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Math Coaching In Metropolitan Detroit

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by

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CHAPTER 1 INTRODUCTION

Background to the Study

The popular discourse on education in the United States has been dominated by calls for reform over the last half-century. Those who make policy and parse international data have decried the mathematics performance of students in the United States. Professional organizations focused on mathematics education have issued their own prescriptions for improvements in teacher preparation, curricula, assessment, and teaching practices. Educational researchers have focused on the professional development of teachers as one means for implementing and supporting educational reform. Successful professional development for in-service teachers has become critical to efforts to reform schools and increase student achievement (Darling-Hammond, 2000; Neufeld & Roper, 2003; Sailors & Shanklin, 2010; Taylor, 2008; Van Haneghan, Pruet, & Bamberger, 2004).

Despite this promise, professional development efforts in education are often isolated and short-term, resulting in limited implementation and impact on student achievement (Showers & Joyce, 1996). Substantial investment in professional development efforts in education over the last several decades has produced little or no impact on classroom instruction (Borko, 2004). Teaching is notably averse to change, as teachers spend nearly all of their work hours in isolation from other practitioners, and there is only a weak system for induction of new members and systemic development of in-service teachers (Feiman-Nemser, 1983; Lortie, 1975). Researchers have begun to advocate for professional development that is on-going, embedded in teachers' practice, and driven by teachers' questions (Ball, 2003; Feiman-Nemser, 1983; Loucks-Horsley, 2003; Neufeld & Roper, 2003; Sowder, 2007).

Instructional coaching has been advocated as an approach to meet these conditions of quality professional development (Neumerski, 2013; Poglinco & Bach, 2004). Agreement on this point, and on the basic assumption that coaches observe teachers and provide feedback, form the foundation of coaching research and practice (Denton & Hasbrouck, 2009). Beyond this, however, a lack of consistency in title, role, and responsibilities surrounds coaching and presents challenges to its execution in schools.

Statement of the Problem

Coaching as both a role and metaphor is pervasive in popular culture, making it an appealing model for professional improvement. The intuitive appeal of coaching suggests that it would be simple to implement, however this perspective underplays the dramatic changes in relationships and practice among teachers and school leadership that coaching requires (Showers & Joyce, 1996). Researchers have called for clarification of the responsibilities of coaches, with the specific details related to what they do and how they spend their time (Denton & Hasbrouck, 2009; Deussen, Coskie, Robinson, & Autio, 2007; Fennell, 2011; Neumerski, 2013; Sailors & Shanklin, 2010; Spillane, Diamond, & Jita, 2003; Taylor, 2008). Additionally, a clearer understanding of the prior learning and experiences coaches bring to the role, as well as the on-going professional development experiences they have and seek, is needed (Anstey & Clarke, 2010; Deussen et al., 2007). Two dimensions of this call prompted the current study: first, there is a need for a concise definition of coaching, derived from the literature and checked against actual practice, in order to clarify discussions of coaching and its possible impact; second, an exploration of the specific activities of coaches in Metropolitan Detroit would both build upon studies from other locations and document the implementation of math coaching in this locale.

A review of the current literature identified research on various aspects of the math coaching role conducted across the United States, but only one study, in which coaching was a component but not the focus, has been conducted in Michigan's Wayne County (Siebers, 2012). Studies from across the country inform an understanding of coaching, but the local dictates of educational policy and practice, in particular, the mandate of instructional coaching in Michigan's lowest-performing schools, nearly all of which are in Metropolitan Detroit, suggest that a review of coaching in practice in Michigan, and specifically Metropolitan Detroit, is appropriate. In this study, the focus was on the work of math coaches in public schools located in Metropolitan Detroit.

Purpose

The purpose of this study was to document and describe the professional experiences and daily work of math coaches in schools in Metropolitan Detroit. This included an exploration of the qualifications and experiences coaches bring to the role and their on-going professional development opportunities, as well as an analysis of their intended and enacted goals and activities.

Research Questions

1. How do districts and schools in Metropolitan Detroit define the job responsibilities of math coaches?
2. How do math coaches in schools in Metropolitan Detroit characterize their work?
3. In what activities do math coaches in Metropolitan Detroit schools engage?
4. What professional training and experiences, previous and on-going, do math coaches in Metropolitan Detroit schools have?

Significance of the Study

As the researcher, I hoped to impact the current understanding of math coaching practice in two ways: through the proposal of a concise definition of math coaching based on the literature and built upon previous studies of coaching practice; and to validate this definition through the documentation of the work of math coaches in Metropolitan Detroit. In crafting a definition of math coaching, the parameters of purpose, audience, activities, and qualifications were considered. The four research questions which guided this study intended to explore these components of a coaching definition, as they are enacted in practice. The research questions are restated here, with the corresponding definitional elements identified.

1. How do districts and schools in Metropolitan Detroit define the job responsibilities of math coaches? This question encompassed purpose, audience, activities, and qualifications, as framed by the school and/or district.
2. How do math coaches in schools in Metropolitan Detroit characterize their work? This question identified what coaches see as the purpose of their work.
3. In what activities do math coaches in Metropolitan Detroit schools engage? This question addressed the activities of math coaches.
4. What professional training and experiences, previous and on-going, do math coaches in Metropolitan Detroit schools have? This question explored qualifications, in addition to on-going development.

The definition of Enacted Math Coaching which will be proposed in Chapter 2 fills a gap within the literature on coaching. Whether or how this definition might describe or contradict coaching practice has the potential to inform additional research and policy decisions.

Beyond what the proposed definition might offer to a broader understanding of coaching, I also sought to describe coaching as specifically enacted in Metropolitan Detroit. Research on coaching has been conducted in California (Dial, 2011; S. M. Olson, 2007), Delaware (Erskine, 2010), Illinois (Edmondson, 2007), New York (Neuberger, 2010), Ohio (Ash, 2010; Hartman, 2012), South Carolina (Dempsey, 2007), Tennessee (Kane, 2013), Texas (Garcia, 2012; Lussier, 2011; Mahagan, 2011), Virginia (Campbell & Malkus, 2011), and Utah (Toone, 2012). Only one study, in which coaching was a component but not the focus, was conducted in Michigan's Wayne County (Siebers, 2012). An illumination of coaching as practiced in Metropolitan Detroit could help inform policy at the local and state levels.

Michigan does not currently require certification for instructional coaches, though new requirements are being placed on coaches hired to work in schools identified by the Michigan Department of Education (MDE) as priority schools. The designation of priority schools, defined as the lowest 5% of the schools in the state, was established in 2012. The requirements for these schools and their staff members are substantial and evolving. One of six goals of the MDE office tasked with oversight of priority schools is "strengthening teacher effectiveness," and coaching has been identified as one component of this support (Michigan Department of Education, 2014). The emerging MDE position on coaching and the concentration of priority schools in Metropolitan Detroit, with a majority in Wayne County, combine to create a unique setting for coaching in this location.

Instructional coaches are used in schools and districts of all sizes, but coaches are more likely to be found in larger, urban districts and public charter schools, also known as public school academies. Larger, urban districts have both the administrative infrastructure and the additional federal funding to support coaching positions. Similarly, public school academies

have administrative flexibility and federal funding which allow for the ability to establish coaching positions. The city of Detroit is home to a large, urban district as well as the second-greatest number of charter schools in the country. During the 2012-2013 school year, over half of Detroit's students attended public school academies, a proportion that ranks Detroit second only to New Orleans (National Alliance for Public Charter Schools, 2013). This concentration of school sites with a greater potential for utilizing coaches also presents Metropolitan Detroit as a unique setting for studying coaching in practice.

Policy and implementation decisions concerning coaching are being developed in Michigan and Metropolitan Detroit. Requirements for credentialing, hiring, and utilizing coaches have yet to be codified. In this context, a proposed definition of coaching and an analysis of the work of coaches in Metropolitan Detroit have the potential to inform practitioners, school leaders, and district- and state-level administrators.

Methodology

This study was a descriptive case study to document the responsibilities, practices, and professional development of math coaches in Metropolitan Detroit. It was framed within the literature focused on improving teacher practice through embedded professional development. A sample of approximately 30 math coaches who work in Metropolitan Detroit were identified through snowball sampling techniques to complete a questionnaire on their background, responsibilities, and coaching activities. From this sample, and additional snowball sampling, eight coaches were selected to complete an interview, using convenience sampling. Schedules, a monthly calendar, daily activity logs, and job descriptions, as available, were collected from these coaches to further illuminate their responsibilities, activities, and professional development. I observed two of the coaches for one full work day, and two other coaches for half

of a work day. Representatives from the mathematics departments within the Intermediate School Districts (ISDs) of Macomb, Oakland, and Wayne counties were interviewed about coaching within their counties. Seven on-line job postings for math coach positions were also reviewed. The general analytic strategy for this study was to develop a case description (Yin, 1994). Data was analyzed following Creswell's (2003) steps for case study analysis, with a content analysis approach to coding the data.

Organization of the Document

The next chapter will provide a review of the literature related to math coaching. Beginning with the broad context of the mathematics performance of students in the United States, a brief account of national reform initiatives will be chronicled. The identification of teacher quality as a major area for reform will be framed by the literature on teacher professional development. Math coaching will be introduced and defined as a promising professional development practice, with its relevant research and themes presented. Finally, an accounting of coaching research similar to this study will be provided.

Chapter 3 will offer the details of the methodology of this study. The research setting and sample will be defined. Procedures for data collection will be identified, and each instrument for data collection will be explained. The instruments themselves are provided as appendices to this paper. A general approach, as well as specific steps, for data analysis will be enumerated. Steps which were taken to establish validity and reliability of the study will be explained and limitations to the study will be demarcated. To conclude this chapter, a subjectivities statement relating the researcher to the study and illuminating areas of potential bias will be presented.

In Chapter 4, a detailed analysis of the results of the study will be presented. These results will be organized by each research question, with broad themes and specific examples

provided. A summary of the results overall and conclusions of the study will be presented. The chapter will end with a brief description of possible trends in the implementation of math coaching in Metropolitan Detroit.

The final chapter of this document will provide an overview of the findings across research questions, identify implications of the findings and suggest areas for further research, and highlight limitations of the study which were recognized after the data analysis. The need for effective, consistent math coaching will be restated, and the key contributions of this study will be identified.

CHAPTER 2 LITERATURE REVIEW

Education Reform in the United States

The mathematics achievement of school children in the United States has long been a matter of national debate and concern. The last fifty years have seen a near-constant push for national educational reform, through court rulings and laws, prompted usually by fears of loss of American preeminence. National mathematics teaching and learning organizations, such as the National Council of Teachers of Mathematics, have similarly issued multiple calls for educational reform. Educational equity, specifically the intractably low mathematics performance of minority students and students living in poverty, has received particular focus in each wave of reform.

Contrary to the bleak public outlook, the National Assessment of Educational Progress (NAEP), colloquially known as the Nation's Report Card, indicated that 9- and 13-year-old students were performing better in mathematics in 2012 than in the early 1970s, though the performance of 17-year-olds had remained the same (National Center for Education Statistics, 2013). While mathematics performance has grown substantially for all subgroups for eighth grade mathematics, the achievement gap between African American and Hispanic students and white students remains wide, having narrowed only slightly (National Center for Education Statistics, 2013; Slavin, Lake, Chambers, Cheung, & Davis, 2009). This gap is one of the most malignant problems facing American society (Burchinal et al., 2011). As the proportion of minority students trends toward majority status, this disparity presents an increasing challenge to the economic and social well-being of the country (Scheurich, Goddard, Skrla, McKenzie, & Youngs, 2010).

Educational scholars have identified a strong relationship between poverty and low academic performance, with average NAEP mathematics scores for students attending urban, high-poverty schools consistently lower than those of students in schools in economically-advantaged districts (Eamon, 2002; McKinney, Chappell, Berry, & Hickman, 2009). Similarly, students in most large cities perform two or more years below grade level upon entering high school (Balfanz, Legters, & Jordan, 2004). In fact, the economic disparities tolerated in the United States may uniquely hinder educational reform efforts; when comparing the performance of American students to their international peers, U.S. scores are lowered by the achievement levels of students from underfunded schools in high-poverty areas (Payne & Biddle, 1999).

Over the last fifty years, national educational reforms have sought to dramatically improve student achievement and eliminate subgroup performance gaps. The first wave of national reforms, issued as court orders, revolved around educational desegregation. The 1954 decision in *Brown v. Board of Education* overturned the 1896 separate but equal doctrine from *Plessy v. Ferguson*, and opened the way for federal intervention in school desegregation. The push toward school desegregation lost momentum 20 years later, when *Milliken v. Bradley*, a case which originated in Metropolitan Detroit, ruled that desegregation could not be mandated across district boundaries. In addition to its impact on school segregation, *Brown v. Board of Education* was instrumental in setting the precedence for federal intervention into local school policies. Prior to *Brown*, and for nearly a decade after, there was little federal financial support for schools. In 1965, the Elementary and Secondary Education Act (ESEA), part of President Johnson's War on Poverty, allocated federal funding for schools and called for achievement gains for underserved populations (Vinovskis, 2009).

The 1983 report, *A Nation at Risk*, further amplified federal interest and action in educational reform. Warning of "a rising tide of mediocrity" and comparing American educational decline with "unthinking, unilateral educational disarmament," *A Nation at Risk* heightened the long-standing popular critique of public education (National Commission on Excellence in Education, 1983, p. 5). Partially in response to *A Nation at Risk*, additional national educational reform efforts were devised, including ESEA reauthorizations, which ultimately became the No Child Left Behind (NCLB) Act in 2001. NCLB called for national implementation of annual state-wide testing, academic achievement benchmarks, teacher and paraprofessional qualifications, and two reading programs (Vinovskis, 2009). The approach of many legislated reforms appears to couple mandates for higher achievement levels with stringent consequences for those who do not reach them, without regard for the iniquities in funding and resources that exist across school settings.

Reform in Mathematics Education

The mathematics education community has also advanced reform initiatives, with the National Council of Teachers of Mathematics (NCTM) leading the way. Over the last four decades, NCTM has released a handful of seminal documents framing advocacy for mathematics education reforms. *An Agenda for Action: Recommendations for School Mathematics of the 1980s* was followed by three foundational documents: *Curriculum and Evaluation Standards for School Mathematics* in 1989, *Professional Standards for Teaching Mathematics* in 1991, and *Assessment Standards for School Mathematics* in 1995 (National Council of Teachers of Mathematics, 2014b). NCTM credited the *Curriculum and Evaluation Standards* document with introducing standards-based education in the United States (National Council of Teachers of Mathematics, 2014a). Continuing this push for standards, NCTM released *Principles and*

Standards for School Mathematics in 2000, outlining fundamental principles for mathematics education and content and process standards for the mathematics students should know (National Council of Teachers of Mathematics, 2000). *Principles and Standards* stands as a clear predecessor to the Common Core State Standards for Mathematics. Other mathematics education professional organizations have joined NCTM in the call for reform and identification of standards. The Association of Mathematics Teacher Educators, the National Council of Supervisors of Mathematics, and the Association of State Supervisors of Mathematics have released joint position statements with each other and NCTM, focused on assessment, teaching practices, mathematics specialists, and the Common Core State Standards.

In addition to curriculum and pedagogical transformation, these reform documents have also included a focus on equity. The RAND report, *Mathematical Proficiency for All Students*, stressed the importance of access to quality mathematics instruction for all students (Ball, 2003). In 2012, the Common Core State Standards surfaced as a call to action on two decades of standards-based reforms. The Common Core State Standards not only advocated for a more focused and coherent curriculum, but also for equity in students' opportunity to learn. Through NCLB and the Common Core State Standards, the idea that all children can reach challenging academic standards has become national policy (Neufeld & Roper, 2003).

Teacher Professional Development

Researchers have focused on the improvement of teacher quality and instructional practices as a means for increasing student achievement (Darling-Hammond, 2000; Silver & Stein, 1996; Slavin et al., 2009; Tarr et al., 2008). Suggestions for improving teacher quality have focused on both pre-service training and in-service professional development. From either perspective, the pre-service preparation of teachers is seen as merely foundational, with

additional development to occur throughout the teacher's career. Despite the acknowledgement of the need for career-long learning, classroom practice has been resistant to change and teachers' implementation of new learning has been rare.

Key factors which impede change in teaching practice have been identified, including teachers' experiences as students themselves, the lack of a strong induction process, and the organizational isolation of teachers. Education is unique in that novice practitioners have over a decade and a half of experience in classrooms, having themselves been students. This apprenticeship of observation (Lortie, 1975) presents a barrier to the professional training of teachers. A teacher's previous experiences as a student may account for the motivation to become a teacher as well as the teaching style she seeks to emulate (Feiman-Nemser, 1983). Since education lacks a strong socialization process (Lortie, 1975), pre-service education and induction experiences do not serve to override the impressions of the layperson and replace them with understandings of a professional, as happens in other fields (Feiman-Nemser, 1983). Without a strong induction experience, teachers' entering assumptions about teaching continue to guide their work without influence from a community of professionals. The social and physical isolation of most aspects of teaching, coupled with uncertainty of expectations and assessment, position those learning to teach as independent agents, thereby minimizing the creation and transfer of a shared body of professional knowledge and support for development and change (Lortie, 1975).

In fact, pre-service teaching experiences may actually establish a preference for instructional and management techniques that produce immediate results over understanding that grows slowly (Feiman-Nemser, 1983). This aversion to the "haltingly and humiliatingly" slow work of practice (Gawande, 2002, p. 18), may follow the teacher into the first years of teaching

and establish a style that lasts throughout her career (Feiman-Nemser, 1983). Indeed, teachers have a greater sense of urgency to avoid what they fear than to accomplish what they hope (Kennedy, 2005). Yet, professional improvement seeks both expertise and progress, and a willingness to learn something new brings a concomitant period of weaker performance (Gawande, 2002). The important aspects of learning to teach come from experience over time, as skill and confidence develop through practice and increase teachers' effectiveness (Feiman-Nemser, 1983; Gawande, 2002; Lampert, 2010). This contradiction between aversion to sustained practice and the need for it in developing effective performance represents a major challenge to learning to teach.

Additionally, the pre-service mathematics preparation of American teachers, as compared to their international counterparts, is simply inadequate (Ball, 2003; Beckmann et al., 2012; Ma, 1999; Stigler & Hiebert, 1999; Taylor, 2008; The Center for Research in Math and Science Education, 2010). As states begin to implement the Common Core State Standards, which demand a deeper understanding of mathematics, the content and pedagogical expectations of teachers, especially at the elementary level, are increasing (Beckmann et al., 2012; Fennell, 2011; The Center for Research in Math and Science Education, 2010).

To address these challenges, strong professional development for in-service teachers becomes critical to efforts to reform schools and increase student achievement (Darling-Hammond, 2000; Neufeld & Roper, 2003; Sailors & Shanklin, 2010; Taylor, 2008; Van Haneghan et al., 2004). Yet, decades of federal and local investment in teacher professional development, to the grand sum of billions of dollars (Borko, 2004), have yielded almost no change in instructional practices. It is a story of "great ambitions and modest results" (Cohen, 1990, p. 312). Education as a field has not answered whether learning to teach should be done by

an individual or maintained by a collective (Lampert, 2010), a key distinction that has guided professional development success in other fields. Currently, the structure of both the occupation of teaching and the dual formal and informal natures of its learning process, remains mired in this ambiguity. Efforts to codify educational learning within a collective, professional understanding live within a formal approach to teacher development and are dominated by post-secondary coursework, including both content courses and pedagogical courses. Teachers rarely point to formal coursework as a source of their learning, however, citing instead the experience of teaching, and talking to other teachers, as most influential (Feiman-Nemser, 1983). This preference situates teacher learning as the responsibility of individuals. Informal sources of professional development have been found to be effective means of teacher development because they allow for learning that is embedded in teachers' own situations, collaborative, and sustained over time. Educators are faced with the challenge of finding a mechanism for converting meaningful, individual learning into collective, lasting understanding.

Early research on teacher professional development found classroom implementation rates of teacher learning to be as low as 10%, meaning curriculum and instructional innovations designed to improve student achievement were rarely presented to students (Showers & Joyce, 1996). To improve implementation rates, researchers have more recently championed teacher professional development that is situated within the content of the student curriculum (Doerr, Goldsmith, & Lewis, 2010; Neufeld & Roper, 2003; Sowder, 2007) and implemented in relationship with students (Lampert, 2010; Neufeld & Roper, 2003). Teachers' learning should be embedded in their practice, addressing their specific needs and concerns (Neufeld & Roper, 2003; Sowder, 2007) and allowing for opportunities for them to think critically about their own practice (Ball & Cohen, 1999; Feiman-Nemser, 1983; Loucks-Horsley, 2003; Sowder, 2007),

through active learning and with a spirit of inquiry (Doerr et al., 2010; Neufeld & Roper, 2003; Taylor, 2008). All of this work must be coherently integrated with school and district reform goals, so that professional development initiatives are consistent and receive systemic support (Bryk, 2010; Doerr et al., 2010; Miles, Odden, Fermanich, & Archibald, 2004; Neufeld & Roper, 2003; Taylor, 2008).

This comprehensive, embedded focus to teacher learning supports the stance that teacher preparation is a long-term endeavor. Beginning teachers often characterize learning to teach as the province of the novice, whereas experienced teachers see learning to teach as continually revisited with each new group of students (Feiman-Nemser, 1983). Beginning teachers cannot be faulted for this view, when many observers of education wrongly maintain that teachers simply need updating rather than serious, sustained learning of curriculum, students, and teaching (Sowder, 2007). Successful performance, of any type, has a long learning curve, and is characterized by a willingness to engage in sustained training (Gawande, 2002). Effective schools are places where students learn, and where teachers learn as well (Feiman-Nemser, 1983).

Mentoring has been identified as one way to improve the induction experience for new teachers and provide informal, embedded support. Approximately 80% of new teachers are now assigned mentors (Gardiner, 2012), a relationship in which a more experienced teacher provides guidance and support to a newer teacher, in order to familiarize her with the organizational and social structure of the workplace (Eby et al., 2013; Eby & Lockwood, 2005). Mentor teachers impact the assimilation and socialization of new teachers; when personal, trusting relationships develop, mentoring can have positive effects on the attitudes and success of the mentee (Eby et al., 2013; Eby & Lockwood, 2005; Gardiner, 2012; Nasser-Abu Alhija & Fresko, 2010). While

mentoring can be one form of on-the-job training (Eby & Lockwood, 2005), it is more often concerned with the acculturation of new teachers, rather than their professional development (Gardiner, 2012; Nasser-Abu Alhija & Fresko, 2010). Mentoring may emphasize surviving the first years of teaching rather than supporting a teacher as she learns from her classroom behavior and instructional choices (Feiman-Nemser, 1983). In high-poverty schools, mentoring does not successfully support the professional learning of new teachers (Gardiner, 2012).

Coaching

Effective teacher preparation that is embedded and long-term must extend beyond the formal training courses and follow a teacher into her career. In contrast with mentoring, which can be seen as a way to support new teachers through the induction process, coaching provides sustained development throughout a teacher's career, a distinction between "immediate needs … and long-term instructional goals" (Gardiner, 2012, p. 195). It is this focus on developing instructional practice, specifically the fact that "instructional coaches *teach* others how to learn very specific, evidence-based teaching practices" (Knight & van Nieuwerburgh, 2012, p. 103) that distinguishes coaching from mentoring. Coaching has become a popular approach to providing teacher-centered, sustained professional development, though the culture of teaching makes coaching more difficult than in other fields (Lampert, 2010).

A Theoretical Framework for Coaching

Cobb and Jackson (2011) suggested approaching the whole endeavor of mathematics instructional reform from "a learning perspective" (p. 25). A variety of learning theories inform a range of research foci and recommendations for coaching practice. These include social learning theory, illuminated by Wenger (2009); activity learning theory, characterized by Vygotsky (Vygotsky & Cole, 1978); and constructivist learning theory, framed by Piaget (Cowan, 1978).

This diversity of perspective impacts what coaches focus on, what they understand, and how they act (Wenger, 2009), a multiplicity which suggests that coaching practice may be varied as well. A common thread among these learning perspectives, as applied to coaching, suggests that teachers learn by engaging in assisted performance with coaches, who serve as more accomplished peers (Cobb & Jackson, 2011; Neumerski, 2013; Polly, Mraz, & Algozzine, 2013). This view of learning is closely aligned with a social theory of learning (Wenger, 2009), which builds from four premises:

- We are social beings. Far from being trivially true, this fact is a central aspect of learning.
- Knowledge is a matter of competence with respect to valued enterprises – such as singing in tune, discovering scientific facts, fixing machines, writing poetry, being convivial, growing up as a boy or girl, and so forth.
- Knowing is a matter of participating in the pursuit of such enterprises, that is, of active engagement in the world
- Meaning – our ability to experience the world and our engagement with it as meaningful – is ultimately what learning is to produce. (p. 210)

An overall focus on participation in communities of practice informs what is needed to support learning:

- For *individuals*, it means that learning is an issue of engaging in and contributing to the practices of their communities.
- For *communities*, it means that learning is an issue of refining their practice and ensuring new generations of members.
- For *organizations*, it means that learning is an issue of sustaining the interconnected communities of practice through which an organization knows what it knows and thus becomes effective and valuable as an organization. (Wenger, 2009, p. 213)

It is these communities of practice that present the potential to offset the isolation of teaching and establish a meaningful induction process. Communities of practice offer a mechanism for formalizing the informal learning of individuals and opening the door to improvements in instructional practice. A coach simultaneously learns, and affects teacher learning, as an individual, within a community, and as part of an organization. This approach to professional

learning stands in contrast with professional development offerings that are not situated in teachers' contexts, with existing curriculum and in interaction with students.

The Historical Development of Coaching

Though the concept of coaching has been discussed in the literature for nearly 80 years, the development of coaching models began to expand in the late 1970s and early 1980s (Denton & Hasbrouck, 2009; Neumerski, 2013; Sailors & Shanklin, 2010). In the last decades of the twentieth century, coaching had limited implementation in schools, primarily in the area of literacy (Bean, Draper, Hall, Vandermolen, & Zigmond, 2010; Denton & Hasbrouck, 2009; Poglinco et al., 2003). The reauthorization of the Elementary and Secondary Education Act in 2000 and the introduction of NCLB in 2001 ushered in calls for highly-qualified teachers and research-based effective practices, along with substantial funding to support these initiatives (Denton & Hasbrouck, 2009; Sailors & Shanklin, 2010). NCLB identified the use of coaches as an effective professional development strategy for supporting teachers in Reading First schools. (Reading First was one of the two reading programs specifically recommended for wider implementation under NCLB.) This increased attention and dedicated funding provided a strong impetus for wider implementation of coaching initiatives (Campbell & Malkus, 2011; Denton & Hasbrouck, 2009; Taylor, 2008). In 2009, President Barack Obama initiated the Race to the Top grant program, which included $3.5 billion for job-embedded professional development, with coaching specifically identified as an acceptable professional development approach (Long, 2014). President Obama also signed into law NCLB's successor, the Every Student Succeeds Act (ESSA), in the last days of 2015. Like NCLB, ESSA specifically names instructional coaching as a professional development strategy and allows for the funding of instructional coaches under federal subgrants (Every Student Succeeds Act, 2015).

With this endorsement and funding from the federal level, traditional districts and charter schools began investing in coaching as a means for improving the instructional practice of teachers (Neumerski, 2013; Poglinco et al., 2003), an idea that has great intuitive appeal (Denton & Hasbrouck, 2009). Researchers have posited that coaches' impact on teachers' instruction, particularly as it deprivatizes (Campbell, 2012; Taylor, 2008) teachers' practice, is a mechanism though which student academic achievement can be improved (Burns, 2006; Coburn & Russell, 2008; Neufeld & Roper, 2003; Poglinco et al., 2003; Showers & Joyce, 1996; Sledge & Morehead, 2006; Taylor, 2008). In this way, coaching becomes a critical component of school reform initiatives (Denton & Hasbrouck, 2009). Coaching also offers a counter point to concerns raised by other professional development measures. Where Cohen (1990) cautioned that adoption of pedagogical changes may only occur at a surface level, leaving the foundation of instructional practice unchanged, coaching may provide the on-going, situational support and oversight (Tarr et al., 2008) necessary to address fundamental change. Similarly, coaching supports an instructional leadership model, which values the creation of a team of committed professionals, over a single, transformational leader. This model of leadership aligns with social learning theory and has been shown to have three to four times greater impact on student outcomes than the transformational leadership model (Robinson, Lloyd, & Rowe, 2008).

It is difficult to assess the impact of coaching on student achievement (Neufeld & Roper, 2003), because of the many variables and intermediary influences that impact student performance. In a review of coaching research, Coburn and Russell (2008) found that different coaching initiatives have led to different results (Coburn & Russell, 2008). Nonetheless, coaching "is no longer unproven" (Sailors & Shanklin, 2010, p. 5), as coaching has demonstrated a positive impact on student mathematics achievement scores (Campbell & Malkus, 2011;

Neufeld & Roper, 2003; Sailors & Shanklin, 2010) after a minimum of three years of implementation (Loucks-Horsley, 2003). Coaching leads teachers to implement new instructional strategies (Neufeld & Roper, 2003; Neumerski, 2013; Polly, 2012; Sailors & Shanklin, 2010; Taylor, 2008), with an eight-fold higher rate than traditional professional development provided without follow-up (Knight, 2009).

A Definition of Coaching

The increased implementation of coaching preceded a robust theoretical and research base, a situation which created ambiguity in the titles, roles, and responsibilities set before coaches. A variety of adjectives modify the title of coach: math coach (Burns, 2006), academic coach, reform coach (Denton & Hasbrouck, 2009), technical coach, collegial coach (Neumerski, 2013), change coach, capacity coach (Neufeld & Roper, 2003), cognitive coach, peer coach (Knight, 2009), with instructional coach leading as the term most widely used (Denton & Hasbrouck, 2009; Gallucci, DeVoogt van Lare, Yoon, & Boatright, 2010; Knight & van Nieuwerburgh, 2012; Neumerski, 2013; Polly, 2012; Taylor, 2008). As the range of titles suggests, each approach to coaching represents differing, if sometimes overlapping, goals and methods (Knight, 2009). Additionally, the title of elementary math specialist is offered in contrast to math coach, but the distinction is framed differently by different authors, and commonality with coaching remains (Association of Mathematics Teacher Educators; Campbell & Malkus, 2013; McGatha, 2009).

The ambiguity surrounding the role and focus of a coach pervades the literature (Burns, 2006; Denton & Hasbrouck, 2009; Gallucci et al., 2010; Poglinco & Bach, 2004; Taylor, 2008). This lack of clarity presents a challenge for schools and districts who are looking to assign responsibilities to coaches (Neumerski, 2013), a difficulty that is mirrored for those who fill the

role of coach (Taylor, 2008). Yet, what role is defined for coaches impacts their work with teachers (Coburn & Russell, 2008).

Narrowing the focus to authors who consider the role of an instructional coach does not yield a concise definition, though researchers present multi-paragraph, rich descriptions of the purposes of coaching and suggested activities in which coaches should engage (Anstey & Clarke, 2010; Campbell, 2012; Campbell & Malkus, 2011; Denton & Hasbrouck, 2009; Gallucci et al., 2010; Neufeld & Roper, 2003; Taylor, 2008). The one point of clarity rests in the agreement that "coaching is a form of sustained, job-embedded professional development and that it includes some form of teacher observation" (Denton & Hasbrouck, 2009, p. 155). This shared understanding is an important beginning, but lacks the dimensions of a fully useful definition. In order to clarify what is, and what is not, math coaching, a definition would need to include the purpose for coaching, the audience for the coaching, the minimum activities that constitute coaching, and the qualifications necessary to be a coach (S. M. Kahn, personal communication, September 16, 2014). Through this lens, and building on the rich descriptions of instructional coaching provided by others, the following definition of Enacted Math Coaching (EMC) is proposed.

Drawing on the terminology utilized in curriculum studies which highlights a distinction between intended and enacted curriculum, the name Enacted Math Coaching is used to emphasize the difference between intended and enacted math coaching, with the hope of unifying the two. Through a clear definition, practitioners can identify which components of a situation are aligned with the literature and intentions of successful math coaching. The definition of Enacted Math Coaching is proposed to support the alignment of coaching with the high-impact practices developed in the literature. Like an emcee, who announces the proceedings

and ensures the smooth unfolding of an event, the EMC definition identifies essential elements and encourages the consistent execution of high-quality math coaching.

A proposed definition of Enacted Math Coaching.

Math coaching occurs when an experienced, successful mathematics teacher with strong mathematical content and pedagogical knowledge and awareness of the needs of adult learners provides direct, nonevaluative, classroom-based, and sustained support to other math teachers to build those teachers' capacity to understand, choose, and implement research-based mathematics instructional practices, through modeling instruction and observing and providing feedback, so as to improve students' mathematics achievement.

This definition of EMC captures the purpose, audience, minimum activities, and qualifications for math coaching in one sentence, though admittedly a long one. The dimensions of coaching included in this definition align with a social theory of learning. Coaches working alongside teachers creates a community of practice, through which both teachers and coaches shape "not only what [they] do, but also who [they] are and how [they] interpret what [they] do" (Wenger, 2009, p. 211). Inherent in the purpose of coaching is the school's goal to establish and sustain communities of practice that would develop organizational knowledge and help the school be effective. Selecting teachers as the audience for coaching acknowledges the need to continually develop new members of the community of practice. Recognizing that knowledge is evidenced by doing well in something the community values, the activities used by a coach seek to engage teachers in refining their practice and contributing to their community of learners. As a prerequisite to engaging teachers in this way, a coach must herself have competence in the practices the community values and must continue to engage in and contribute to the community alongside the teachers (Wenger, 2009).

Purpose of coaching.

The purpose of coaching, as outlined in the initial discussion above, is to improve instructional practice and thereby increase student achievement. It has been posited that coaching helps improve instructional practice through increasing implementation of research-based mathematics instructional practices (Association of Mathematics Teacher Educators; Campbell & Malkus, 2011; Dempsey, 2007; Knight, 2004, 2005; Neufeld & Roper, 2003; J. Olson & Barrett, 2004; Sailors & Shanklin, 2010; Slavin et al., 2009; Taylor, 2008). Coaching is viewed as one component of school reform initiatives and alignment between the coach's role and broader school and district goals is essential for effective coaching (Cobb & Jackson, 2011; Neufeld & Roper, 2003; Poglinco & Bach, 2004). A shared responsibility for instructional leadership among coaches, principals and other school leaders (Cobb & Jackson, 2011; Taylor, 2008), including a shared understanding of the coach's role (Coburn & Russell, 2008) and clarity of coaching priorities (Neufeld & Roper, 2003) create an essential foundation for successful coaching initiatives.

Audience for coaching.

Perhaps too simply stated, the target audience for instructional coaching is teachers. Beyond that basic assumption, however, the literature does not limit how those teachers are to be selected or the parameters of their work with a coach. Taylor (2008) identified seven dimensions over which coaches' work with teachers could differ: coaches may work with novice, experienced, or expert teachers, with the implication that coaches work with teachers who are struggling as well as those who are successful; coaches may work in one school site or multiple school sites; coaches may work with teachers within or across grade levels; coaches may interact

with teachers continuously, periodically, or rarely; and coaches may work with teachers for less than a year, a full year, or over the course of multiple years.

Coaching activities.

Much of what is held as standard practice for instructional coaches comes from the foundational research on literacy coaching (Atteberry & Bryk, 2011; Bean et al., 2010; Poglinco et al., 2003), and math coaching has been greatly informed by this research. Drawing on current recommendations for effective professional development, coaches must work directly with teachers, in their classrooms, over an extended period of time. It is widely maintained that coaches' work with teachers should be nonevaluative (Campbell & Malkus, 2013; Knight, 2009; Neufeld & Roper, 2003; Showers & Joyce, 1996; Taylor, 2008). In this context, nonevaluative emphasizes a separation between coaches and those who are responsible for formally evaluating teachers, as well as a distinction between the developmental practice which occurs during coaching interactions and the summative performance which characterizes evaluative experiences. Insisting that coaching is nonevaluative does not preclude coaches from assessing the proficiencies and needs of the teachers with whom they work. Two specific activities define the minimum expectations of coaching: modeling research-based instruction, and observing and providing feedback. While these are minimum expectations, their focus on classroom practices represents a major shift in the typical isolated nature of teaching. This shift necessitates a fairly intense relationship between coach and teacher, which may well be stressful for both (Bean et al., 2010; Denton & Hasbrouck, 2009).

In modeling research-based instruction, the coach works toward the purpose of improving instructional effectiveness by demonstrating promising instructional techniques and strategies (Denton & Hasbrouck, 2009). This demonstration is made more powerful by the fact that it takes

place with the teacher's own students (Sailors & Shanklin, 2010). In an analysis of coaching in Reading First schools, Bean et al. (2010) found that "modeling appeared to be a popular approach for helping teachers understand how to make instructional changes and also appeared to generate other coaching activities such as conversations and observations" (p. 104).

In enacting observation and feedback, the coach observes the teacher at work in her classroom and provides feedback to support the teacher as she effectively implements changes to improve her practice (J. Olson & Barrett, 2004; Polly et al., 2013). Observation and feedback may follow a formal cycle characterized by an initial observation, teacher goal setting for improvement, the development of strategies to meet that goal, a second observation to view those strategies in action, and feedback which leads to refinement of the goal or setting of a new goal (Bruce & Ross, 2008). A review of three different models of instructional coaching noted that all three models included a pre-lesson conference, observation, and feedback cycle (Mudzimiri, Burroughs, Luebeck, Sutton, & Yopp, 2014). Bean et al. (2010) found that this formalized structure never occurred in the Reading First schools they researched, however. Other approaches may involve observation and feedback when new techniques are implemented (Knight, 2005), or a more informal observation and feedback structure. Regardless, Knight (2009) emphasized that observation and feedback should be nonjudgmental and occur within a spirit of inquiry and dialogue.

Many other possible coaching activities have been identified. Under the definition of Enacted Math Coaching, these additional activities are considered appropriate but only constitute coaching when coupled with modeling, observation, and feedback. Killion (2008) characterized the many activities in which coaches might engage as evidence of two types of coaching: "coaching *light* and coaching *heavy*" (p. 1). Coaches may work with teachers to set personal

improvement goals as well as instructional goals outside of an observation and feedback cycle (Knight, 2011; Knight & van Nieuwerburgh, 2012; Taylor, 2008). Coaches may work with teachers to explore the mathematics content that teachers are enacting with students (Campbell & Malkus, 2011; Coburn & Russell, 2008; Dempsey, 2007; Gallucci et al., 2010). This focus on content might be undertaken in isolation, or it may be based within a study of the curriculum materials with which teachers are working (Campbell, 2012; Campbell & Malkus, 2011, 2013; Fennell, 2011; Taylor, 2008). Coaches might also be called on to analyze and interpret student achievement data with teachers and/or administrators (Campbell, 2012; Campbell & Malkus, 2011, 2013; Taylor, 2008). Coaches are often expected to lead professional development initiatives for small or large groups of teachers outside of their regular coaching routines (Campbell & Malkus, 2011; Coburn & Russell, 2008; Fennell, 2011; Knight, 2005). This additional professional development may center on any of the above mentioned activities or other needs as defined by the school or district.

What shared expectations for the practices of instructional coaches have developed are challenged in the implementation of these roles in schools and districts across the country. There is a wide variation in how coaching programs are designed (Cobb & Jackson, 2011; Taylor, 2008) and how coaches spend their time (Denton & Hasbrouck, 2009; Neumerski, 2013; Taylor, 2008). Taylor (2008) identified three dimensions along which coaching can vary in practice, with indicators ranging from purpose to style to duration. The four-step coaching process of planning, observing, modeling and providing feedback, as developed in the literacy coaching literature, was found to be executed rarely if at all in actual practice (Atteberry & Bryk, 2011; Bean et al., 2010; Neumerski, 2013). Cobb and Jackson (2011) also identified situations in which coaches were assigned responsibilities that diminished the time they had to work with teachers. Campbell

(2011) documented that coaches spent over twice as much time on other tasks as on actually coaching teachers. To enhance the work of coaches, researchers called on administrators to organize school schedules and calendars to maximize opportunities for teachers to participate in common planning (Dempsey, 2007) and work collaboratively with coaches (Coburn & Russell, 2008; Neufeld & Roper, 2003), including avoiding the temptation to divert coaches in the service of other school needs (Neufeld & Roper, 2003).

Qualifications and development of coaches.

School leaders impact the quality of coaching through the selection of qualified coaches and a commitment to their on-going professional development. Coaches' demonstrated instructional expertise in mathematics is a key consideration in coach selection (Coburn & Russell, 2008), but Knight (2005) argued that "*how* a coach goes about working is just as important as *what* a coach knows" (p. 19). Poglinco and Bach (2004) and Neufeld and Roper (2003) also advocated for coaches to have strong interpersonal skills, especially the ability to establish trust. One component of establishing trust is demonstrating professional expertise through success in the classroom (Knight, 2004, 2005; Neufeld & Roper, 2003). This becomes especially salient as coaches utilize relationships to exert influence, since they typically have no formal authority over the teachers with whom they work (Gallucci et al., 2010; Neufeld & Roper, 2003).

The depth of a coaches' capacity to understand and implement effective mathematics instruction necessarily impacts teachers' understanding and implementation of the same (Poglinco & Bach, 2004). Coaches should come to the position with strong mathematical content and pedagogical knowledge, as well as an understanding of the unique needs of adult learners. To support the continued growth of coaches, it is recommended that they participate in on-going

professional development (Cobb & Jackson, 2011; Gallucci et al., 2010; Poglinco & Bach, 2004), with Neufeld and Roper (2003) suggesting that one day per week be allocated to this. The nature of this professional development needs to be specific to coaching itself (Cobb & Jackson, 2011), including mathematics content courses and coaching courses (Campbell & Malkus, 2011; Knight, 2009), review of research (Knight, 2004), and knowledge of adult learners (Bloom, 2005). Ideally, coaches should themselves be coached (Knight, 2009; Neufeld & Roper, 2003).

CHAPTER 3 METHODOLOGY

Introduction

The purpose of this study was to document and describe the professional experiences and daily work of math coaches in schools in Metropolitan Detroit. This included an analysis of math coaches' goals and activities, as well as an exploration of the qualifications and experiences they bring to the role and their on-going professional development opportunities.

In this study, I hoped to impact the current understanding of math coaching practice through the documentation of the work of coaches in Metropolitan Detroit. Four research questions guided this study:

1. How do districts and schools in Metropolitan Detroit define the job responsibilities of math coaches?
2. How do math coaches in schools in Metropolitan Detroit characterize their work?
3. In what activities do math coaches in Metropolitan Detroit schools engage?
4. What professional training and experiences, previous and on-going, do math coaches in Metropolitan Detroit schools have?

Design of Study

This study was a descriptive case study designed to document the responsibilities, practices, and professional development of math coaches in Metropolitan Detroit. The purpose of this descriptive study was to identify and address the range of descriptions and responsibilities associated with the position of math coach. This study focused on providing a detailed account of the work of math coaches in everyday practice, a previously unexamined case (Creswell, 2003; Merriam, 1998; Yin, 1994).

While the phrase case study is often used broadly to refer to a range of research activities, for this study it is used to describe a research strategy. Yin (1994) described a case study as appropriate for research seeking to answer how and why questions, focused on contemporary events, but without control over the behavior under study. This study focused on how the work of math coaching in Metropolitan Detroit was defined and enacted, and what credentials and development opportunities math coaches have. The purpose of this study was not to intervene or assess effectiveness, but to describe math coaching in Metropolitan Detroit.

Research Setting

Metropolitan Detroit is representative of many urban centers in the nation, but it is also impacted by factors that are unique to this region. Metropolitan Detroit emanates from the City of Detroit and includes the three counties of Macomb, Oakland, and Wayne, often referred to as the tri-county area. Communities in the tri-county area span a wide spectrum of economic and social demographics and house schools with high academic rankings as well as those with poor performance records. There are approximately 1,500 public schools in Metropolitan Detroit, including both traditional public schools and public school academies, also referred to as charter schools. Only public schools were considered for this study. The city of Detroit has the second-greatest number of charter schools in the country, and there are many public school academies throughout Metropolitan Detroit. The emergence of large numbers of charter schools, as well as traditional districts opening enrollment to students living outside their boundaries, has resulted in the shifting of student populations across municipal borders.

The State of Michigan has an intermediary layer of governmental agency, between school districts and the state, charged with supporting public education. These agencies are known as Intermediate School Districts (ISDs), and they serve individual counties, or clusters of rural

counties, providing programs and services, and collecting data for the state. Metropolitan Detroit has three ISDs; one each for the counties of Macomb, Oakland, and Wayne. Technically, the ISD for Wayne County is called a Regional Educational Service Agency. For consistency within this paper, it is referred to as an ISD.

The State of Michigan ranks all public schools based on performance measures and classifies the lowest 5% of schools as priority schools. The state has mandated that instructional coaching be adopted by priority schools during each year that they are in this category after the first year they are classified. Michigan ISDs are charged with providing state-mandated supports to priority schools, and a majority of the priority schools in the state are located in Wayne County. A subset of priority schools were transferred to state management in 2011 and reconstituted under a new district, the Education Achievement Authority (EAA). All EAA schools are in the Detroit.

Academically, the performance of students in Detroit, in both traditional and charter schools, has been used to exemplify urban school dysfunction. In the two years that students in the Detroit Public Schools participated in the NAEP exam, 2009 and 2011, they had the lowest scores in the nation, with mathematics scores far below the next lowest school district at both the fourth and eighth grade levels. In 2009, during a visit to Detroit, then U.S. Secretary of Education Arne Duncan expressed his sense of outrage at the state of schools in Detroit and identified Detroit as “ground zero” for education in the United States (The Washington Times, 2009). The academic achievement of students in Detroit may be a low-water mark, but academic challenges are faced by students in schools throughout the Metropolitan area and include both traditional and charter districts. In particular, traditional districts in East Detroit, Pontiac,

Southfield, Warren, and Wayne-Westland are all home to schools ranking in the lowest percentiles based on data from the 2013-2014 school year (MI School Data, 2014).

It is in this setting that this study of math coaches was undertaken. The case under study was defined in terms of the job responsibilities, daily practices, and professional development of math coaches regardless of their official titles. Individuals working within public schools in Metropolitan Detroit, whose responsibilities and activities focused on improving teacher practice in mathematics, through work primarily with teachers or teachers and their students concurrently (Kane, 2013) were considered members of the case under study. For clarity in discussion, these individuals are referred to as math coaches throughout this paper, even though their actual titles may vary. Constraining the study to those who work within this region focused this study on the unique case of Metropolitan Detroit. Defining the role of coach by responsibility and activity, rather than title, circumvented the uncertainty associated with the variety of titles that have been documented for similar positions.

Sample

The population of math coaches in Metropolitan Detroit is not documented. In order to reach the greatest number of individuals, snowball sampling was utilized (Patton, 1990). Knowledgeable contacts, including education and K-12 outreach faculty and staff from local universities, representatives from the Michigan Department of Education, and staff of the tri-county Intermediate School Districts and the Michigan Association of Public School Academies were asked to identify participants (Merriam, 1998; Patton, 1990). These individuals were each sent a recruitment email, along with a request to forward the email to others. This process was repeated a second time, approximately six months later. Participants were also identified through phone calls to all public school districts in the tri-county area. In addition, eight math coaches

were selected from the larger sample for further data collection and analysis. These coaches were selected using convenience sampling, based on their willingness and availability (Merriam, 1998; Patton, 1990). These coaches provided additional data related to coaching practice in Metropolitan Detroit.

The snowball sampling technique and support from knowledgeable contacts, as outlined above, resulted in 48 individuals accessing the online questionnaire over the course of eight months. Five of the individuals did not advance beyond the consent page. Overall, 30 respondents completed 70% or more of the questionnaire, and 27 coaches completed 90-100% of the questionnaire. Data for the 43 participants who completed some part of the questionnaire were included in this study. Unless otherwise noted, all percent data provided refer to a total of 30 respondents, though some items had 27, 28, 29 or 30 responses.

Demographic data from the coaches who responded to the questionnaire indicated that 90% of them work full-time. Thirty-nine percent work in districts with more than 10,000 students, 25% work in districts with 1,000 to 9,999 students, and 39% work in districts with less than 1,000 students. Half of the participants were funded through a combination of federal funding sources, and the other half through district, state, or grant funds. The coaches were evenly split between traditional public schools and charter schools, with one coach working for the Educational Achievement Authority. Only two coaches did not work in a Title I Schoolwide or Targeted Assistance school. Forty-five percent of the coaches worked in Wayne County, 31% in Oakland County, 17% in Macomb County, and 7% reported working in more than one county. The State of Michigan has specific requirements for mandated instructional coaches who work in priority schools. These priority-school coaches are hired as part-time consultants through the ISDs. Five respondents self-identified as working in a priority school.

For additional perspective on math coaching as enacted in Metropolitan Detroit, representatives from the mathematics departments in the Macomb, Oakland and Wayne County ISDs were interviewed about math coaching initiatives within their counties. It is not known what percent of the population of math coaches in Metropolitan Detroit a sample of 48 coaches represents, since the total number of coaches in Macomb, Oakland, and Wayne counties was unidentified. As part of the interview, all three ISD math specialists were asked about the number of math coaches working within their counties. They confirmed that 48 respondents approximated their estimates of the number of math coaches in the region.

Interviewed Coaches

Ten respondents to the questionnaire volunteered to share further information about their coaching work, though only five provided their contact information. Two respondents had since transitioned to administrative roles and were not selected for further data collection. The three remaining coaches, along with five others recruited through additional snowball sampling, were selected for further data collection, using convenience sampling, based on their willingness and availability (Merriam, 1998; Patton, 1990). They are identified in this study by pseudonyms.

Sarah Allen worked with students and teachers in two K-5 elementary schools within a traditional district in Macomb County. Allen held an elementary mathematics endorsement, a bachelor's degree in elementary education with a major in mathematics, and a master's degree in curriculum. She completed an interview, provided her job description (see Appendix D) and weekly schedule, and was shadowed for one school day in the spring of the 2015-2016 school year.

Brittany Clark held a bachelor's degree in mathematics and completed additional courses to earn an elementary teaching certificate with an elementary mathematics endorsement. She

held a master's degree in curriculum. Clark worked in an upper elementary (grades 5 and 6) school in a traditional district in Wayne County, supporting both teachers and students. Clark was interviewed and shadowed for half of a school day in the spring of the 2015-2016 school year. She also provided her daily schedule.

Jessica Grant held a master's degree in curriculum and instruction, with a concentration in language arts for both of her degrees. Grant was responsible for working directly with students as well as teachers in a K-8 charter school in Oakland County. Grant provided weekly schedules from the 2014-2015 and 2015-2016 school years, her monthly calendars for the 2014-2015 school year, her position posting (see Appendix D) and evaluation, and other supporting documents related to her work as a coach. Grant also completed an interview and was observed for one school day in the fall of the 2015-2016 school year.

Maria Hamilton worked in a K-5 elementary school, in a traditional district in Oakland County. Hamilton was working toward a doctorate of philosophy in curriculum and instruction, and neither of her previous degrees included a mathematics concentration. Hamilton participated in an interview and provided ten daily logs from across the 2014-2015 school year. The interview and logs made clear that she served as a math intervention teacher working directly with students. Though her title was math coach, she did not have any responsibility for interacting with teachers. An observation of Hamilton was not scheduled, since her work was exclusively with students.

Ashley Jackson served as a part-time mathematics consultant working with teachers for an Intermediate School District. She held bachelor's and master's degrees in mathematics education and an elementary mathematics endorsement. She was working on an education specialist degree. Jackson had completed all of her coaching work for the 2015-2016 school year

when she entered the study, so she was not observed. She was interviewed and provided documents describing the project within which she worked.

Angela Samuelson was responsible for providing intervention to students in one K-5 school and also for working with teachers to improve their mathematics instruction in three other schools (one K-5, one middle school, and one high school) within a charter district in Macomb County. Samuelson held a master's degree in curriculum instruction, with a focus in language arts for her graduate and undergraduate studies. Samuelson completed an interview and provided her weekly schedule for the 2014-2015 school year. Samuelson was reassigned to a classroom position, due to budget constraints, and thus was not available for coaching observation.

Darryl Williams worked as a district-level math coach supporting teachers in a traditional district in Wayne County and had previously worked as a building-level math coach. He held bachelor's and master's degrees in mathematics education and an elementary mathematics endorsement. Williams participated in an interview and provided a copy of his daily log.

Josephine Wright held a bachelor's degree in mathematics and a master's degree in elementary education, along with an elementary mathematics endorsement. She worked as a math coach serving teachers in a K-8 school in a traditional district in Wayne County. Wright was interviewed, shadowed for half of a school day in the spring of the 2015-2016 school year, and provided her weekly schedule (see Appendix D).

Data Collection

Data for this study were gathered using a questionnaire, an interview, an observation, and existing documents. The selection of these data collection tools and questions was based on a social theory of learning, in which learning occurs through scaffolded practice with accomplished peers. In particular, components of the questionnaire, interview, observation, and

existing documents explored the qualifications of the coach who had been identified as an accomplished peer. The questionnaire, interview, observation, and existing documents also sought to understand what coaches do to support teachers. Table 1 summarizes the instruments used.

Table 1
Data Collection Instruments

Method of Data Collection	Source	When Undertaken	Research Questions Addressed
Questionnaire (Qualtrics)	Full Sample of Coaches	Initial	1, 2, 3, 4
Interview (in person or via phone)	Interviewed Coaches	After Questionnaire	1, 2, 3, 4
Interview (via phone)	ISD Math Specialists	After Questionnaire	1, 3, 4
Existing Documents (schedules, daily logs, job descriptions, evaluation tools)	Interviewed Coaches	Concurrent with Interview	1, 3, 4
Observation	Interviewed Coaches	After Questionnaire	2, 3, 4
On-line Job Postings	Online District Documents	Throughout	1, 3, 4

The questionnaire and interview questions were derived from the literature and augmented by newly created questions. These questions were submitted to local experts for review. Feedback was received from three mathematics education faculty members, two ISD mathematics consultants (not the same individuals who participated in interviews for the study), a member of Wayne State University's Research Design and Analysis Consulting Unit, and an instructional specialist who worked in a charter school in Detroit, supporting literacy and science instruction. The instruments were revised based on this feedback (Merriam, 1998). A description of each instrument follows, and all instruments are included as appendices to this document.

Questionnaire

In this study, a questionnaire was developed as a form of a structured interview (Merriam, 1998; Patton, 1990; Yin, 1994). This approach allowed for the collection of responses to more questions from a broader group of respondents in a short time (Patton, 1990). Though a questionnaire constrains responses to those categorized by the researcher, it facilitates direct comparison of data (Merriam, 1998; Patton, 1990). The questionnaire (see Appendix A) was administered to all participants using Qualtrics, a web-based application. The first screen of the questionnaire provided information about the study; responding to the questionnaire served as consent. The questionnaire addressed all four research questions, as well as the components of the definition of Enacted Math Coaching, namely purpose, audience, minimum activities, and qualifications. The questionnaire included both open-ended and closed questions, and the questions were grouped into four categories: background, position, activities, and professional development. The background section was partially adapted from Deussen et al. (2007), who called for a clear picture of the qualifications and background of the individuals who become literacy coaches, and informed by McCrary (2011), who studied the efficacy of instructional coaching within an urban district. The seminal work by Campbell and Malkus (2011) on mathematics specialists in Virginia also provided guidance for the questions in this section.

The second section of the questionnaire addressed aspects of the coach's position, beginning with the coach creating a definition and identifying a purpose for coaching. Taylor (2008) identified 15 dimensions of instructional coaching, covering basic, procedural and structural components. These dimensions were considered as an overarching frame in the development of questions in this section, and contributed specifically to questions 20, 22, and 23. The sources of position funding identified by Miles et al. (2004) were used in question 10.

Question 25 was taken from Kane's (2013) dissertation on math coaches in Tennessee. Additional questions in this section of the questionnaire were derived from an interview created by the Middle-school Mathematics and the Institutional Setting of Teaching (2011) at Vanderbilt's Peabody College of Education and Human Development in a study of instructional reform in four large, urban districts.

The third section of the questionnaire gathered information on the coaching activities of participants. Activities which were named in the questionnaire emerged from the definition of Enacted Math Coaching and from the review of the literature (Campbell, 2012; Denton & Hasbrouck, 2009; Deussen et al., 2007; Middle-school Mathematics and the Institutional Setting of Teaching, 2011). Items in the final section of the questionnaire, focusing on professional development for coaches, were adapted exclusively from the Middle-school Mathematics and the Institutional Setting of Teaching (2011) coach interview.

Interviews

Interviews were used in this study to provide the researcher with an opportunity to discover "what is in and on someone else's mind" (Patton, 1990, p. 278). Two sets of interviews were undertaken; one interview (see Appendix B) was administered to the eight math coaches selected using convenience sampling, and a second interview (see Appendix C) was used with the three ISD math officials. Both sets of interviews were standardized and open-ended, which proscribed the questions and the order in which they were asked (Patton, 1990). Although the scripted nature of the interviews may have limited the personalization of responses, it increased the comparability and ease of organization and analysis of data (Patton, 1990). Six individuals were interviewed over the phone, and five interviews took place in person (Creswell, 2003; Yin, 1994).

The first set of interviews was conducted with each of eight identified coaches following the completion of the questionnaire. The interview was designed to address all four research questions and all dimensions of the Enacted Math Coaching definition. It was separated into three sections: discussion of coaching activities, employer expectations, and professional development. Questions in the first section were informed by the work of Anstey and Clarke (2010), Campbell (2012), Kane (2013), Middle-school Mathematics and the Institutional Setting of Teaching (2011), and Taylor (2008). The questions addressing employer expectations were taken directly from the math coach interview developed by the Middle-school Mathematics and the Institutional Setting of Teaching (2011). Kane's (2013) questions on coach professional development were excerpted for that section of the interview.

The second set of interviews was conducted with representatives from the mathematics departments of each of the three ISDs that serve the Metropolitan Detroit region. The interview was designed to address three of the research questions by capturing information about the definition of coaching and coaching responsibilities, the activities of coaches, and the qualifications and professional development of math coaches. All questions on this interview were newly created, with the exception of the list of coaching activities, which mirrored those named in the questionnaire and emerged from the definition of Enacted Math Coaching and from the review of the literature (Campbell, 2012; Denton & Hasbrouck, 2009; Deussen et al., 2007; Middle-school Mathematics and the Institutional Setting of Teaching, 2011).

Documents

Merriam (1998) highlighted that "documents or artifacts have been underused in qualitative research" (p. 113). While documents not prepared by the researcher may be disjointed, and the researcher may be unable to confirm their validity, they are nonetheless

situated in the real context of the study and are unaffected by the research agenda (Merriam, 1998). Interviewed coaches were asked to provide their schedule, daily logs, job description, and any other documents which they felt would illuminate their work as a coach. Weekly or daily schedules were provided by Allen, Clark, Samuelson, and Wright. Grant supplied her monthly calendar from the 2014-2015 school year. Hamilton submitted ten daily logs from across the 2014-2015 school year, and Williams provided an empty daily log form. Job descriptions were secured from Allen and Grant. Grant also shared her performance evaluation, surveys she designed for teachers to provide feedback on her work, and the results of those surveys. Jackson provided documents describing the project within which she worked.

While the questionnaire allowed for the quick, inexpensive capture of many pieces of information, it constrained respondents with researcher-created categories (Merriam, 1998). Documents submitted by the interviewed coaches captured more open-ended characterization of coaching activities, as well as more detailed, sustained documentation of these activities. The documents provided data that addressed the activities component of the Enacted Math Coaching definition and the third research question: In what activities do math coaches in Metropolitan Detroit schools engage? All documents had been created prior to participation in the study.

Position postings represent an important data source for answering the first research question: How do districts and schools in Metropolitan Detroit define the job responsibilities of math coaches? Similarly, postings provide insight into the professional training and experiences coaches are expected to bring to their positions, a key component of the fourth research question and the qualifications dimension of the Enacted Math Coaching definition. In addition to the job descriptions provided by Allen and Grant, seven other job postings for math coaches in Metropolitan Detroit were included in the data analysis. Though on-line resources need to be

considered cautiously (Merriam, 1998), they offer readily available data that exist outside of the above mentioned collection methods.

Observation

One of the limitations of the questionnaire and the supporting documents was that they captured only self-reported data. Observations were used to mitigate that limitation, as well as to collect additional information (Merriam, 1998; Patton, 1990). Allen, Clark, Grant, and Wright agreed to be observed. The shadowing process occurred at their schools during the 2015-2016 school year. Data collected during the observations were used primarily to contribute to answering the third research question: In what activities do math coaches in Metropolitan Detroit engage? Observational data also lent insight into the purpose and audience dimensions of the definition of Enacted Math Coaching.

Fieldnotes were taken concerning the observed math coaches' activities at their work locations (Creswell, 2003). Attention was paid to how these activities fit within the categories established in the questionnaire, but fieldnotes were not limited to these categories. The observations afforded the opportunity to notice activities or dimensions of coaching that were not identified in the questionnaire, interview, or supporting documents, which led to a better understanding of math coaches' responsibilities and activities (Merriam, 1998).

Data Analysis

Guided by a social learning theoretical framework, I was interested in the ways in which coaches might serve as more accomplished peers as they support teachers through assisted performance, all situated within communities of practice. Through this lens, the purpose of this study was to describe the definitional dimensions of coaching – purpose, audience, activities, and qualifications – to inform practitioners, school leadership, and policymakers. In a descriptive

case study, detailed description of the subject occurs first, though it is often followed by interpretation or evaluation (Creswell, 2003; Merriam, 1998). This analytic strategy is aligned with the theoretical framework, purpose, and audience for this study. Thus, the analytic strategy for this study was to develop a case description (Yin, 1994).

Analysis of the data followed Creswell's (2003) comprehensive six step progression for a case study analysis.:

> Step 1 *Organize and prepare* the data for analysis.
> Step 2 Read through all the data to get a *general sense* of the information.
> Step 3 Begin detailed analysis with a coding process.
> Step 4 Use the coding process to generate a description of the setting or people as well as categories or themes for analysis.
> Step 5 Advance how the description and themes will be *represented* in the qualitative analysis.
> Step 6 A final step in data analysis involves making an *interpretation* or meaning of the data. (pp. 191-195)

Additionally, the specific approach to coding the data followed the steps of content analysis, which Patton (1990) characterized as the "process of identifying, coding, and categorizing the primary patterns in the data" (p. 381). Content analysis provided a unifying approach to analyzing both the quantitative data captured from the questionnaire and the data gathered through the interviews, observation, and other documents.

Following the first three steps outlined by Creswell (2003), I initially read through all of the data from the questionnaires, two interviews (Hamilton and Samuelson), one observation (Grant), and other documents. For a period of two weeks, I did not write or respond to this data in any way. I then reread all the data, making notes on my general impressions of the data. These reflections tended toward critiques of the differences between coaching as represented in the literature and coaching as enacted by these participants, so I read the data again, with the intention of identifying positive trends in the data. Following this reading, I generated a draft list

of 22 codes, assigning a color to each code. In terms of the questionnaire data, codes were primarily derived from the open-ended responses. Draft codes were then applied to the data from the closed-response questions, to illuminate connections between the open and closed responses. Two draft codes of note were "heavy" and "light," an attempt to classify the nature of coaching activities that were named in the data (Killion, 2008). I then went through all of the collected data and color-coded it using these codes.

To elaborate on this coding process and begin a more in-depth analysis, I created a spreadsheet designed to group data points associated with each code. As I was inputting the first data, from an interview of one of the ISD math specialists, I modified and clarified some codes. I clarified my working definitions of the heavy and light codes to capture more specifics and make them mutually exclusive. In particular, I decided to classify the code feedback as heavy, though Killion (2008) argued that it could be either heavy or light, depending on the content and focus of the feedback. This process of categorizing activities as either heavy or light resulted in the creation of two different classifications, *transformative* and *supportive*, which will be addressed in Chapter 4.

I then grouped the initial codes into themes, guided by the research questions, as shown in Table 2. At this grouping stage, I further refined some codes, collapsed separate codes into one, and added two additional codes. I read through the full set of data one additional time, to look for any activities that might not yet have been named or coded and any surprising or contradictory data points. Confident that I had reached saturation, I settled on the final codes which are also listed in Table 2.

Table 2
Codes by Research Question

Research Question	Initial Codes	Final Codes
How do districts and schools in Metropolitan Detroit define the job responsibilities of math coaches?	audience role definition introduction to teachers position consistency over time deliverables/accountability coordination with ELA coach	audience clarity school hierarchy flexibility content focus evaluation
How do math coaches in schools in Metropolitan Detroit characterize their work?	relationship resources improve teaching improve student achievement	improving teaching increasing student achievement improving teaching to increase student achievement
In what activities do math coaches in Metropolitan Detroit schools engage?	nonevaluative priority schools frequency of contact modeling (heavy) observing & feedback (heavy) feedback from teachers (heavy) meet with teachers (light) observe teachers (light) collaborative planning (light) lead professional development (light) student data (light) work with students (light) provide support (light) relationship building (light) creating assessments (light) implementing curriculum (light)	nonevaluative priority v. other coaches teachers served frequency of contact transformative activities modeling instruction observing and providing feedback building capacity collecting data on coaching supportive activities meeting with teachers observing teachers planning collaboratively leading professional development working with student data working with students providing support building relationships other activities
What professional training and experiences, previous and on-going, do math coaches in Metropolitan Detroit schools have?	qualifications soft qualities internal/external hire hire process professional development	qualifications professional development

Following this initial analysis, I gathered data from five additional math coaches: two interviews (Jackson and Williams), three interviews along with observations (Allen, Clark, and Wright), and additional documents. I coded these new data using the previously established codes. One additional sub-code of clarity was identified and labeled as flexibility. Previously coded data was then reviewed for instances of flexibility.

Validity, Reliability, and Limitations

In order to establish confidence in the researcher, the study, and the results, a comprehensive accounting of data collection and analysis procedures, as well as the presentation of ample detail to support findings, are provided in this paper (Creswell, 2003; Merriam, 1998). Specific strategies were utilized to establish the validity and reliability of this study, and the inherent limitations of the study were noted.

Validity

Strategies which were utilized to establish the trustworthiness of this study include triangulation, member-checking, peer debriefing, discussing contrary information, and clarifying the researcher's bias (Creswell, 2003; Merriam, 1998; Patton, 1990). Quantitative data captured through the questionnaire were triangulated with the qualitative data provided by the other data sources. Additional triangulation within the qualitative data sources was used to strengthen the findings derived from the interviews, observations, and documents (Creswell, 2003; Merriam, 1998; Patton, 1990). Additionally, to establish construct validity for the instruments themselves, data collection methods and instruments validated by previous research on similar topics were adapted for this study (Yin, 1994).

Member-checking was used to assess the accuracy of tentative findings (Creswell, 2003; Merriam, 1998). Draft findings were shared with Grant and Samuelson for their feedback and

clarification. Similarly, peer debriefing, in which colleagues were asked to provide their feedback on the study and its findings, was utilized (Creswell, 2003; Merriam, 1998). A committee of mathematics and mathematics education faculty reviewed and commented on the foundation, design, and findings of this study, and revisions suggested by the committee were made.

To increase validity, as the analysis unfolded, information that contradicted emerging categories was identified (Creswell, 2003; Patton, 1990). A detailed description of the case under study was provided to support the reader in making comparisons with other situations (Merriam, 1998). A final strategy to improve trustworthiness was to clarify the researcher's biases, both at the outset of the study, as presented in the section on subjectivity below, and throughout the data collection and analysis process (Creswell, 2003; Merriam, 1998).

Reliability

For this study, consistency and dependability were established through the use of protocols and processes developed by previous researchers (Yin, 1994), as well as a comprehensive description of the researcher's position and a detailed accounting of data collection, analysis, and decision making (Merriam, 1998). In this study, data collection methods, instruments, and analysis protocols all followed previously published work by other researchers.

Limitations

Acknowledging that the coaching role is complex in nature, this study was limited to specific components of the math coach position. Components not assessed include: the quality of coaches' qualifications and skills; their knowledge or beliefs; their interactions with teachers, administrators, or other school personnel; their impact on teacher performance and student

achievement; and any observed changes in their practice over time. The purpose of this study was to document and describe the professional experience and daily work of math coaches in Metropolitan Detroit. Because the population of individuals who are math coaches in Metropolitan Detroit is not documented and is in a constant state of change, the snowball sampling technique may not be representative of the population. The data reported in this research represents self-reported and observed data on activities and experiences of the math coaches in Metropolitan Detroit who participated in the study during the 2014-2015 and 2015-2016 school years.

Subjectivities Statement

This study is firmly grounded in my personal and professional history, bringing the insights and blinders that come with all subjective experience. In defining sources for research, Merriam (1998) asked:

> Where do you look for something that perplexes and challenges the mind? The most logical place for those of us in applied fields such as education is with our everyday practice. Look around. What is interesting to you that you do not quite understand? What puzzles you? What are you curious about? (p. 56)

This study was prompted by exactly such a "look around."

My professional and research interests have long been centered in the field of mathematics education. I am concerned with issues of equity and social justice, which I see as foundational to the educational endeavor. More narrowly, I am focused on creating successful and equitable educational experiences in urban settings.

I bring a variety of subjectivities to this research which has informed both my interest in the topic and my approach to it. I was born in the city of Detroit and educated in the Detroit Public Schools. As a first grader, I spent two weeks in my neighborhood school before transferring to a school of choice, where I remained until eighth grade. For grades 9 through 12, I

attended a college-preparatory magnet school. While I had little or no input in the choice of these schools, these decisions had a significant impact on me. One dimension that is relevant to my approach to education and educational research is the clear implication that school isn't a passive activity over which participants have no control. I have accepted the belief that participants must strive for the most beneficial educational environment and that students, parents, and school personnel all bear responsibility for creating such environments. This fundamental message, made explicit to me as a six-year-old, has informed much of my professional direction and commitment.

I am white and hail from a college-educated, middle-class family, in a city where each of those traits has minority status. The experiences that come from living in this milieu have led me to confront questions of power and inequity, especially in terms of race and economic status. In my youth, as friends moved out of the city, the clear circumstances of inequity were laid bare before me, in the differences between their previous and new neighborhoods and schools. The injustice of these stark differences has been further reinforced as I have spent time in schools throughout Metropolitan Detroit, across the nation, and in different countries during my professional career.

I received both my Bachelor's and Master's degrees from Wayne State University, where I am currently a Doctoral candidate; Wayne State University is located in Detroit, Michigan. I spent ten years as a classroom teacher in a Detroit Public School and an additional five years at a charter school in Detroit. I have recently returned to the Detroit Public Schools, where I am again working as a classroom teacher. For twelve of my years in the classroom, I was a middle-school mathematics teacher. My educational training and my experiences as a teacher have led to presumptions about the situation in Detroit classrooms generally and in mathematics instruction

specifically. Having an educational concentration in mathematics gives me an informed perspective on mathematics curriculum and instruction. My training and years of experience as a teacher, with students from kindergarten through the undergraduate level, lead me to hold very strong opinions about the pedagogy and the culture of successful classrooms. Conversely, my limited experience in terms of receiving all of my educational training and professional experience within the Detroit city limits surely blinds me to interpretations and possibilities that would arise from a broader or more diverse range of experiences.

I worked for a year and a half as a math specialist for a small, charter district in Detroit. It was this experience that prompted my curiosity about the implementation of math coaching in Metropolitan Detroit. In my role as researcher, I sought to set aside the presumptions and biases that arose from my experience of the coaching role. Wenger (2009) offered a frame for learning that serves as both reinforcement and caution as I undertook this research: "We pay attention to what we expect to see, we hear what we can place in our understanding, and we act according to our worldviews" (p. 214). While Merriam (1998) accepted that a case study may be influenced by the researcher's bias, she cautioned that it is limited by the "sensitivity and integrity" of the researcher (p. 42). To that end, my experience with large- and small-scale, qualitative research projects guided my work and tempered my subjectivities as I completed this study.

CHAPTER 4 RESULTS AND DISCUSSION

Introduction

This study was designed to document math coaches' goals and activities, as well as the qualifications and experiences they bring to the role and their on-going professional development opportunities. Questionnaire responses were received from 43 coaches, with 30 respondents completing 70% or more of the questionnaire. Unless otherwise noted, all percent data provided refer to a total of 30 respondents, though some items had 27, 28, 29 or 30 responses. In terms of the questionnaire data, the primary analysis and identification of themes derived from the open-ended responses. Data from closed-response questions were used to provide quantitative information, such as a coach's number of years of teaching experience, or to further illuminate themes from the open-ended responses, such as the use of math coaching activities. Eight coaches participated in an interview and provided additional documents concerning their work. Four of these coaches were observed during their work day. Representatives from the mathematics departments of the Intermediate School Districts (ISDs) in Metropolitan Detroit were also interviewed. Findings based on the analysis of the data are presented in this chapter and organized by each of the four research questions which guided this study.

Research Question 1
How do districts and schools in Metropolitan Detroit define the job responsibilities of math coaches?

In crafting the definition of Enacted Math Coaching proposed in this paper, the four parameters of purpose, audience, activities, and qualifications were considered. Respondents answered the open-ended question "How do you define math coaching?" The responses to this question were analyzed for phrases that addressed any of these four parameters. Twenty-five of those responses included a reference to the audience for coaching, 21 listed at least one activity,

20 expressed a purpose for the coaching, and none of the responses included qualifications for coaching. These data suggest that identifying the audience for coaching is the easiest and least contested dimension of the coaching definition. Math coaches seemed to be equally clear that they should be pursuing certain activities to fulfill a particular purpose, though there was not nearly as much agreement on which activities and the purpose of these activities. The descriptions of purpose will be discussed further in the section on research question 2, and an exploration of activities will follow in the section on research question 3. That none of the definitions provided by coaches included any reference to the qualifications for a math coach might indicate that coaches thought qualifications were assumed based on the position. Perhaps, as the questionnaire responses came from math coaches, they were less inclined to consider or include their own or necessary qualifications. The only qualifying phrase that was used to describe a math coach was "mathematics educator." When the ISD representatives were asked to define math coaching, they did not make reference to qualifications of a coach either. When specifically asked about qualifications for math coaches in other parts of the interview, however, the ISD math specialists did address them, as will be discussed in the section on research question 4.

Audience

Twenty-two respondents identified teachers as the audience for math coaching. Three responses identified students as the target population for their services; these responses were all provided by participants who indicated they were primarily responsible for working directly with students. Six out of nine math coaching job postings identified the audience for coaching as teachers; the other three targeted students. Responses from the interviewed coaches supported

this data and shed additional light on how teachers were selected to work with math coaches, as well as how the role of the coaches were characterized when they were introduced to staff.

The questionnaire asked participants to identify the target population for coaching activities. Half of the coaches indicated that their target population consisted of all teachers in the school. As Grant expressed, "We work with everyone." Grant's job description, however, indicated that she would be expected to model instruction "in all classrooms at teacher's invitation or as specified by administration (based on data)." Only 17% of the respondents indicated that services were initiated by teachers who elected to work with coaches. Other selections, each representing 7% of the total, included novice teachers, "administrative decision," "no selection," and "varies." Only one coach responded that teachers were selected due to a poor performance rating, an exception to the consensus among respondents and the literature that coaching should be nonevaluative (Campbell & Malkus, 2013; Knight, 2009; Neufeld & Roper, 2003; Showers & Joyce, 1996; Taylor, 2008). The challenges coaches face related to school-wide implementation, or teachers seeking out coaches, was evidenced in Grant's statement, "Some teachers need more administrative push to 'encourage' participation." This may be the "as specified by administration" referred to in her job description.

Williams, working at the district level, was sometimes assigned to specific teachers and sometimes worked with all the teachers in a given school. All of the other interviewed math coaches worked in settings where all teachers received services from the math coach. Each of these coaches was introduced to the teachers at the first staff gathering of the school year. The head of the school introduced the coach with her new title, providing no clarification of her role; as Grant said, "That was it." It was left to the coaches to explain their purpose and responsibilities to their colleagues. Samuelson sent an email to all of the teachers "saying, this is

what I can do for you." Grant wondered if the teachers in her building would even be able to describe what she does. This sentiment was echoed by Clark: "The teachers don't know what we do. Sometimes I think they think we're just counting grass down here."

Lack of Clarity

The teachers might not be the only ones unclear about the role of a math coach. Respondents indicated inconsistencies in the responsibilities of their role and in its implementation. Interviewed math coaches expressed both frustration and an appreciation of the flexibility allowed by this lack of clarity. Some of the variations in the role of math coach center on the positioning of the coach within the hierarchy of the school staff. Other differences concern the level of emphasis on content area expertise.

School hierarchy.

Math coaches, as auxiliary positions within schools, must find their standing within the school hierarchy. There was evidence across all data sources of confusion and inconsistency concerning where a math coach fits in the hierarchy of the school. As was anticipated based on the literature, those who self-identify as math coaches have a wide range of titles. Williams expressed frustration with the inconsistency of titles: "Math Coach and Instructional Specialist are not the same thing. A coach coaches." Some of the titles named by participants suggested an administrative position, while other titles appeared to settle in a space between administrators and teachers. Of the questionnaire respondents who provided their current title, nine were leadership titles, such as "Math Curricular Leader." Seven titles included the word specialist, six used coach, and one title was "Math Coach/Specialist." Three respondents had the title teacher and another three included the word mentor.

This uncertainty of positioning adds a level of confusion to the role of math coach. Allen expressed that coaches are "sort of in limbo, not seen as a classroom teacher and not as an administrator." For Williams, though, when working as a building-level math coach: "I was looked upon as a mini-administrator. They leaned on me." Wright also reported that another instructional specialist in her building "essentially serves as an administrator." During the observation, a teacher with whom Wright worked drew a contrasting opinion. She said to Wright: "You're not like an administrator. You know what to look for and which students to talk to."

Responses from the interviewed coaches indicated that ambiguities extended beyond different naming conventions and positioning, as they described the specifics of their roles as either unclear, or clear but evolving. Allen expressed that, within her district, "When there's anything related to elementary math, the answer is 'Sarah will do that.'" Clark captured the lack of clarity succinctly: "We're our own little island. No one understands our role except us. Teachers don't get it. Administration might get it, but they forget." Yet, Clark admitted her own confusion about her role, saying, "We learned a lot about the role on the fly." Other interviewed coaches shared similar characterizations. Grant said, "There's no manual that tells you what to do;" Williams found that "there's not a schedule, a routine;" and Wright shared that she was "literally plopped into finding my way."

Grant searched "online to try to better define my existing job description." Grant's job description listed her job function as: "To assist classroom teachers and other instructional staff in developing strategies, skills, tools, and techniques, to effectively teach mathematics and science to all students." Descriptions from other position postings, found online, include: "Develop educational practices, provide technical assistance and other training and coaching to

staff aimed at raising student achievement in identified schools;" and "Provide job-embedded professional learning to support teachers in implementing research-based core instruction in all content areas."

Even when job descriptions were written and clear, interview participants reported that expectations were changed on an ongoing basis or were enacted differently than written. Within one school year, Hamilton's major responsibilities continuously evolved, from leading small groups, to teaching one class, to video recording lessons of teachers for absent students, to covering classes for teachers who were absent or had resigned. The reassignment from her initial job description to roles that did not include coaching responsibilities was clearly evident. Wright was reassigned from her coaching duties to be a classroom teacher for nearly one fourth of the school year. Allen, Grant, and Samuelson also described changes to their positions across school years, with different years having more emphasis on working with students or with teachers.

Coaches and ISD personnel noted a difference between job descriptions and the reality of coaching implementation. Allen, Clark, and Williams expressed that coaching expectations were not aligned between the district- and building-level administrators, resulting in math coaching being implemented differently across school sites within the same district. Wright reported that expectations and implementation were different among coaches within the same building. One ISD official clarified that her expectation for coaching "is different than what's enacted." Grant explained that there was a difference between the official purpose of her role, which she characterized as providing embedded professional development to improve class instruction and increase student achievement, and what she saw as her unofficial purpose, which she defined as being a resource for teachers.

Flexibility.

Interviewed math coaches also reported that some dimensions of the lack of clarity of the math coaching role were benefits of the position. Both Clark and Allen expressed that they were "given free rein." Jackson found that the open nature of the role "is nice," and Grant enjoyed that the position "doesn't have as much day-to-day grind as the classroom." Allen and Clark's daily schedules indicated intervals of unscheduled time; Allen had gaps of five to 15 minutes across the day, and Clark's whole afternoon was not itemized. As contrasted with the role of a teacher, Clark emphasized that a math coach "can go to the bathroom when we need." Samuelson and Wright's schedules accounted for each minute throughout the school day, yet the time assigned to working with teachers has less rigidity and immediacy than that of being in front of students. During all four observations, the math coaches demonstrated flexibility in adhering to their schedules.

Additionally, some interviewed coaches liked the blend of working with students and teachers, seeing the role as step in their professional growth. Allen, Clark, Grant, and Wright all reported that they liked the additional experience and opportunity to work with teachers afforded by the math coach position. Allen referred to it as "getting to have your cake and eat it too." Grant did express concern about the higher level of stress and "extra work for the same pay." Williams, conversely, said he was "pulled out of the classroom, kicking and screaming."

Content focus.

Even among those who self-identified as math coaches, there were variances in the content focus of their role. Some math coaches work with just the one subject area, some are assigned to coach additional subjects, and a few are responsible for all subject areas. Two thirds of the questionnaire respondents specified coaching mathematics. Allen, Clark, Jackson, and

Wright only coached mathematics; Allen and Clark were the lone math coaches in their respective districts. According to an ISD representative, some coaches have dual subject area roles. This was supported by the questionnaire responses as well. Five coaches were responsible for mathematics and science. This was the situation for Grant, whose position had been posted as a "Math/Science Coach." In her interview, Samuelson reported a dual focus on mathematics and language arts, indicating that she was "officially an interventionist for reading," but her principal enlisted her to support mathematics as well. Williams was faced with the opposite situation when a district-wide reorganization resulted in him occasionally being asked to coach teachers of other subjects. Two respondents to the questionnaire coached all subjects. One coach entered "n/a."

Grant, who is responsible for coaching mathematics and science, would prefer to coach just one subject or all subjects. She felt working with one subject would allow intensive focus on content and working with all subjects would emphasize key instructional practices. She expressed that coaching two subjects made her time and focus more fragmented and kept her from meeting either purpose well. These findings suggest that some math coaches are positioned as content experts while others are seen primarily as teaching experts, highlighting another factor contributing to the ambiguity of their role. This issue relates to the qualifications of math coaches as well, which will be discussed in the section on the fourth research question later in this chapter.

Evaluation

Lack of clarity about expectations for a math coach was further documented in the interviewed coaches' characterization of their accountability and the process for their evaluation. When asked about her outcomes as a coach, Samuelson retorted, "You should ask my superintendent." Samuelson had requested his perspective on her responsibilities prior to our

interview: “I asked what he thought. I told him ‘Monica is calling tomorrow.’ He said, ‘Let me know how that goes.’” Samuelson’s impression from this response, and previous interactions with her administrators, was that “there are pretty much no deliverables.” Grant and Jackson also reported that they had “no deliverables for the administration.”

Some coaches, however, were clear on how student achievement was factored into their evaluations. Part of Samuelson’s evaluation was based on student learning: “I have to deliver for my intervention students.” Using student performance data as part of the evaluation was standard for all teachers at her school. Samuelson did not have additional components which focused on her work as a coach. Allen and Clark were also evaluated, just as the teachers in their buildings, based on student achievement data. Conversely, Grant’s evaluation was different from that of the teachers in her school. Her evaluation was based on progress toward the goals of the school’s strategic plan. Grant mentioned twice that her evaluation had been strongly emphasized when she was a classroom teacher, but that it was referred to much less since she had become a coach. Clark similarly reflected that her administrators suggested that she need not worry about the student data: “They’re supportive. They tell us we’re ok.”

Summary

There was variety and inconsistency in how districts and schools in Metropolitan Detroit defined the job responsibilities of math coaches. The one area of agreement was that the audience for math coaching is teachers, with the majority of coaches reporting that they worked with all the teachers in a school. Ambiguity of title was compounded by a lack of clarity of the coaching role in the hierarchical structure of the school staff, which also afforded some appreciated flexibility for math coaches. Variation in the definition of the math coaching role

included differing emphasis on mathematics content and the absence of clear standards for evaluation.

Research Question 2
How do math coaches in Metropolitan Detroit characterize their work?

In the questionnaire and interviews, respondents were asked two open-ended questions: the first asked participants to define math coaching and the second was to identify the purpose or goal of math coaching. Themes derived from these responses indicated that math coaches and ISD math representatives characterized the work of coaching in three ways: improving teaching, increasing student achievement, or, the fully articulated, improving teaching to increase student achievement. These categories were consistent across questionnaire responses and interviews. Only one respondent provided answers outside of these three categories, referencing bridging mathematics content to real world experiences as both the definition of and purpose for math coaching.

Improving Teaching

A majority of respondents defined math coaching as a means to improve the teaching of mathematics. Two of the nine analyzed job postings also identified this purpose: "support teachers in implementing research-based core instruction" and "assist classroom teachers…to effectively teach mathematics." Two ISD representatives also defined math coaching in terms of improving teaching; the third ISD representative was not asked to define math coaching. Coaches referred to helping teachers "more effectively teach." Two respondents elaborated on this definition, specifically referring to improving teachers' understanding of "mathematical content and teaching practices." One ISD official also characterized math coaching in this light: "support teachers' content knowledge, really their mathematical knowledge for teaching, and their pedagogical practices in the context of the content and the classroom." These responses

indicated that math coaches work, in the words of one respondent, "to increase instructional capacity…centered around high quality math instruction." During the interview, Samuelson identified the purpose of her coaching as helping teachers improve instruction based "on where the teacher is at and what their needs are." A document provided by Jackson, describing the project in which she worked, stated: "The purpose of coaching is to provide collegial support and collaboration."

Increasing Student Achievement

Two other two job postings referenced "raising student achievement" as the purpose for math coaching. Only two respondents defined math coaching in terms of increasing student achievement. Citing increasing student achievement in their definition might be related to their job role, as these two respondents reported their titles as "Math Coach/Specialist" and "Math Specialist." The third respondent with the title "Math Specialist" defined math coaching in terms of improving teaching. Yet, when asked to describe the goal of math coaching, just over one third of questionnaire respondents emphasized that "the goal is to improve student learning." More questionnaire respondents identified increasing student achievement as the goal of math coaching rather than including it in their definition of math coaching.

Improving Teaching and Increasing Student Achievement

A third group of definitions linked improving teaching to the end result of increasing student achievement: "Math coaching is supporting and working directly with teachers to improve their math instruction to support student learning." Two of these responses specifically mentioned mathematics: "supporting teachers in their mathematics content and instructional techniques." In identifying the goal of math coaching, a little over one third of the respondents linked improving teaching with the goal of increasing student achievement: "better teaching for

better student outcomes." Five of the analyzed job descriptions referenced increased student achievement through improvements in teaching. Allen, Williams, and Wright characterized the purpose of their coaching in this way as well. Wright considered her work with teachers to improve their instruction as a way to increase her impact on students' mathematics achievement "exponentially."

Grant also identified this as her "official" purpose: "improve class instruction and improve student achievement." There was evidence of this purpose in action during the day-long observation of Grant. In each of the two meetings she held with individual teachers, there were references to instructional improvements that should be undertaken to increase student achievement, including analysis of standardized test data to inform instructional support for low-performing students. In a passing conversation in the hallway, a teacher asked for Grant's help in setting an instructional plan to meet the needs of two high-performing students.

Summary

Math coaches in Metropolitan Detroit characterized their work in three ways: improving teaching, increasing student achievement, or improving teaching to increase student achievement. These three characterizations could be seen as shades of the same focus, though respondents did not use the language interchangeably. There was a shift in the language coaches used to characterize the definition of coaching compared to the language they used to identify the goal of math coaching. When defining coaching, more coaches referenced improving teaching alone than in conjunction with increasing student achievement. This emphasis flipped when respondents identified the goal for math coaching. More coaches linked improving instruction with increasing student achievement as the goal of coaching than those who addressed improving instruction alone.

Research Question 3
In what activities do math coaches in Metropolitan Detroit schools engage?

In attempting to understand the work of math coaches throughout Metropolitan Detroit, a detailed documentation of the activities in which coaches engage was undertaken. Two over-arching understandings emerged when reviewing coaching activities: most coaching is nonevaluative; and the frequency of coaching contact and the number of teachers with whom a coach works varied widely. At a more fine-grain level, building on previous characterizations of high-impact and low-impact practices (Campbell, 2012; Deussen et al., 2007; Killion, 2008; Polly, 2012), and drawing on data gathered for this study, two categories of activities are proposed: transformative activities and supportive activities.

It is important to note that all three ISD representatives separated their answers to questions about coaching activities into two categories: priority-school coaches and district/school/ISD-based coaches. State-mandated priority-school coaches are hired by the ISDs, but two of the three ISD math representatives expressed that they did not have as much connection with the priority-school coaches as they would like: "I do content work for them, fixing the train wreck." District/school/ISD-based coaches were described as coaches other than those hired to be priority-school coaches. Five questionnaire respondents self-identified as working in a priority school.

Coaching is Nonevaluative

The literature on coaching is unequivocal in the importance of coaches' work being nonevaluative (Campbell & Malkus, 2013; Knight, 2009; Neufeld & Roper, 2003; Showers & Joyce, 1996; Taylor, 2008). ISD representatives underscored this perspective, and responses from participants supported with this view. Asked if they were responsible for formal evaluation

of the teachers with whom they work, 90% of respondents said no. Interviewed coaches also emphasized that they did not evaluate teachers.

Though coaching is nonevaluative, coaches assess the proficiencies and needs of the teachers with whom they work. The literature did not address the gray area between these stances of formal evaluation and informal assessment, nor how math coaches should navigate this distinction. This issue also relates to the clarity of position of the coach in the hierarchical structure of the school staff. Interviewed coaches referenced this challenge to their work.

Samuelson explained that, because she reported directly to the assistant superintendent of her district, some teachers thought she was doing evaluation under a newly adopted evaluation system. An observation of Grant demonstrated how coaches might serve as evaluators, even if unintentionally. In a weekly meeting with a school administrator, Grant shared her frustrations concerning a reluctant teacher, saying "on Friday I went through the evaluation form and pointed out where refusing to do something would hurt her rating." While the overall tone of this interaction was centered on how to support the teacher, this was a clear instance of evaluative information being shared between coach and administrator.

Other interviewed math coaches highlighted the challenges and importance of assessing teachers' strengths. Jackson shared: "The hardest thing is when I see something that makes me cringe. I want to bring it up, but you don't want to make them upset, because you want to get them to let you back." Both Allen and Williams stressed that sometimes what teachers want to work on is different than what the coaches think they need to improve. These comments from the math coaches highlighted the precarious position of the coach and has broader implications related to the lack of clarity of their roles.

Teachers Served and Frequency of Contact

Coaches reported a wide range of numbers of teachers served as well as frequency of contact with the teachers. Coaches responding to the questionnaire were evenly spread across grades K-8, with the most number of coaches reporting work with teachers in grades 2-3 and the least number reporting work in grades 9-12. There was a wide range in the number of teachers with whom coaches reported working, from 2 teachers to 360 teachers; the median number of teachers per coach was 14. The majority of coaches worked in one school site. For coaches who worked in multiple school sites, the range was from three to 16 schools.

When the number of possible contact hours is finite, the number of teachers with whom a coach works necessarily impacts the frequency of contact. Just as there was a wide range in the number of teachers assigned to each coach, there was great variance in the amount of time coaches spent working with teachers. According to questionnaire responses, coaches spent 25 minutes per day to 10 minutes per month interacting with the teachers with whom they work. The responses also indicated a range of frequency and scheduling with 20% of the coaches reporting that they work with teachers daily, 40% in regularly scheduled visits, and 37% in irregularly scheduled visits. Visits that were not daily happened weekly, monthly, or as needed.

Jackson, who worked part-time, met with six teachers twice per month. In Grant's school, teachers had daily common planning time. It was expected that the teachers meet together during this time, and Grant used this time to meet with teachers as well. Samuelson indicated that she worked one day per week in each of four buildings, splitting her time among the teachers in each building. Williams worked in many schools, focusing on three or four teachers in each. Allen reported that being spread across schools was very challenging. An ISD math specialist explained that priority-school coaches provided "coaching on demand," with an estimated

frequency of 1 visit per week. Coaches hired by another ISD were expected to provide coaching one hour per month.

This inconsistency in frequency and duration of time spent with teachers further underscored the lack of clarity of role and standards for evaluation as discussed in the section on the first research question. The difference between daily visits of 25 minutes and monthly visits of 10 minutes, and the many variations in between, would necessarily impact the types of activities in which math coaches can engage.

Transformative Activities

Research reviewing the effectiveness of instructional coaching suggested that some activities have greater potential to transform instruction than others. These more-promising activities have been referred to as high-impact, high-intensity, and heavy (Campbell, 2012; Deussen et al., 2007; Killion, 2008; Polly, 2012). In an attempt to group these recommended practices, and highlight the importance of their impact, these activities were identified and defined in this study as transformative activities. Transformative activities were selected based on recommendations from the literature, and whether or not they met the essential characteristics in the definition of Enacted Math Coaching advanced in this paper. They are: modeling instruction, observing and providing feedback, building teachers' capacity, and collecting data on coaching effectiveness. As characterized by one ISD official, these activities are the "at the shoulder kinds of things."

Modeling instruction.

Modeling instruction was identified as one of two required activities in the definition of Enacted Math Coaching. Five job postings named modeling as a responsibility of the coaching position; it was the only transformative activity mentioned across multiple postings. Sixty-seven

percent of coaches said they modeled research-based instruction in teachers' classrooms. When asked to identify activities that are most important for successful coaching, four coaches ranked modeling instruction first and 43% included it in the top five. Only one other activity matched this importance ranking, and only one exceeded it. The importance of modeling evidenced in the job postings and questionnaire responses stood in contrast with the expectations for, and implementation of, modeling derived from the interviews and observations.

At the county-level, ISD representatives reported different expectations for modeling. Among priority-school coaching, one county math specialist identified it as expected, while the other two said it occurred "sometimes." For district/school/ISD-based coaches, modeling is forbidden in one county's model, mandatory in another's, and occasional, based on "coach and school relationships" in the third. Documents describing Jackson's project said math coaching may include modeling. Though modeling was a category on his log, Williams said he only provided impromptu modeling. Samuelson reported liking to do modeling, but did not list it as an activity she actually did, and Grant said "the ELA coach does a lot of modeling, but me not so much." Allen was sometimes directed by her principal to model lessons for specific teachers. Clark spent two months teaching the mathematics class for one of her teachers before gradually transitioning the class back to the teacher. Other than that extended experience, she did not model lessons. Despite the clear call for modeling in the literature (Bean et al., 2010; Denton & Hasbrouck, 2009; Sailors & Shanklin, 2010), data from all sources indicate modeling was inconsistently expected and implemented.

Observing and providing feedback.

The second required activity included in the Enacted Math Coaching definition, based on a near-unanimous call for it in the literature (Bean et al., 2010; Bruce & Ross, 2008; Knight,

2005, 2009; Mudzimiri et al., 2014; J. Olson & Barrett, 2004; Polly et al., 2013), was observing and providing feedback. This pair of actions was considered one activity as opposed to observation alone, which was classified as a supportive activity. The addition of providing post-observation feedback, especially with a focus on student learning, was what shifted the potential to significantly impact changes in instruction. Ideally, a full cycle of pre-conference, observation, and post-conference occurs. In the questionnaire both post-observation feedback and the full cycle were listed as possible coaching activities, with 67% of coaches saying they provided post-observation feedback and 33% completing the full cycle. One coach ranked post-observation feedback as the most important activity for successful coaching, with three ranking the full cycle as number one. Approximately one third of coaches ranked each activity in the top five.

Enacting post-observation feedback was expected in priority schools and among school/district/ISD coaches in two counties. One ISD math specialist said, “It’s imperative that there’s debriefing,” and coaches cannot be paid for observation time unless there is an associated debriefing session. She noted, however, that “the complete cycle is the weakest,” with less pre-observation conferencing occurring. In the third county, post-observation feedback did not happen. Only one job description specifically listed observation and feedback as a responsibility of the position. Jackson, Samuelson, and Williams indicated that they would like to be able to provide post-observation feedback more often, but that scheduling constraints prevented it. Clark reported only completing one observation-feedback cycle, with one teacher, at the beginning of the school year. In contrast, time for planning, observing, and providing feedback was specifically listed in Wright’s weekly schedule.

Building capacity.

The proposed definition for Enacted Math Coaching, drawing on the work of others, emphasized the importance of building teachers' capacity to understand, choose, and implement research-based mathematics instructional practices. When asked about building capacity for teacher learning, 53% of coaches indicated it was an activity in which they engaged. Five coaches ranked building capacity for teacher learning as the most important activity for successful coaching, and 15 coaches placed it in the top five. These are higher rankings than for any other activity. Allen and Wright both emphasized this dimension of their work with teachers. During a conversation with a teacher, Wright was observed saying: "Let's pick a goal for your focus for next year. Make it something you can change, rather than a district or school issue." Allen wished more professional development opportunities in her district would focus on building teachers' capacity: "I'm only one person. I need teachers to be able to intervene with students in their classrooms."

Priority schools are required to implement an instructional learning cycle and professional learning communities, and, according to the ISD officials, coaches in two of three counties engage in capacity building at least occasionally. One ISD representative cautioned, though, that professional learning communities within her county rarely, if ever, focus on mathematics. In Grant's school, professional learning communities are built into the weekly school schedule, with four topics (whole staff, core subjects, grade level, and school culture) rotating over the course of the month.

Collecting data on coaching effectiveness.

Killion (2008) insisted that coaches gather and analyze data related to their effectiveness. This idea was not suggested in the questionnaire or interview, but it arose from two of the

interview participants. Samuelson had taken the initiative to develop a survey for the teachers with whom she worked. She sent the survey to teachers after meeting with them, and then compiled the data for her own reflection and for sharing with the school and district administrators. Samuelson reported that having this feedback from teachers "was very helpful for me." Grant also developed surveys to gather feedback from her teachers, which she distributed and analyzed at the end of each semester.

Supportive Activities

Coaches spend time doing more than modeling instruction, providing post-observation feedback, developing teachers' capacity, and collecting data on coaching effectiveness. Some of these activities were mentioned in the literature. These activities are collectively referred to here as supportive activities. It is important to note that supportive activities are not presented in opposition to transformative activities; they have merit, but less power to change instruction in classrooms. Other than the transformative activity of modeling instruction, and one mention of providing post-observation feedback, all coaching activities listed in the job postings were supportive activities. With the exception of Wright's scheduled time for planning-observation-feedback, and Jackson's document that said coaching may include modeling, all activities referenced in the coach-provided documents were supportive activities. Likewise, outside of Wright's capacity-building conversation mentioned above, all observed coaching activities were supportive activities.

Meeting with teachers.

The questionnaire data were unequivocal in identifying the activity coaches engage in the most: meeting with teachers individually or in groups. Meeting with individual teachers had the highest response rate at 90%, and meeting with groups of teachers was second at 80%, tied with

observing teachers in their classrooms. Three coaches ranked meeting with individual teachers as the most important activity for successful coaching, and 12 coaches placed it in the top five, making it the third highest ranked activity. Meeting with groups of teachers was rated first by two coaches and in the top five by five coaches. According to representatives from all three ISDs, meeting with teachers, individually or in groups, was undertaken by all coaches. Interviewed coaches identified meeting with teachers as an activity they like to do and would want to do more often.

During the observations, Grant and Wright were observed meeting with teachers. Wright met with two teachers, to reflect on the school year, discuss student data, and begin to consider goals for the upcoming school year. Grant's calendar lists many meetings with teachers; she recorded meeting with individual teachers, grade-level teams, and cross-grade content teams. During the day-long observation of Grant, she met with two teachers individually. The nature of these meetings underscored both the frequency of teacher meetings and their classification as supportive rather than transformative. The first occurred during the teacher's planning period and focused on accessing mathematics curriculum materials: Grant reminded the teacher of the login information needed to access online instructional materials and made sure the teacher could login; student consumable pages were discussed, then identified as the wrong grade level; correct student pages were secured, separated, and collated; and the grade-level team's collaborative planning assignments were clarified. Briefly, during the initial discussion of the student workbook pages, Grant and the teacher discussed the sequence of topics in the mathematics text.

The second meeting had been scheduled so that Grant could observe a student about whom the teacher was concerned. Grant and the teacher met for a few minutes during the end of the teacher's lunch period, during which time Grant asked questions about the student's

attendance, classroom behavior, and mathematics performance on standardized assessments and classroom assignments. Grant indicated that she would type up her notes following the observation, and share them with the teacher, administrators, and the Response to Intervention team. When the students arrived from lunch, Grant remained in the room for the 45-minute mathematics lesson, sitting off to the side or circulating among the students.

Both of these meetings had been scheduled at the teacher's request, lasted about one hour, and were warm, friendly encounters. Both Grant and the teachers shared an expectation that she would meet with them at their request to address their needs. The nature of these encounters also highlighted why meeting with teachers is classified as a supportive rather than a transformative activity. There was no discussion of mathematics content, current instructional practices, or suggested instructional adaptations. These meetings were observed during the second month of school, and the first teacher was accessing online curriculum resources for the first time and securing student consumable pages for the second lesson in the curriculum. Grant later expressed surprise that the teacher was only beginning to teach the proscribed mathematics curriculum, but no such surprise, or comment of any kind, was expressed to the teacher.

Observing teachers.

Observing teachers in their classrooms without any formal feedback is contrasted here with the transformative activity of observing and providing post-observation feedback, or completing a whole cycle of pre-conference, observation, and post-conference. Observation alone occurs much more often, with 80% of coaches reporting doing so, a tie with meeting with groups of teachers as the second most selected activity. Observing teachers in their classrooms also tied for second place in rankings of importance, alongside the transformative practice of modeling. Four coaches ranked observing teachers as the most important activity for successful

coaching, and 13 coaches placed it in the top five. Grant shared that she liked to observe teachers, but made no mention of post-observation feedback. Her calendar referenced observations of teachers as well as observations of students, which she termed "Child Study," and one of these observation sessions occurred during the day she was shadowed. Jackson reported that observing teachers was a large component of her work, while Allen's observations of teachers were only a side-effect of her work in classrooms with students. While questionnaire data indicated that many coaches observe teachers, interview and observation data suggested that these observations may not happen frequently.

Planning collaboratively.

As the fourth most frequently identified activity, 70% of coaches indicated that they collaboratively plan for instruction with teachers. None of the respondents ranked this as the most important activity, but 12 coaches placed it in the top five for successful coaching. ISD math specialists said collaborative planning occurred with coaching in priority schools and occasionally in other coaching models, though "not as much as we think is most effective." Clark and Jackson both reported that teachers really enjoyed collaborative planning time, so they did it often.

Leading professional development.

Sixty-seven percent of coaches lead professional development sessions for teachers. None of the respondents ranked this as the most important activity, though eight coaches placed it in the top five for successful coaching. Across all three ISDs, priority-school and other coaches engage in leading professional development at least sometimes. During the interviews, coaches also shared that they provided professional development to the teachers in their schools. Grant expressed that she would like greater coordination with administrators on the goals and

frequency of professional development sessions. In Grant's calendar, there were references to both the planning of professional development and the implementation of what she termed "training" sessions. Allen, Clark, and Williams all provided both building-level and district-level professional development.

Working with student data.

Coaches noted that they spend some of their time working with student data. Sixty percent of coaches reported that they managed student assessment data. While none of the coaches ranked this as the most important activity, 6 placed it in the top five. ISD math specialists reported that coaches work with student data, including using it to help teachers make instructional decisions. In Grant's school, teachers, coaches, and administrators review standardized assessment data on a student-by-student basis following each of the three yearly testing windows. Grant mentioned that she likes to look at data, but she worried that "data and assessment might push out good teaching." This concern has implications for how data are valued and used as a tool to inform instructional improvements. Allen and Clark each expressed, in a nearly identical quote, that: "Teachers don't use data. They don't know how, and they don't have time. So we do the analysis for them." Wright also reported that she analyzed standardized assessment data for her school.

Working with students.

Half of the coaches who responded to the questionnaire said they work directly with students. One coach ranked providing interventions to students as the most important activity for successful coaching, with three coaches listing it as a top-five activity. Hamilton was currently assigned to solely provide intervention to students, which was reflected in her interview and daily logs. Allen, Clark, Grant, and Samuelson also spent some portion of their time with

students, which ranged from direct instruction to monitoring student progress with an on-line supplemental instruction program. Allen and Grant explained that coaches previously only administered the intervention program, but that a reduction in staff resources led to coaches providing direct intervention. This is in contrast to expectations stated by all three ISD representatives who stated that coaches' responsibilities should not include working directly with students. Jackson and Williams did not spend any of their time working with students. Wright was not expected to work directly with students, yet she was reassigned from her coaching role to be a classroom teacher for one fourth of the school year.

Building relationships.

In characterizing their work with teachers, and identifying their best attributes for coaching, coaches highlighted the importance of establishing positive relationships with their teachers. When asked to identify a role that characterized their work with teachers, 87% of the respondents selected "provide support and encouragement." Only one other potential role, "respond to teachers' requests or questions" was selected more frequently. Observation and interview data reinforced that math coaches seek to build positive relationships with teachers. Allen, Jackson, Samuelson, and Williams echoed this sentiment in their interviews, with Samuelson noting the "careful balance on how you approach people and get them to talk to you." Three coaches described their best attributes for coaching mathematics in relational terms: "relationship building;" "building relational trust with the teachers… allows the teachers to open up and trust me as an additional support in their classroom;" and "People feel comfortable working with me and I make sure they know that I am approachable and here to help as much as they need." Samuelson also emphasized her interest in "supporting whatever I can," asking teachers to let her know what they need, and tailoring her support to match "the teacher's

comfort level and our relationship." Wright was observed maintaining a trusting and supportive relationship with both teachers with whom she met, stressing confidentiality, sharing encouraging words, and utilizing humor. An ISD math official also emphasized that coaching activities are defined by relationships.

Providing resources.

The above quotes suggest an interplay between establishing relationships and providing resources. Providing resources was defined as supplying concrete resources, such as curriculum or other materials, as well as serving as a resource, providing advice or sharing knowledge as an experienced colleague.

Coaches reported providing a variety of resources for their teachers. One ISD math specialist emphasized the importance of coaches working with teachers to ensure teachers have a curriculum in place that is "aligned, sequenced, and coherent." She was particularly concerned that coaches work to combat, "curriculum by Pinterest." Another ISD representative said coaches are "used as specialists for a big need or a shift to new curriculum materials." Samuelson agreed with this characterization: "my role last year was to get that [a new math workshop routine] up and running." In contrast, Samuelson also mentioned a new curriculum adoption in her school as a side note during the interview, but never referenced it as part of her purpose as a math coach.

Clark and Jackson said teachers will often ask them for resources on a particular topic, which they will gather and share. Each of these coaches also referenced purchasing manipulatives for teachers. One questionnaire respondent defined math coaching in part as "providing information and research results on best practices to teachers."

Grant captured both dimensions of this idea of providing resources as a purpose for math coaching when she described her "unofficial" purpose for coaching: "I'm meant to be a resource

for the teachers. When I meet with a teacher, I help them secure and prepare resources." In addition to providing concrete resources, Grant saw herself as "a huge resource help – collecting and sharing the resources they need." "Respond to teachers' requests or questions" was selected by 90% of coaches as a role which characterized their work. To the same question, 67% of coaches categorized their work as "serve as expert or mentor." In identifying their best attribute for coaching math, two coaches claimed "resourcefulness," with one elaborating, "I am very creative and able to provide teachers with a wide range of ideas." During three of the four job shadows, math coaches were observed sharing physical resources and serving as a knowledge resource.

Other activities.

Additional activities were identified by coaches, though they were not prompted in questionnaire or interview questions. Coaches reported developing "common assessments for math," as well as "both formative and summative assessment resources and protocols for teachers." Other coaches described curriculum development activities: "developing our K-5 Math Curriculum;" "designing and coordinating resources to help support teachers in the implementation of our new curriculum;" "inputting curriculum into a district program;" and "curriculum mapping." Allen, Clark, and Williams developed curriculum materials and administered and scored common assessments.

Observation and supporting documents from the interviewed coaches indicated that coaches engage in administrative activities. Samuelson's weekly schedule blocked time each day for "bus duty/morning routine support" and Wright's schedule indicated daily time for supervising "Breakfast" and "3rd Lunch." Clark and Williams served as testing coordinators and technology support for their buildings. Grant was responsible for administering assessments as

well. Williams and Wright reported being pulled from their coaching duties to be substitute teachers; during the observation, one of Wright's teachers said, "You always hear the announcement 'Mrs. Wright, would you please report to room whatever to cover the classroom.'" Grant's calendar also included time spent providing substitute coverage. In contrast, Allen and Clark emphasized that their administrators had made it policy to not use them as substitute teachers. During the observation day, Grant met with administrators, responded to email, and scheduled substitute teachers. One questionnaire respondent also listed other activities as "support/assist other site stakeholders: building administration, office staff, tech department, and maintenance." This long list of other activities suggests that some portion of math coaches' time may be diverted from coaching activities.

Allocation of Coaching Time

Having identified the activities in which coaches in Metropolitan Detroit engage, and delineated those which are transformative and those which are supportive, a question of emphasis arises. A clear majority of math coaches described their purpose in terms of improving instruction and increasing student achievement, as discussed in the preceding section. Transformative activities hold greater promise for serving this purpose. What portion of their time do coaches spend in transformative activities? In order to begin to answer this question, the amount of time coaches allocated to coaching activities must first be determined, and then the portion of this time that is spent in transformative activities must be identified.

Time spent coaching.

Twenty-seven coaches responded to the questionnaire item asking them to estimate the percent of their time spent on given activities. The activities, and the average of respondents' answers, are listed in Table 3. Average responses were considered appropriate as they were very

close to median responses and added neatly to 101%. The average for one activity, teaching or supporting students, was pulled upward based on one respondent's entry of 100%. The average was retained in Table 3, but the median of 5% should also be considered. Three coaches included other activities which fit under the coach-provided heading of "Curricular Leader duties." These coaches estimated time allocations of 10%, 55%, and 70% on this activity.

Table 3
Allocation of Coaches' Time – Questionnaire Averages

Activity	Percent of Time Allocated to Activity
Coaching (i.e., working directly with one or more teachers)	28
Preparing for coaching	12
Supporting assessment (i.e., administering or analyzing results)	12
Teaching or supporting students directly (not modeling a lesson)	22
Performing school-based duties (i.e., substituting, lunch duty, etc.)	6
Meetings (non-coaching)	11
Personal professional development	5
Other: "Curricular Leader duties"	5
Other: Interaction with researcher	0

The percent of time spent on each of the activities listed in Table 3 were calculated for the schedules provided by interviewed math coaches, as shown in Table 4, as well as the observations of coaches, as shown in Table 5. Three activities listed in Table 3 were neither scheduled nor engaged in, so they were not included in Tables 4 and 5. Table 4 shows that math coaches' schedules aligned with the questionnaire averages of engaging in coaching activities approximately 25% of the time. Wright's schedule was an exception, with 58% of her time dedicated to coaching. Wright's allocated time was also out of synch with the other three

schedules in that she spent nearly one fifth of her time on school-based duties, when others spent no time on these activities, and in that she was not scheduled to work directly with students at all. The remaining three schedules devoted 60% of math coaches' time to working with students, nearly three times more than the questionnaire average.

Table 4
Allocation of Coaches' Time – Scheduled

Activity	Percent of Time Allocated to Activity			
	Allen	Clark	Samuelson	Wright
Coaching (i.e., working directly with one or more teachers)	25	20	32	58
Preparing for coaching	16	10	8	12
Teaching or supporting students directly (not modeling a lesson)	63	60	60	0
Performing school-based duties (i.e., substituting, lunch duty, etc.)	0	0	0	19
Meetings (non-coaching)	0	10	0	11

During the observations, each math coach spent a large portion of the day describing her role and responsibilities to me, as shown in Table 5. In Clark's case, this appeared to be a deliberate modification of her schedule, as she responded to multiple phone calls, saying, "I'll pull them tomorrow." Many classes of students were also away from the building that day, which cancelled her scheduled time with some groups of students. Field trips and teacher absences also resulted in cancelations of Allen's scheduled time with students and teachers. For Grant and Wright, it was not clear how time spent with the researcher would have been otherwise allocated.

Table 5
Allocation of Coaches' Time – Observed

Activity	Percent of Time Allocated to Activity			
	Allen	Clark	Grant	Wright
Coaching (i.e., working directly with one or more teachers)	0	0	7	68
Preparing for coaching	0	0	17	0
Teaching or supporting students directly (not modeling a lesson)	40	0	17	0
Performing school-based duties (i.e., substituting, lunch duty, etc.)		0	0	0
Meetings (non-coaching)		0	14	0
Other: Interaction with researcher	60	100	31	32

Williams shared that he didn't do as much coaching as he would like, because "other duties come down the line." Williams understood that "the administration has so much to do, they have to lean on other people." Clark emphasized both of these points: "We are the people. We volunteer for a lot of extra craziness. In small ways we get pulled all the time." Her position required that she spend 20% of her time coaching, yet, when documenting her time at the end of each month, Clark said she was always low on coaching. She expressed confusion, "but we do it all the time, five minutes here and there." During Allen's observation, the issue of being pulled away from her scheduled responsibilities arose. Allen remarked to one group of students, "I didn't get to see you on Tuesday." A student responded, "Yeah, you were testing." According to her schedule, Allen spent Mondays and Wednesdays in one school and Tuesdays and Thursdays in a second school, with Fridays scheduled to be split between the two buildings. In practice, though, Allen said, "That's usually when I get pulled to do other things." When discussing her schedule, Grant expressed frustration at the limited time she had available for coaching because of the demands of providing student intervention. Her calendar listed non-coaching activities, such as administering standardized assessments and covering classrooms during teachers'

absences, as impediments to her coaching. Similarly, when Wright reviewed her schedule, which had been set at the beginning of the school year, she said, “This just makes me sad to look at.” Having been pulled to cover classrooms and other duties, Wright wished she “just had a chance to do coaching well.”

Of particular interest in the above analysis is the proportion of time that coaches spent actually coaching. Questionnaire responses, coaches’ schedules, and observations each estimated that math coaches devoted only one fourth of their time to coaching. The majority of coaches’ time was allocated to activities that are neither supportive nor transformative and which were not identified in any respondents’ definitions of, or purposes for, coaching.

Time spent in transformative activities.

In the next section, time spent coaching is parsed into particular coaching activities. A deeper comparison of math coaches’ time spent in different coaching activities, as well as their ratings of the importance of these activities, can begin to describe what portion of coaching time is spent in transformative and supportive activities. In the questionnaire, coaches were asked to indicate in what math coaching activities they engage, from among a list of activities. Twenty-eight coaches responded to this question. The activities they selected were ranked in order by the percent of coaches who engage in each, as shown in Table 6. Transformative activities are shaded gray.

Table 6
Coaches Who Engage in Designated Activities

Activity	Percent
Meet with individual teachers	89
Observe teachers in their classrooms	79
Meet with groups of teachers	79
Collaboratively plan for instruction with teachers	71
Provide post-observation feedback	68
Model research-based instruction in teachers' classrooms	68
Lead professional development sessions for teachers	68
Manage student assessment data (entering, analyzing, and/or representing data)	61
Co-teach with teachers in their classrooms	54
Build capacity for teacher learning (through professional learning communities, lesson study groups, etc.)	54
Provide interventions directly to students	50
Complete cycle of pre-conference, lesson observation, and post-conference	32

More math coaches engaged in activities categorized as supportive, and fewer coaches engaged in activities identified as transformative. While only one third of the coaches reported completing the full cycle of pre-conference, lesson observation, and post-conference, two thirds did provide post-observation feedback. This discrepancy was not surprising given the greater time demands of executing a full cycle. Modeling lessons was also enacted by two thirds of coaches. That the top four activities most engaged in by coaches are all identified as supportive presents a dilemma: are coaches aware of which activities hold greater potential for transforming the instructional practice of the teachers with whom they work?

Coaches were asked to rank the importance of each of these designated activities, by identifying the top five they considered the most important for successful coaching. Twenty-seven coaches responded to this question. The activities they prioritized were ranked in order

first by the number of coaches who chose each as the most important. Then, as needed, a secondary ranking was determined by the number of coaches who placed each activity somewhere in their top five. These rankings are shown in Table 7, again with the transformative activities shaded in gray.

Table 7
Coaches' Most Important Activities for Successful Coaching

Activity	Number of Coaches Who Identified as Most Important	Number of Coaches Who Placed in Top Five
Build capacity for teacher learning (through professional learning communities, lesson study groups, etc.)	5	15
Model research-based instruction in teachers' classrooms	4	13
Observe teachers in their classrooms	4	13
Meet with individual teachers	3	12
Complete cycle of pre-conference, lesson observation, and post-conference	3	9
Meet with groups of teachers	2	5
Co-teach with teachers in their classrooms	1	8
Provide post-observation feedback	1	8
Provide interventions directly to students	1	3
Collaboratively plan for instruction with teachers	0	12
Lead professional development sessions for teachers	0	8
Manage student assessment data (entering, analyzing, and/or representing data)	0	6

Providing post-observation feedback, which was presented as an essential, transformative activity in the definition of Enacted Math Coaching, was ranked low by math coaches. This discrepancy was ameliorated somewhat by the higher ranking of the more robust full-cycle activity. Two activities described as transformative were also ranked by math coaches as most important for successful coaching. Math coaches prioritized transformative activities.

Comparing the data in Tables 6 and 7 reveals that three of the activities which math coaches rated as most important were also activities in which they engaged less: building capacity for teacher learning, modeling lessons, and completing full-cycle observations. These were all transformative activities. Conversely, coaches engaged in supportive activities more often than they considered important, especially planning collaboratively with teachers. The one exception was providing post-observation feedback, which was categorized as transformative. In this case, coaches spent more time on this activity than they identified as important for successful coaching. Interview and observation data corroborated this analysis, with only Wright scheduling and performing any transformational activities.

Summary

Math coaches agreed that coaching should be nonevaluative. For other findings related to the activities there was less agreement. Coaches reported wide ranges in the number of teachers with whom they work and the frequency as well as the duration of their visits with individual teachers. Coaches documented that they spent only about one fourth of their time engaged in coaching activities. Two categories of coaching activities, transformative activities and supportive activities, were identified, with transformative activities holding greater potential for improving teaching practice. Coaches rated transformative activities as important, but spent more of their coaching time on supportive activities.

Research Question 4
What professional training and experiences, previous and on-going, do math coaches in Metropolitan Detroit schools have?

The activities undertaken by math coaches, and the coaches' capacity for meeting the goals of their position, are impacted by their qualifications and on-going professional development. This section identifies the qualifications of math coaches in Metropolitan Detroit

and the opportunities these individuals have for becoming better at their work. Data provided by the participants as well as job descriptions were analyzed.

Qualifications

Formal qualifications for educational positions typically include degrees earned and areas of certification, and job descriptions for coaching positions reviewed in this study included both. Among the 38 coaches who responded to the question, 13% held a bachelor's degree, 84% had earned a master's degree, and 10% held a doctorate or educational specialist degree. Five of nine job descriptions required a master's degree, with another posting listing a master's degree as preferred. Half of the participants' bachelor's degrees included a major area of study in mathematics or mathematics education. Their graduate degrees were evenly split among mathematics, educational leadership, curriculum, and education. All of the coaches indicated holding a teaching certificate, and 36 coaches listed their area of certification. In Michigan, teacher certification has two levels: secondary, for grades six through 12; and elementary, for kindergarten through grade 8. Eleven coaches were certified in secondary education and all of them were certified in mathematics. In Michigan, this requires either a major or minor in mathematics. Twenty-three coaches held K-8 certification, with only nine holding mathematics endorsements. Of the two coaches who did not indicate their certification level; one had a mathematics endorsement and one did not. Overall, twice as many coaches were elementary certified than secondary certified, and only half of elementary-certified coaches were certified in mathematics. All of the job descriptions required a teaching certificate, and five of the nine required a mathematics endorsement.

Another minimum requirement identified in job descriptions for math coach positions was mathematics teaching experience, quantified as three, five, or 10 years. Thirty-seven

respondents provided their years of teaching experience, as presented in Table 8. The data showed that participants in this study were experienced teachers. For every grade band other than middle school, most have worked 10 or more years. Twenty-seven percent of respondents identified their experience as math teachers as their best attribute for coaching mathematics.

Table 8
Coaches' Years of Math Teaching Experience

Grade level	Less than 1 Year	1-4 Years	5-9 Years	10+ Years
Elementary (preK-5)	1	5	7	10
Middle (grades 6-8)	2	11	8	2
High (grades 9-12)	2	1	1	9

In contrast, the participants lacked experience as coaches. Table 9 shows the coaching experience listed by 37 coaches. Given that the push for math coaches can be traced to NCLB in 2001, it is not surprising that no coaches reported 10 or more years of experience. It is interesting to note that few coaches at any grade band have more than four years' experience. Similarly, 87% of coaches reported having been in their current position for less than four years, with an overall range of one month to seven years in the current position.

Table 9
Coaches' Years of Math Coaching Experience

Grade level	Less than 1 Year	1-4 Years	5-9 Years	10+ Years
Elementary (preK-5)	11	13	4	0
Middle (grades 6-8)	3	16	1	0
High (grades 9-12)	3	7	2	0

More coaches highlighted what might be seen as personal characteristics rather than their math teaching experience as the best attribute they bring to the coaching position. These attributes included patience, listening skills, being non-judgmental, sincerity, and

approachability. Allen, who has a mathematics endorsement, emphasized that math coaches "need to have content knowledge and understand pedagogy across grade levels." Yet, the idea that good math coaches might not even need to be good math teachers was raised by interview participants. Grant, who is not certified in mathematics, reflected that knowing the content helps, but that "my teachers are the content experts." She supported the idea that "best practices are best practices regardless of content." One of the mathematics specialists from an ISD reported that ISD administrators supported this notion. This issue was also mentioned in the discussion of content focus in the section on the first research question.

This same ISD math specialist acknowledged, however, that she has had to hire math coaches "who might not have been math certified but are pretty strong in math instruction." All three ISD representatives shared that "it's a challenge to find high-quality, committed coaches." Some of the challenge is due to the lack of qualified candidates, but other challenges arise from the structure and funding of coaching positions. Especially among the mandated coaches for priority schools, where funding is soft money and positions are part-time: "You can't get the best people to coach, because there isn't security around the position. We do have some great people, but often the people that have the most skills to support this work are going to be people who expect a certain level of compensation and security."

Professional Development

Participants were asked to share the types of professional development they had received, their continuing professional development opportunities, and the topics about which they would like to learn more. Questionnaire responses indicated that coaches have received professional development in curriculum materials, analyzing tasks and lessons in terms of the underlying mathematics, and strategies for supporting teachers and students. This professional development

was provided by employers roughly twice as often as coaches sought it out on their own. Clark and Grant, however, reported that their schools did not have resources to support their professional development. Along with Allen and Wright, most of their professional development has been informal, through peer collaboration, online resources, and observation of other instructional leaders, or sought out and paid for on their own. Often, professional development opportunities are offered through the ISDs, but two of the three ISDs reported that they did not currently offer any professional development for coaches, due to a lack of personnel and funding resources. The third ISD did provide monthly meetings for coaches, drawing on the online Coaching Corner resources from the National Council of Supervisors of Mathematics. Allen reported using the Coaching Corner resources as well.

The State of Michigan requires coaches working within priority schools to complete a four-day course titled Coaching 101. These coaches must also complete four on-line modules about coaching, along with an additional math-module if they intend to coach mathematics. No respondents to the questionnaire mentioned these opportunities, though they were not specifically prompted. One ISD representative did not mention these courses. The other two suggested that the courses were not of the quality they would like, though they both acknowledged not having seen the courses. Jackson, who works for an ISD, was told not to take Coaching 101. Samuelson and Grant had heard of Coaching 101, and expressed an interest in participating in the training. They were both skeptical that coaches would be released from their schools for the four days needed to complete the course. Williams and Wright had attended Coaching 101 and found it very valuable, and Clark was looking forward to taking the course during the next school year. These data suggest a discrepancy between the views of ISD math representatives and math coaches on the usefulness of Coaching 101.

When asked to identify the professional development opportunities they would like to have, respondents highlighted topics related to working with adult learners and strategies for supporting low-achieving students. Grant affirmed this desire to learn more about "best practices in math," as well as to receive training on different technologies. Allen wanted training on guided math; Jackson was interested in developing her ability to have "difficult conversations" with teachers; and Wright was "trying to learn how to talk to people about how to improve themselves without being a know-it-all." One ISD math specialist had already envisioned a comprehensive summer program to train math coaches, focused on "high-quality math instruction, the Standards for Mathematical Practice, and how to be a good coach."

Summary

The math coaches who participated in this study were experienced, certified teachers. All coaches who held secondary certifications were certified in mathematics; less than half of the elementary-certified coaches held mathematics endorsements. Respondents were fairly new to math coaching, with most having four or less years of experience in that role. To support their coaching work, math coaches reported that they have had professional development in curriculum and supporting students. Interviewed math coaches reported that their districts did not allocate resources for their ongoing professional learning, though respondents were interested in additional professional development on working with adults and supporting low-achieving students.

Summary and Conclusions

At the outset of this study, a definition for Enacted Math Coaching (EMC) was proposed, based on the current coaching literature. This definition is restated here: Math coaching occurs when an experienced, successful mathematics teacher with strong mathematical content and

pedagogical knowledge and awareness of the needs of adult learners provides direct, nonevaluative, classroom-based, and sustained support to other math teachers to build those teachers' capacity to understand, choose, and implement research-based mathematics instructional practices, through modeling instruction and observing and providing feedback, so as to improve students' mathematics achievement. This definition of EMC will now be compared to the findings from this study, to see how it aligns with the self-reported and observed data from coaches in the field.

In the EMC definition, the audience for coaching was identified as "other math teachers," embracing a coaching practice that targets teachers rather than students. Coaches in this study overwhelmingly supported this view and identified teachers as the audience for their coaching. Coaches who identified students as the audience for their work appeared to have job descriptions that dictated that they support students directly, rather than working primarily with teachers. The literature does not provide clear guidelines for how teachers should be targeted for the services provided by a math coach. Data in this study suggested a strong preference for coaches working with all the teachers in a school building. The unequivocal message that coaching should be nonevaluative has been internalized, though it is challenging and nuanced in practice.

The definition for Enacted Math Coaching identified the purpose of coaching as "to build those teachers' capacity to understand, choose, and implement research-based mathematics instructional practices … so as to improve students' mathematics achievement." The goal of increasing student achievement, through improving teaching, was held by the majority of responding coaches. Coaches also referenced building content and pedagogical knowledge as means through which instruction could be improved.

The literature articulated a lengthy list of potential activities for coaching. Activities prioritized in the literature were highlighted in the definition of Enacted Math Coaching: "direct, nonevaluative, classroom-based, and sustained support … through modeling instruction and observing and providing feedback." The nonevaluative nature of coaching was clearly supported by questionnaire respondents and ISD representatives alike. The reported frequencies of contact with teachers varied widely, ranging from 25 minutes per day to 10 minutes per month.

The categories of transformative activities and supportive activities were advanced to classify the types of activities in which a math coach might engage. These labels were meant to value each subset of activities, yet to clearly prioritize the transformative activities for their greater potential to improve mathematics instruction. A focused analysis of the activities coaches rated as valuable, and where they spent their time, found a disconnect between perceived priorities and the reality of implementation. Coaches tended to agree with the literature in terms of the value of transformative activities, in particular modeling and observing and providing feedback, but reported engaging in supportive activities more frequently. The implementation of transformative activities was further inhibited by the time coaches reported spending on activities not related to coaching.

The definition of Enacted Math Coaching suggested qualifications coaches should bring to the role, and hinted at the need for professional development opportunities specific to their coaching role: "an experienced, successful mathematics teacher with strong mathematical content and pedagogical knowledge and awareness of the needs of adult learners." Coaches who participated in this study were experienced teachers. At the secondary certification level, they also had specific coursework in mathematics. Less than half of the elementary math coaches, however, reported a mathematics background. Three of the eight interviewed math coaches,

including one of the four observed coaches, were not certified in mathematics. In terms of professional development, coaches reported having received training in curriculum materials, analyzing tasks and lessons in terms of the underlying mathematics, and strategies for supporting teachers and students. They sought more development in working with adult learners and strategies for supporting low-achieving students. Interviewed coaches and ISD representatives both raised concerns about the availability and coherence of professional development for coaches.

CHAPTER 5 CONCLUSIONS AND IMPLICATIONS

Introduction

The purpose of this study was to document and describe the professional experiences and daily work of math coaches in schools in Metropolitan Detroit. This included an analysis of math coaches' goals and activities, as well as an exploration of the qualifications coaches bring to the role and their on-going professional development opportunities. As the researcher, I hoped to impact the current understanding of math coaching practice in two ways: through the proposal of a concise definition of math coaching based on the literature and built upon previous studies of coaching practice; and to validate this definition through the documentation of the work of math coaches in Metropolitan Detroit. Policy and implementation decisions concerning coaching are being developed in Michigan and Metropolitan Detroit, yet requirements for credentialing, hiring, and utilizing coaches have yet to be codified. In this context, the definition of Enacted Math Coaching and an analysis of the work of coaches in Metropolitan Detroit have the potential to inform practitioners, school leaders, and district- and state-level administrators as they make decisions concerning the implementation of math coaching.

Four research questions guided this study:

1. How do districts and schools in Metropolitan Detroit define the job responsibilities of math coaches?
2. How do math coaches in schools in Metropolitan Detroit characterize their work?
3. In what activities do math coaches in Metropolitan Detroit schools engage?
4. What professional training and experiences, previous and on-going, do math coaches in Metropolitan Detroit schools have?

Findings

The findings in this study were consistent with existing research on math coaching in many ways. Inconsistent themes were uncovered as well, especially in the definition and implementation of the coaching role. Detailed findings, organized by research question, were presented in Chapter 4. In this section, findings are summarized across research questions.

Areas of Consensus

First, as suggested in the literature, math coaches articulated a clarity of purpose for their work. Instructional coaching has been heralded as a means to improve instructional practice and thereby increase student achievement. Coaches and ISD representatives characterized the purpose of coaching in terms of improving teaching to increase student achievement. Additionally, math coaches embraced the literature-supported position that coaching should be nonevaluative.

Second, coaches and potential employers agreed that teaching experience is a minimum qualification for math coaches. Position postings required a minimum of three to ten years of teaching experience, and the experience reported by participants in this study, on average, met or exceeded that. While one interviewed coach and ISD math officials expressed their opinion that teaching experience did not necessarily have to be mathematics teaching experience, questionnaire responses showed that math coaches consistently had ten or more years of experience teaching mathematics. This study was grounded in a social theory of learning (Wenger, 2009), which holds that teachers learn by engaging in assisted performance with coaches, who serve as experienced peers (Cobb & Jackson, 2011; Neumerski, 2013; Polly, Mraz, & Algozzine, 2013). Coaches in this study were indeed experienced peers.

Third, math coaches rated highly the activities which research has shown to be more powerful for improving teaching and increasing student achievement. Transformative activities, identified and defined in this study, were based on recommendations from the literature and whether or not they met the essential characteristics in the definition of Enacted Math Coaching advanced in this paper. These activities are: modeling instruction, observing and providing feedback, building teachers' capacity, and collecting data on coaching effectiveness. Other coaching activities were identified as supportive, as research suggests they are important but less likely to impact teaching practice. Math coaches were asked to select from a list of activities which ones they thought were the most important for successful coaching. Their two top priorities, building teachers' capacity and modeling instruction, were transformative activities. Coaches ranked observing teachers third, though the transformative activity of observing and providing feedback was rated by coaches as less important.

Areas of Inconsistency

The above mentioned areas of consensus have the potential to inform consistency of implementation of math coaching, but that has not yet happened in Metropolitan Detroit. The literature does not provide one definition of math coaching, and neither did the coaches or ISD math officials in this study. The lack of a consistent definition was also apparent in coaches' uncertainty about the goals and standards of evaluation for their work. Ambiguity of position was evidenced most strikingly in coaches' reported allocation of their time and choice of coaching activities.

Questionnaire responses, schedules, and observations indicated that math coaches spend only about 25% of their time engaged in coaching activities. Of the time spent coaching, more coaches engaged in supportive activities than transformative activities. According to the theory

of social learning, participation in a community of practice is the mechanism through which coaches will help teachers to improve their instruction. Findings from this study indicate that math coaches spend very little of their time interacting with teachers in this way.

Implications and Recommendations for Future Research

Both themes of consensus and inconsistency are useful for understanding math coaching in Metropolitan Detroit and for informing implications and possible next steps. The need to improve student achievement in mathematics in this region continues, as does the potential of math coaching to address this need.

Continuing Need for Math Coaching in Metropolitan Detroit

During the course of this study, the State of Michigan introduced the new M-Step assessment, the results of which were called "baseline" (AlHajal, 2015). If previous results suggested schools in Metropolitan Detroit were falling short of standards, one implication of "baseline" is that there is even more work to be done now. As was emphasized by one of the ISD math specialists, the need for school-based mathematics support for teachers is pervasive. Future studies focused on the impact of math coaches on student achievement, especially in priority schools, are needed to inform policy and personnel decisions at both the state and local level.

The Current State of Math Coaching in Metropolitan Detroit

The definition and implementation of coaching in Michigan is left to districts, schools, and individuals. In the tri-county area there is a disconnect between what math coaches hold as valuable practices, which is aligned with recommendations in the literature, and what practices the math coaches actually implement. Math coaches embraced the shared understanding that coaching should involve modeling instruction and building teachers' capacity, but this understanding was not reflected in coaches' daily work. Further research is needed to determine

why this inconsistency exists and to clarify if a consistent definition of math coaching would impact coaching implementation.

This study did not explore the relationship between coaching qualifications and coaching activities. In Michigan, a state without coaching certification requirements, the qualifications for being a math coach are determined by districts, schools, and individuals. At the elementary level, half of the math coaches in this study did not have a mathematics background. A question for future research is the impact a mathematics preparation, as defined by a mathematics degree or endorsement, has on the activities in which a math coach engages.

A troubling finding of this study was how little time math coaches spent coaching. According to their own estimates, schedules, and direct observation, only about 25% of coaches' time was allocated to coaching activities. Given that all but two respondents worked in Title I funded schools, this rate of engagement in coaching activities might signify non-compliance with federal funding regulations. A reluctance to make such a reality public might explain some of the hesitance of coaches and administrators to allow direct observation of coaching practice. Within the one fourth of math coaches' time allocated to coaching activities, the majority of time was spent on supportive rather than transformative activities. Math coaches reported both a commitment to improving teaching and increasing student achievement, but they documented that they were working diligently on less effective, supportive activities. Additional exploration of the factors that influence these decisions is warranted.

One such factor, which merits additional research, was suggested by this study. Math coaches rank in a middle space between administrators and teachers. Math coaches are seen as an extra pair of hands by administrators, teachers, and coaches themselves. In the absence of clearly

defined roles and deliverables, math coaches and administrators may take advantage of the flexibility of the position to divert coaches' time to other pressing school or district needs.

Representatives from the mathematics departments of each ISD expressed difficulty hiring qualified math coaches, which they attributed to the uncertainty of funding for these positions and that the positions are often part-time. The instructional coaching positions which are mandated for priority schools are hindered by both of these constraints. The ISDs are charged with hiring and facilitating coaches assigned to priority schools, which are, by definition, those schools with the greatest need according to state assessment criteria. If qualified coaches cannot be found for these schools, the prospects for success of these mandatory coaching initiatives are limited. The ISD specialists also raised concerns that coaches in priority schools have no authority to make the changes they seek. Additionally, these coaches spend limited time in schools and are not accountable to these school communities. All of these reflections raise concerns for the quality and efficacy of coaching in priority schools. More research is needed on the implementation and effectiveness of coaching as it relates specifically to priority schools.

Further exploration of professional development for math coaches and the induction process is warranted. Along the same lines, an exploration of the role and impact of Coaching 101 and the state's instructional coaching modules on the implementation and effectiveness of coaching in priority schools is suggested. A review of certification and professional development programs offered in other states would also help to inform the development of effective professional development for math coaches in Michigan.

Improving Coaching in Metropolitan Detroit

Data from this study suggest a need for clarity of the definition of coaching, as well as an increase in the implementation of transformative activities. In order to improve math coaching

efforts in Metropolitan Detroit, three suggestions are offered: identify and disseminate a shared definition of math coaching; establish shared expectations for minimum activities of math coaches; and create coherent professional development opportunities for coaches.

To increase consistency of coaching across schools, it is suggested that a comprehensive definition of math coaching be adopted by state, ISD, and district officials. The Enacted Math Coaching definition proposed in this paper reflected the recommendations in the literature and served as a measuring stick for the coaching reported in this study. EMC is offered as an accurate and discerning definition for use in job descriptions and evaluations.

Gawande (2010) documented the use of checklists as a tool for improving reliable implementation of complex processes. A checklist for math coaching could impact how it is implemented and provide a means through which fidelity could be improved. An over-simplified checklist is offered in Table 10, as a starting point for documenting coaching practices and increasing implementation aligned with current understandings of effective math coaching. Coaches would record the time spent in each category, with the aim of increasing time spent on coaching activities overall, and transformative coaching activities in particular.

It is also suggested that state, ISD, and district officials create intentional and coherent guidelines for the professional development of coaches. Mandating qualifications or setting new certifications might be considered, but would still be insufficient. Math coaches, just like the teachers they serve, need comprehensive and on-going professional development to support their growth.

Table 10
A Rudimentary Checklist for Math Coaching

Teacher(s) Served	Length of Contact	Days Since Last Contact

Activities	Minutes Spent Each Day	Percent of Daily Time Spent
Transformative		
Modeling Instruction		
Observing and Providing Feedback		
Supportive		
Meeting with Teachers		
Planning Collaboratively		
Leading Professional Development		
Working with Student Data		
Non-Coaching		

Limitations of the Study

This study was limited to specific components of the math coach role, acknowledging that the coaching role is complex in nature. Many components of coaching, and its potential impact on teachers and students, were not assessed. These limitations were discussed previously in Chapter 3. Data collection efforts evidenced additional limitations, as did analysis of the data.

Only a small number of coaches were recruited for additional data collection beyond the questionnaire. Additional attempts to secure opportunities to interview and observe math coaches were not successful. Two coaches, identified through personal contacts, initially expressed interest, but then ceased responding to communications. A third coach, also identified through a

personal connection, participated in an interview and attempted to gain support from her administrator for a job shadow. When her administrator refused, she withdrew her consent for participation in the study. Additionally, one of the math coaches observed for this study was not certified in mathematics. While this might represent a limitation, it is also representative of the sample of coaching respondents, in which half of the math coaches with elementary teaching certificates did not have endorsements in mathematics.

In terms of limitations appearing during data analysis, not all respondents answered all questions on the questionnaire. The reason behind these varying response rates, and any possible implications for existing responses, is unknown. Though the questionnaire was purposely designed, in alignment with the consent process, to allow for respondents to opt out of any questions, different or additional data could have been generated if each question had required a response. Second, it is unknown how the format of each question, as either open-ended or closed, impacted the data which was gathered. For example, the observation was made that no respondents mentioned qualifications of a coach in their definitions of math coaching. Participants were asked one, open-ended question to define math coaching. If participants had been asked a series of closed questions about the four dimensions of a coaching definition, that is, purpose, audience, activities, and qualifications, different data would have resulted.

Conclusion

This study documented and described the job responsibilities, goals, coaching activities, qualifications, and professional development of coaches in Metropolitan Detroit. There is a need to increase students' mathematics achievement, and math coaching has shown potential in other studies to provide professional development for teachers to improve their instructional practices.

Findings from this study indicated that this potential has yet to be realized in the ways math coaching is currently implemented in Metropolitan Detroit.

Three key contributions, with the potential to improve math coaching, derive from this study. First, documenting that math coaches currently allocate only one fourth of their time to coaching activities is a foundational finding in describing math coaching in Metropolitan Detroit. Second, the definition of Enacted Math Coaching which was advanced in this paper fills a critical void and could help establish the clarity needed for more consistent implementation of math coaching in this region and elsewhere. Third, the demarcation of transformative and supportive activities contributes a shared language for evaluating and advancing math coaching practice. Each of these key contributions, backed by the full findings of this study, position all interested parties to make more fully-informed decisions at the school, district, and state levels so as to better implement math coaching and to fulfill its promise for increasing students' mathematics achievement.

Post-Script: Trends in Coaching in Metropolitan Detroit

When asked to reflect on the current state of math coaching in their counties, and the future of the math coach position, ISD officials indicated that the use of the position may be diminishing. They were confident that the coaching associated with priority schools would continue, as it is part of state mandated policy and funding, but because of funding shifts "the trend is to move away from coaching," as "there's a big push to go where the dollars go." Though this may not fully represent the policies of the districts within their boundaries, ISD math officials perceived a decreasing interest in coaching initiatives. Allen indicated that her district was moving away from math coaching positions, and both buildings in which Wright worked would not have math coaches for the upcoming school year.

One ISD math specialist argued the case for increasing math coaching. She reported that many teachers were now staying within their districts rather than coming to the ISD for learning opportunities, since the state broadened continuing certification mandates related to professional development for teachers to a wide variety of organizations, including local school districts. As a result, she was not providing services for the teachers who could benefit from professional development. “We have had literacy coaches since the ’80s, but no attention has been paid to numeracy.” A recent survey of all of the elementary teachers within her county revealed that 85% are English/Language Arts majors. “With that data, it is clear we need a math presence in the buildings.”

The Every Student Succeeds Act (ESSA), which became law at the end of 2015, continues the NCLB’s call for instructional coaching as a professional development strategy and allows for the funding of instructional coaches under federal subgrants (Every Student Succeeds Act, 2015). It is too soon to tell what impact ESSA will have on the funding and provisions for math coaches throughout the nation or in Metropolitan Detroit. The ISD representatives agreed that math coaching positions were on the decrease outside of cases where it is mandated for priority schools. It is possible that the judgment on the effectiveness of math coaches has been rendered before we have sufficiently defined the role and assured its high-quality implementation.

APPENDIX A

QUESTIONNAIRE

Background Information

1. Please indicate the degree(s) you hold and your major area of study for each degree.

   - Bachelor's: _____
   - Master's: _____
   - Educational Specialist: _____
   - Doctorate: _____

2. Are you a certified teacher?

   - No
   - Yes

     In which subjects and for which grade levels are you certified? _____

3. Please indicate your years of math **teaching** experience at each level.

	Never taught math at this level	Less than 1 year	1-2 years	3-4 years	5-9 years	10+ years
Elementary (grades preK-5)						
Middle (grades 6-8)						
High (grades 9-12)						
Post-secondary						

4. Please indicate your years of math **coaching** experience at each level.

	Never coached math at this level	Less than 1 year	1-2 years	3-4 years	5-9 years	10+ years
Elementary (grades preK-5)						
Middle (grades 6-8)						
High (grades 9-12)						
Post-secondary						

Current Position

5. How do you define math coaching?

6. What is the goal of math coaching?

7. What is your current title?

8. How long have you been in your current position? ____ years and ____ months

9. Do you work in this position part-time or full-time?

   - Part-time
   - Full-time

10. Approximately how many students are enrolled in the district in which you work? (If you work in more than one district, please select all categories that apply.)

    - Less than 1,000
    - 1,000-9,999
    - 10,000-49,999
    - 50,000 or more

11. What is the primary source of funding for your current position?

- District funds
- State funds
- Title I funds
- Federal funds other than Title I
- Grant funds
- Other _____

12. In which type of school do you work? If you work in more than one type of school, please select all categories that apply.

- Traditional public school
- Charter school, i.e., public school academy
- Education Achievement Authority (EAA) school
- Other _____

13. According to the State of Michigan rankings, what is your school's designation? If you work in more than one school, please select all categories that apply.

- Priority school
- Focus school
- Reward school
- None of the above

14. What level of federal Title I funding does your school receive? If you work in more than one school, please select all categories that apply.

    - Title I Schoolwide
    - Title I Targeted Assistance
    - Neither

15. Which subject(s) do you coach? Please select all that apply.

    - Math
    - Language Arts
    - Other _____

16. With how many teachers do you work? _____

17. What is your primary work location?

    - One school site
    - Multiple school sites (please enter the number of sites _____)
    - Regional Educational Service Agency or Intermediate School District office
    - Other _____

18. In which county do you work?

    - Macomb
    - Oakland
    - Wayne
    - Other _____

19. What grade level, and how many teachers at each level, do you support? Please select all that apply.

- Grades K-1 (please enter the number of teachers _____)
- Grades 2-3 (please enter the number of teachers _____)
- Grades 4-5 (please enter the number of teachers _____)
- Grades 6-8 (please enter the number of teachers _____)
- Grades 9-12 (please enter the number of teachers _____)

20. How frequently do you interact with the teachers with whom you work?

- Daily (please enter the approximate number of minutes each day) ____
- Regularly scheduled visits (please indicate the approximate number of minutes per visit and the frequency of the visits, i.e., 30 minutes twice per week.) ____
- Irregularly scheduled visits (please indicate the approximate number of minutes per visit and the frequency of the visits, i.e., 30 minutes once per month.) ____

21. Who selects the teachers with whom you work?

- The teachers volunteer.
- You select the teachers.
- The administration selects the teachers.
- All teachers at the school participate.
- Other _____

22. How are the teachers with whom you work selected?

- The teachers are novice teachers.
- The teachers have received a poor performance rating.
- All teachers at the school participate.
- Other _____

23. Which role(s) characterize your work with teachers? Please select all that apply.

- Serve as expert or mentor
- Work alongside teachers as co-learner
- Facilitate as teachers work to problem solve issues in their practice
- Provide support and encouragement
- Provide materials
- Respond to teachers' requests or questions
- Initiate interactions with teachers
- Other _____
- Other _____

24. Are you responsible for formal evaluation of the teachers with whom you work?

- Yes, I have an evaluative role.
- No, I do not have an evaluative role.

25. What do you perceive to be your best attribute for coaching mathematics?

Activities

26. In what math coaching activities do you engage? Please select all that apply.

- Observe teachers in their classrooms
- Provide post-observation feedback
- Complete cycle of pre-conference, lesson observation, and post-conference
- Model research-based instruction in teachers' classrooms
- Support teachers in implementing school or district interventions
- Co-teach with teachers in their classrooms
- Collaboratively plan for instruction with teachers
- Meet with individual teachers
- Meet with groups of teachers
- Lead professional development sessions for teachers
- Lead teacher study groups to discuss instructional practices
- Lead teacher study groups to examine student work
- Build capacity for teacher learning (through professional learning communities, lesson study groups, etc.)
- Model and promote teacher self-reflection
- Provide interventions directly to students
- Coordinate or administer student assessments
- Manage student assessment data (entering, analyzing, and/or representing data)
- Other _____
- Other _____

27. What activities do you consider most important for successful coaching? Please rank your top five activities.

- Observe teachers in their classrooms
- Provide post-observation feedback
- Complete cycle of pre-conference, lesson observation, and post-conference
- Model research-based instruction in teachers' classrooms
- Support teachers in implementing school or district interventions
- Co-teach with teachers in their classrooms
- Collaboratively plan for instruction with teachers
- Meet with individual teachers
- Meet with groups of teachers
- Lead professional development sessions for teachers
- Lead teacher study groups to discuss instructional practices
- Lead teacher study groups to examine student work
- Build capacity for teacher learning (through professional learning communities, lesson study groups, etc.)
- Model and promote teacher self-reflection
- Provide interventions directly to students
- Coordinate or administer student assessments
- Manage student assessment data (entering, analyzing, and/or representing data)
- Other _____
- Other _____

28. In your best estimate, what percent of your time is spent in each of the following activities? (Your answers must total 100%.)

Coaching (i.e., working directly with one or more teachers) _____%

Preparing for coaching _____%

Supporting assessment (i.e., administering or analyzing results) _____%

Teaching or supporting students directly (not modeling a lesson) _____%

Performing school-based duties (i.e., substituting, lunch duty, etc.) _____%

Meetings (non-coaching) _____%

Personal professional development _____%

Other _____ _____%

Other _____ _____%

Professional Development

29. In what professional development opportunities have you participated in the last few years? Please select all that apply.

	Have not participated	Participated (provided by my employer)	Participated (I sought this out on my own)
Using specific curriculum materials			
Analyzing mathematical tasks or lessons in terms of the underlying mathematics			
Analyzing the strategies that students use to solve particular math problems			
Discussing how to work effectively with math teachers			
Strategies for meeting the instructional needs of low-achieving students			
Working with adult learners			
Learning math content			
Other _____			
Other _____			

30. In what professional development opportunities would you like to participate? Please select all that apply.

    - Using specific curriculum materials
    - Analyzing mathematical tasks or lessons in terms of the underlying mathematics
    - Analyzing the strategies that students use to solve particular math problems
    - Discussing how to work effectively with math teachers
    - Strategies for meeting the instructional needs of low-achieving students
    - Working with adult learners
    - Learning math content
    - Other _____
    - Other _____

31. What additional information would be helpful in understanding your job responsibilities, coaching activities, and personal professional development?

Additional Information

32. We would like to learn more from you about coaching. This would include keeping a log of your coaching activities for 10 days over the course of two months, allowing the researcher to shadow you for one day, and participating in an hour-long interview. If you are selected and complete these additional activities, an Amazon gift card for $100 will be provided to compensate you for your time and effort.

Are you interested in participating further in this study?

- Yes
- No

Thank you for being willing to share further! In order to coordinate the next steps, please select a four-digit number that you will easily remember. Please enter than number below.

_____

Please make note of the four-digit number you entered. We will need it later.

APPENDIX B

INTERVIEW: MATH COACH

Discussion of Daily Activities

1. What is your official work start and end time?
2. How did you select which activities to do this week?
3. How did you prepare for these activities?
4. Which activities do you most prefer to do?
5. Would you say this week was typical in terms of how your time was allocated and the activities in which you engaged? If no, what was unique about this week?
6. Has the way you allocate your time and the activities in which you engage changed over the course of the school year? If yes, how?
7. Has the way you allocate your time and the activities in which you engage changed over the time you have been in your current position? If yes, how?
8. Has the way you allocate your time and the activities in which you engage changed over your career as a coach? If yes, how?
9. Why do you think these changes have occurred?
10. What do you see as the purpose of your coaching?
11. What responsibilities, knowledge, and skills do you associate with successful coaching?
12. If you could design your own coaching program for your work with teachers, how would it differ from what you are presently doing?

Employer Expectations

13. Who hired you for your current position?
14. What was the process?

15. What are the expectations for you in your current position?
16. How have these expectations been communicated to you?
17. Who communicated these expectations to you?
18. When you began your current role, who introduced you as a coach to the math teachers with whom you work?
19. How did this person describe your role to the math teachers with whom you work?

Professional Development

20. Who or what has contributed the most to your development as a mathematics coach? How?
21. How has your past training and experience specifically prepared you for doing your job?
22. What in-school practical experiences and professional development activities currently support your ongoing development as a coach?
23. If you could design an ideal professional development program for mathematics coaches, what would your program include?
24. What else would help me better understand your role as a mathematics coach, especially in terms of your job responsibilities, your coaching activities, and your own professional development?

APPENDIX C

INTERVIEW: INTERMEDIATE SCHOOL DISTRICT MATH SPECIALIST

1. How do you define math coaching?
2. What is your ISD's vision for and approach to the use of math coaches?
3. What do you see as trends in the use of math coaches within the ISD?
4. What do you see as trends in the use of math coaches in the schools and districts in your ISD?
5. What programs or initiatives does the ISD currently have that include math coaching?

   [For each program mentioned, ask these follow-up questions.]

   a. What is the duration of these programs (i.e., how long have they been running, and how long do you anticipate they will continue to run)?
   b. Approximately how many math coaches work as part of this program?
   c. Approximately how many are involved in this program?
   d. How are coaches selected to work in this program?
   e. What are the qualifications needed to be a coach for this program?
   f. What activities do coaches do as part of this program?

      - Observe teachers in their classrooms
      - Provide post-observation feedback
      - Complete cycle of pre-conference, lesson observation, and post-conference
      - Model research-based instruction in teachers' classrooms
      - Support teachers in implementing school or district interventions
      - Co-teach with teachers in their classrooms
      - Collaboratively plan for instruction with teachers

- Meet with individual teachers
- Meet with groups of teachers
- Lead professional development sessions for teachers
- Lead teacher study groups to discuss instructional practices
- Lead teacher study groups to examine student work
- Build capacity for teacher learning (through professional learning communities, lesson study groups, etc.)
- Model and promote teacher self-reflection
- Provide interventions directly to students
- Coordinate or administer student assessments
- Manage student assessment data (entering, analyzing, and/or representing data)
- Other _____
- Other _____

g. What, if any, professional development do coaches receive as part of this program?

6. How many schools in your ISD employ math coaches?
    a. Is there a formal way of tracking that?
    b. If not, how did you arrive at your estimate?

You generously sent the invitation to my questionnaire to the math coaches who work with your ISD twice. The other ISDs did so as well, and I also recruited through other personal contacts and their referrals. At this point, [insert current number] people have looked at the questionnaire, and [insert current number] people have completed the questionnaire.

7. What are your impressions of this response rate?
8. Why do you think that [i.e., a high rate or a low rate] might be the case?

APPENDIX D

DOCUMENTS COLLECTED

Allen's Job Description

MATH SPECIALIST (1.0 FTE)

REQUIRED QUALIFICATIONS

- **EX Endorsement - Masters in Math *(preferred)***
- **Elementary Level Teacher Certification**
- **Minimum of three years of teaching experience**
- **Experience with elementary math programs**
- **Must meet NCLB Highly Qualified Criteria (Major in content area, or Minor and Passed MTTC exam)**
- **Experience in a like position *(preferred)***

PERFORMANCE RESPONSIBILITIES

- **Develop, administer, and/or facilitate assessments to determine student math levels**
- **Create instructional math plans to match student ability and learning styles**
- **Guide children through math activities to help them overcome obstacles**
- **Consult with parents and teachers to recommend at-home strategies to improve math skills**
- **Assist classroom teachers in planning math programs and instruction**
- **Assist all teachers with teaching/learning strategies that promote math comprehension**
- **Model math instruction in primary and intermediate classrooms**
- **Assist teachers with instructional interventions**
- **Maintain current and efficient records, including the preparation of reports and presentations**
- **Assist in the creation and implementation of after-school math tutoring programs**
- **Organize Summer Math Camp for Title I Students and/or other such support programs**
- **Develop and Prepare Summer Camp Math Kits**
- **Train/work with Paraprofessional Interventionists on directed prescriptive programs for math**
- **Other duties as assigned**

Grant's Job Description

MATH/SCIENCE COACH

EMPLOYER: Academy Board of Directors

REPORTS TO: Academy Director

JOB FUNCTION: To assist classroom teachers and other instructional staff in developing strategies, skills, tools, and techniques, to effectively teach mathematics and science to all students.

QUALIFICATIONS:

1. Shall hold a Master's Degree from an accredited university or college.
2. Shall hold a valid permanent or provisional teacher's certificate in elementary education from the State of Michigan.

MINIMUM GENERAL REQUIREMENTS:

1. Minimum of three years teaching experience.
2. Proven success on standardized assessments.
3. Experience administering the MEAP.
4. Strong understanding of the common core standards for mathematics and the NGSS for science (K-8).
5. Possess the ability to model and discuss mathematics and science approaches.
6. Subject to a Criminal Records Check as required by Board Policy.

ESSENTIAL DUTIES AND RESPONSIBILITIES:

1. Service all new math and science teachers for a minimum of two years.
2. Model "Best Practices" of math and science instruction in all classrooms at teacher's invitation or as specified by administration (based on data).
3. Assist teachers in making a diagnosis of math/science strengths and weaknesses and matching these skills with appropriate techniques and materials.
4. Conduct individual and whole group instructional dialogue meetings with teachers.
5. Facilitate student growth through the K-8 math and science curricula.
6. Work as a co-coordinator of the RtI department.
7. Work in conjunction with the RtI department to service at-risk students.
8. Present yearly updates to Board of Directors.
9. Perform other duties as assigned by the Director, Student Director and Curriculum Director of the Academy.

Wright's Weekly Schedule

Wright

2015 – 2016

Day	8:00 – 9:00	9:00 – 9:30	9:30 – 10:15	10:15 – 11:00	11:00 – 11:45	11:45 – 12:30	12:30 – 1:15	1:15 – 2:00	2:00 – 2:45	2:45 – 3:40
	A.M. & 1st	1st	2nd	3rd	4th	5th	6th	7th	8th	9th
Mon	Breakfast	Principal Mtg.	Peer Mtg.	Peer Mtg.	Peer Mtg.	Peer Mtg.	3rd Lunch	*Lunch*	Peer Mtg.	Peer Mtg.
Tues	Breakfast	Principal Mtg.	Peer Obs.	Peer Obs.	Peer Obs.	Peer Obs.	3rd Lunch	*Lunch*	Peer Obs.	Peer Obs.
Wed	Breakfast	Principal Mtg.	Feedback	Feedback	Feedback	Feedback	3rd Lunch	*Lunch*	Feedback	Feedback
Thurs	Breakfast	Principal Mtg.	**Follow-up Obs. »**	»	»	»	3rd Lunch	*Lunch*	»	»
Fri	Breakfast	Principal Mtg.	Planning	Planning	Planning	Planning	3rd Lunch	*Lunch*	Planning	Content Mtg

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ABSTRACT

MATH COACHING IN METROPOLITAN DETROIT

by

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Major: Curriculum and Instruction (Mathematics Education)

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On-going professional development for in-service teachers is critical to efforts to reform schools and increase student achievement. Coaching has been advocated as an approach to meet the conditions of quality professional development, and it has demonstrated a positive impact on student mathematics achievement scores when implemented over multiple years. Ambiguity of title, definition, and role surround coaching, presenting challenges to its execution in schools.

This study proposed a definition of Enacted Math Coaching to help address this ambiguity. As schools throughout Metropolitan Detroit adopt coaching as a component of school reform initiatives, the purpose of this study was to document and describe the professional experience and daily work of mathematics coaches in schools in Metropolitan Detroit. This included an exploration of the qualifications coaches bring to the role and their on-going professional development opportunities, as well as an analysis of their intended and enacted goals and activities. Data was gathered using a questionnaire, interviews, observations, and existing documents.

This study found clarity and consensus on the audience and purpose for math coaching. A review of the activities which coaches valued, and those on which they spent their time, highlighted a disconnect between priorities and implementation. Coaches reported spending only

one fourth of their time on coaching activities of any type. Coaches had received training in curriculum materials, analyzing tasks and lessons in terms of the underlying mathematics, and strategies for supporting teachers and students. They sought more development in working with adult learners and strategies for supporting low-achieving students.

AUTOBIOGRAPHICAL STATEMENT

Monica McLeod earned a Bachelor of Science degree in Elementary Education in 1993 and a Master of Education in 1996, both from Wayne State University. She is currently a doctoral candidate in Curriculum and Instruction in Wayne State's College of Education.

Ms. McLeod has over twenty years' experience in K-12 education, primarily in middle school mathematics. She currently works as a classroom teacher in the Detroit Public Schools.