysis of the one-on-one interactions between coaches and teachers in this study, we have developed the observation protocol presented in Table 5. We propose that this protocol will be useful for those conducting qualitative observations for research analysis. The consistent format for gathering qualitative data to support analysis or comparison of different coaching sessions will enhance the replicability of empirical studies of coaching.

Table 5
*A Proposed Coaching Observation Protocol*

**Preliminaries.** Gather background data prior to the observation.

- How long the coach has been in a coaching role
- How long the coach has been working with this teacher/group of teachers
- How the coach has worked with this teacher in the past

**Pre-lesson conference.** Describe the purpose and content of coach-teacher interactions. Provide details.

- Co-planning a specific lesson
- Coach plans alone and shares the plan prior to teaching a lesson
- Teacher plans alone and shares the plan prior to teaching a lesson
- Planning with a group (lesson study or similar model)
- Discussing and setting year-long classroom goals
- Discussing and setting broader goals
- Reflecting on a prior lesson
    - Indicate whether or not this includes follow-up plans for the upcoming lesson
- Other

**Lesson observation.** Record the coach's activities during the lesson. Provide details.

- Teacher teaches while coach observes
    - Coach circulates and helps students with work
    - Coach collects or notes student work but does not help students
    - Coach communicates ideas to the teacher during the lesson (If so, describe)
- Coach co-teaches the lesson with the teacher
- Coach teaches the lesson as a form of modeling
    - Teacher observes and/or helps students with work
- Lesson study model: one teacher teaches while others, including coach, observe

**Post-lesson conference.** Describe the purpose and content of interactions. Provide details.

- Note the format (e.g., face-to-face conversation, written report, e-mail)
- Note the timing of the debriefing
    - Immediately following lesson observation or at a later time; rushed or with adequate reflection time; stand-alone or connected to another interaction
- Record dynamics of the conversation: who initiates, controls, guides, or responds
- Record the coach's use of reflective questioning, pausing, and paraphrasing
    - Note the teacher's response to any of the above
- Record episodes of "looking ahead": next coaching cycle; later lessons; overall goals

**Overall impressions of the coaching cycle.** Provide specific details for each prompt.

- Note long- and short-term goals and trajectories that emerge from the pre-lesson and post-lesson conferences. Record how the coach guided development of goals and trajectories.
- Describe how student work was used (if at all) at any point in the coaching cycle
    - Was the use of student work planned in advance? Who collected the student work and for what purpose?
- Describe how and when mathematics content was discussed.
- Describe how and when student learning was discussed.
- For each item above, were the discussions initiated by the teacher or the coach? Provide details.

The protocol is focused on the classroom-supporter role of the coach (Killion, 2009), and we believe it will aid in the observation of coaching interactions between a coach and one or more teachers. The protocol is best used to document a complete coaching cycle: a pre-lesson conference, a coached lesson, and the post-lesson conference or debriefing of that lesson. It could be used

repeatedly for the same coach (with different or the same teachers) to obtain a view of that coach's practice in one-on-one coaching sessions. However, this instrument is not suitable for documenting the many different roles taken on by coaches or the full range of activities they carry out in those roles.

Non-researchers might also find use in this protocol as they seek to better understand how coaches carry out their work. We must emphasize that the purpose of this observation instrument is to provide a structure for conducting a qualitative observation of interactions between mathematics coaches and teachers: it is not a checklist. It is not intended to offer guidance or training to score or evaluate the coach. Rather, it provides a means by which observers can gather consistent data about the practice of mathematics classroom coaching.

At the outset of this study, we intended to capture information about the dynamics of coaching interactions. We discovered that in some cases, a written observation report was not able to capture the details and subtleties that help define the dynamics of a coaching relationship. Subjective constructs such as "respect" require direct observation and analysis of a coaching session. To that end, video-recorded coaching sessions would provide a more effective source of data to examine the nuanced dynamics of the coaching relationship.

## Conclusion

Mathematics coaching programs can have positive effects on schools by improving school culture, sharing teaching knowledge effectively among teachers, and encouraging staff collaboration. We expect that these school effects may also lead to positive impacts on student academic performance over time. However, we caution that the roles, content, and dynamics of coaching identified in this study cannot be evaluated in terms of effective practice. More research is needed to establish norms and definitions for effectiveness in coaching. This study does illuminate many characteristics of mathematics coaching as well as the content of coaching sessions and supports the ongoing study of what constitutes effective coaching practice. By analyzing the content of coaching sessions in this study and proposing the coaching observation protocol, we have developed a platform from which the effectiveness of mathematics coaching can be empirically studied and understood.

## References

Barlow, A. T., Burroughs, E. A., Harmon, S. E. , Sutton, J. T., & Yopp, D. A. (2014). Assessing views of coaching via a video-based tool. *ZDM: Mathematics Education, 46*, 227–238.

Campbell, P. F., & Malkus, N. N. (2010). The impact of elementary mathematics specialists. *The Journal of Mathematics and Science: Collaborative Explorations*, *12*, 1–28.

Campbell, P. F., & Malkus, N. N. (2011). The impact of elementary mathematics coaches on student achievement. *Elementary School Journal, 111,* 430–454.

Carr, J. F., Herman, N., & Harris, D. E. (2005). *Creating dynamic schools through mentoring, coaching, and collaboration*. Alexandria, VA: ASCD.

Costa, A. L., & Garmston, R. J. (2002). *Cognitive coaching: A foundation for renaissance schools* (2nd ed.). Norwood, MA: Christopher-Gordon.

Darling-Hammond, L.(1999). *Professional development for teachers: Setting the stage for learning from teaching.* Retrieved from The Center for the Future of Teaching and Learning website: http://www.cftl.org/documents/Darling_Hammond_paper.pdf

Darling-Hammond, L., Wei, R. C., Andree, A., Richardson, N., & Orphanos, S. (2009). *Professional learning in the learning profession: A status report on teacher development in the United States and abroad.* Retrieved from the National Staff Development Council website: http://www.learningforward.org/docs/pdf/nsdcstudy2009.pdf

Hill, H., Rowan, B., & Ball, D. (2005). Effects of teachers' mathematical knowledge for teaching on student achievement. *American Educational Research Journal*, *42*(2), 371–406.

Killion, J. (2009). Coaches' roles, responsibilities, and reach. In J. Knight (Ed.), *Coaching approaches and perspectives* (pp. 7–28). Thousand Oaks, CA: Corwin Press.

Knight, J. (2007). *Instructional coaching: A partnership approach to improving instruction.* Thousand Oaks, CA: Corwin Press.

Knuth, E. J. (2002). Secondary school mathematics teachers' conception of proof. *Journal for Research in Mathematics Education, 33*(5), 379–405.

Maxwell, J. A. (2013). *Qualitative research design: An interactive approach*. Los Angeles, CA: Sage Publications, Inc.

National Commission on Mathematics and Science Teaching for the 21st Century. (2000). *Before it's too late: A report to the nation from the National Commission on Mathematics and Science Teaching for the 21st Century*. Retrieved from http://www.ptec.org/items/detail.cfm?ID=4059

National Mathematics Advisory Panel. (2008). *Foundations for success: Final report of the National Mathematics Advisory Panel.* Washington, DC: U.S. Department of Education.

Neufeld, B., & Roper, D. (2003). *Coaching: A strategy for developing instructional capacity: Promises and practicalities*. Washington, DC: Aspen Institute Program on Education; Providence, RI: Annenberg Institute for School Reform. Retrieved from http://www.edmatters.org/webreports/CoachingPaperfinal.pdf

Obara, S. (2010). Mathematics coaching: A new kind of professional development. *Teacher Development, 14*(2), 241–251.

Obara, S., & Sloan, M. (2009). The evolving role of a mathematics coach during the implementation of performance standards. *The Professional Educator*, *33*(2), 11–23.

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Sutton, J. T., Burroughs, E. A., & Yopp, D. A., (2011). Coaching knowledge: Domains and definitions. *Journal of Mathematics Education Leadership*, *13*(2), 12–20.

West, L., & Staub, F. (2003). *Content-focused coaching: Transforming mathematics lessons*. Portsmouth, NH: Heinemann.

# Appendix

Coach Practice Observation Tool

*Part I. Visitation Information*

Date: _____Observer: _____Name of Coach: _____

**Part II. Observation**

**Check time at 15-minute intervals, or when dynamics/content/context changes. Use additional sheets if necessary. Especially look for:**

*Dynamics of Coaching Interactions*

- *Ways the coach and teacher communicate;*
- *What the coach and teacher communicate about;*
- *What role(s) the coach and teacher demonstrate (e.g., active, passive, collaborative, directive, etc.);*
- *Ways that respect is demonstrated between the coach and teacher;*
- *What relationships are presented (e.g., collegial or hierarchical); and*
- *What levels and type of engagement are present in the coach and teacher interaction.*

**Content of Coaching Interactions**

- *What the interaction is focused on and what is emphasized (e.g., management, pedagogy, mathematics content, needs sensing, reflection, counseling, other);*
- *What is done by the coach and/or teacher to prepare for sessions (e.g., gathering materials, reviewing research.); and*
- *What strategies/techniques does the coach employ (e.g., reflective questions, needs assessment, counseling, mentoring, instructional support).*

*Context*

- *Coaching session: location, when (e.g., between classes, break time, beginning of day, end of day), length of the session (e.g., fly-by);*
- *In the classroom: coach role as co-instructor, modeling, working with kids, observer; and*
- *Coach role within larger school context: (e.g., administrator, colleague of teachers, teacher leader). What does it look like (talking with other staff, talking with administrator)*

| **Time** | **Observations** | | |
|---|---|---|---|
| | **Dynamics** | **Content** | **Context** |
| | | | |

**Inquiries into Coach Background**

**1. Coaching Assignment**

a. What best describes your current assignment as a coach? (instructional coach, classroom coach, multiple responsibilities, etc.)

b. How long have you been a mathematics coach?

c. How long have you been in your current position?

d. What does your typical coaching session look like?

**2. Formal Training**

a. Tell us about what degrees you have earned, the major or emphasis of these degrees, and what certifications you hold.

b. How many years have you taught?

c. How many years have you coached?

**3. Coaching Training and Professional Development**

a. Have you had any coaching training (and when did that take place)?
b. Have you read any books that have influenced your knowledge of coaching?

## About the Authors

Rejoice Mudzimiri
University of Southern Mississippi
rejoice.mudzimiri@usm.edu
Rejoice Mudzimiri is an assistant professor in the Department of Mathematics at the University of Southern Mississippi in Hattiesburg, Mississippi. She is a mathematics education researcher, with particular interest in the development of technological and pedagogical content knowledge in teachers. She is active in interdisciplinary grant-funded projects that support mathematics teaching.

Elizabeth A. Burroughs
Montana State University
burroughs@math.montana.edu
Elizabeth Burroughs is an associate professor of mathematics education in the Department of Mathematical Sciences at Montana State University in Bozeman, Montana. Her research is focused on the preparation and continued professional development of school mathematics teachers. She is a Principal Investigator of the Examining Mathematics Coaching Project and chair of the Mathematical Association of America's Committee on the Mathematical Education of Teachers. She will spend 2014–15 at the University of York in York, U.K., as a Fulbright scholar.

Jennifer Luebeck
Montana State University
luebeck@math.montana.edu
Jennifer Luebeck is an associate professor of mathematics education in the Department of Mathematical Sciences at Montana State University. She has spent two decades designing professional development and outreach programs for K–12 mathematics teachers across the Mountain West. Her primary research interests include developing mechanisms and systems to mentor and support rural mathematics teachers and designing distance learning to provide effective professional development in mathematics. She has published in the Journal of Mathematics Education Leadership and the Journal of Distance Education.

John Sutton
RMC Research Corporation
sutton@rmcdenver.com
Dr. Sutton serves as Senior Research Associate at RMC Research Corporation and is a Co-PI on the NSF-funded DRK-12 Examining Mathematics Coaching project which is exploring the types of coaching knowledge in the K-8 environment that contributes to changes in teacher knowledge and practice. Dr. Sutton also serves as PI for the NSF-funded Technical Evaluation Assistance in Mathematics and Science (TEAMS) project, which provides technical assistance to NSF-funded and U.S. Department of Education-funded MSP projects to improve the quality and rigor of project evaluations. Additionally, Dr. Sutton serves as RMC Research Deputy Associate Director for the Institute of Education Sciences (IES) Central Regional Education Laboratory. Dr. Sutton is a former Vice-President for the National Council of Supervisors of Mathematics and a former member of the Research Committee for the National Council of Teachers of Mathematics.

David Yopp
University of Idaho

dyopp@uidaho.edu
David Yopp is a mathematics education researcher at University of Idaho. He has written and co-authored numerous publications on mathematics coaching, mathematical argumentation, and the mathematical knowledge for teaching.

## About the Guest Editor

Sarah Woulfin
University of Connecticut
Sarah.Woulfin@UConn.edu
Sarah Woulfin is an assistant professor of Educational Leadership at the University of Connecticut, Storrs. She studies the relationship between education policy, leadership, and instructional reform. Using lenses from organizational sociology, she investigates how leaders influence teachers' responses to reform efforts. In her doctoral work at the University of California, Berkeley, she focused on institutional theory, policy implementation, and coaching. She has published in the American Educational Research Journal (AERJ) and Reading Research Quarterly. Currently, she is an associate editor for Educational Administration Quarterly (EAQ). She is also on the executive steering committee of the Districts in Research and Reform SIG at AERA. From 2009-2012, Dr. Woulfin served as the program chair for AERA's Organizational Theory Special Interest Group. As a former urban public school teacher and reading coach, she was dedicated to strengthening students' reading and writing skills to promote educational equity. As a scholar, her commitment to raising the quality of instruction motivates her research on how policy influences—and is influenced by—administrators and teachers.

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