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Examining the Role of a Math Content Coach

"Faith is taking the first step even when you don't see the whole staircase."

Martin Luther King, Jr.

Current practice in mathematics teaching has been impacted by the National Council of Teachers of Mathematics Content and Process Standards (NCTM 2000, Appendix 1), NCTM Curriculum Focal Points for K-8 Mathematics (NCTM 2006, Appendix 2), and the Federal No Child Left Behind Act (2001). As states, districts, principals, and teachers consider how to increase student achievement in communication, problem solving, and complex reasoning strategies, content coaching initiatives for mathematics have begun to emerge. In some cases, teachers have left the classroom to fulfill this call to action with very little support and preparation. This book investigates the fundamental nature of teacher leadership and the essence of content coaching in mathematics.

Having faith in the coaching process requires us to take the first step: understanding and planning. When we begin to walk up a staircase, we don't see every step but we need to trust in the process; it will take us to the landing. This first chapter defines and examines the role and responsibilities of a building math coach as a school leader and the importance of developing professional learning communities. Given that each school and district initiative is unique, administrators and math coaches will need to determine what fits their specific site.

Defining the "Math Content Coach" Position

Math content coaches provide professional development in mathematics content and instructional pedagogy. Initially, they might help schools examine their resources for teaching mathematics: *How much time is being spent teaching math during the school day? Are there funds available for purchasing math curriculum, supplementary materials, and required manipulatives? Are additional people available to help teach math in smaller groups, support classroom teachers in preparing materials,*

tutoring at-risk students, and challenging high potential students? Coaches, along with building leadership, may suggest ways in which to allocate these resources more effectively. Throughout the school year, coaches provide ongoing professional development with an eye on increasing student achievement in mathematics in a variety of ways. Each site will determine the math coaches' roles and responsibilities based on their needs. Below are a few suggestions to consider.

Roles and Responsibilities of Math Content Coaches

- ◆ Support the professional growth of elementary and/or middle school mathematics teachers by increasing classroom teachers' understanding of math content
- ◆ Enhance mathematics instruction and student learning by helping teachers develop more effective teaching practices that allow all students to reach high standards
- ◆ Collaborate with individual teachers and teacher teams on planning standards-based units, modeling, team-teaching, and coaching cycles
- ◆ Share research about how students best learn mathematics and facilitate teachers' use of these instructional strategies, including differentiated instruction for diverse learners, manipulatives, and visual models for mathematical thinking and reasoning
- ◆ Facilitate opportunities for teachers to develop an understanding of the national, state and district math standards and grade level benchmarks and to identify the "essential learning" in mathematics for their students
- ◆ Assist administrative and instructional staff in interpreting student achievement data and designing approaches to improve instruction and student learning
- ◆ Examine classroom-based math assessments and standardized test items for alignment, cognitive demand, equity, and purpose and use this information to make instructional decisions
- ◆ Examine student work as evidence of understanding, misunderstanding, and proficiency and use this information to make instructional decisions
- ◆ Provide staff development for the math curriculum or adopted math supplements
- ◆ Organize professional math resources such as reading and teaching materials

In addition to *content coaches* that work with all teachers, some districts have also hired *mentor* teachers. Mentors are usually experienced teachers who are

assigned new-to-the-profession (or new-to-the-district) teachers with the goal of initiating them through a process of induction and support. These mentors are generally responsible for several content areas, enhancing classroom and materials management skills, dealing with logistics, and setting up curriculum, instruction, and assessments schedules. Many of these responsibilities may overlap with the roles of math content coaches. In September of 2007, NCTM released a position statement on mentoring new teachers:

. . . These partnerships should ensure a strong focus on mathematics content knowledge, pedagogical knowledge, and knowledge of Principles and Standards for School Mathematics (NCTM 2000) and its application to the classroom.

Perhaps the two most significant differences are that math content coaches focus on mathematics teaching and learning and include veteran and novice teachers. Mentors may not be able to support a comprehensive understanding of math content and pedagogy knowledge or have the time to work with veteran teachers. Both coaches and mentors need to be consistent, flexible, respectful, willing to engage in dynamic learning, and committed to increasing student achievement. Their interactions are built on fairness, confidentiality, privileged communication and therefore should not be used in a formal evaluation process. Coaches and mentors are NOT administrators, supervisors, or evaluators of teachers.

That said, often principals rely on coaches and mentors for “another pair of eyes” on classroom situations: *How’s it going? How much support does a teacher require to effectively teach math? What other resources need to be allocated to help the teacher be successful?* One size doesn’t fit all, and therefore coaches and mentors make professional recommendations and decisions based on what’s in the best interest of the students. When they recognize a critical situation, they act in a professional manner.

At a grade level follow-up meeting in November, I discovered a teacher was a whole unit behind in her instruction because she had not allocated enough time for teaching mathematics, did not like teaching math, and claimed her students didn’t like the new program. This was going to significantly impact student achievement, and therefore it was my responsibility to meet with the principal and inform him of the circumstances. We collaborated on a plan that would include organizing her classroom schedule and materials and providing two weeks of in-class modeling on how to teach this new standard-based program. We also planned one week of monitored guided practice with specific feedback on key instructional strategies and a biweekly meeting to ensure a gradual release of responsibility. This intervention would not have worked without the principal’s participation and a professional coaching relationship with the teacher. By February, the teacher was on target with her instruction and surprised at how much her students were learning!

—Math coach reflection

Coaches as Leaders in a Professional Learning Community

Math content coaches relate as peers and focus on reflection, content, and teaching and assessment practices. This specialized inquiry focused on student learning in mathematics creates a true professional learning community, sometimes beginning with just a few teachers and coaches. DuFour & Eaker (1998) define the Characteristics of Professional Communities:

Characteristics of Professional Communities

- ◆ Shared mission, vision, and values
- ◆ Collective inquiry
- ◆ Collaborative teams
- ◆ Action orientation and experimentation
- ◆ Continuous improvement
- ◆ Results orientation

Coaches are leaders in the establishment of these communities. They commit to guiding principles: the mission, vision, and values that identify what the school believes and what they seek to create. Math content coaches also commit to the implementation of a standards-based mathematics curriculum, via the process standards, and authentic assessment practices. They commit to increasing their own and teacher content and pedagogy knowledge. They question the status quo, seek new teaching methods, test those methods, and then reflect on the results. Coaches that make a difference don't just go along with what's been happening in the building. Their professional curiosity and openness to possibilities inspire team members to develop new skills and take risks as well. These experiences lead to genuine shifts in attitudes and beliefs about student learning.

Math coaches increase building capacity because they recognize that organizational growth depends on collaborative teams, not independent work. Teaching can be an isolated profession, where each person has a room with a door that remains closed during the day. The students in the classroom are the responsibility of that one teacher. In some schools, teachers are actually encouraged to compete with each other for parent requests or higher test scores. Coaches believe that teaching should not be an isolated or competitive profession and seek to open those doors in a figurative sense. They encourage teams of teachers to take ownership of all their students, share their best practice, and promote inquiry about their profession. Many schools already have pockets of professionals that work collaboratively. Content coaches strive to make these exceptional relationships intentional

and expand them to include all the teachers in the school. If students need to be a community of learners in the classroom, then surely teachers need to develop as a community of learners, too. Effective coaches make connections, one-by-one, and in small groups, towards the development of a schoolwide community that learns together. This intradependence creates the synergy, the momentum for positive change and renewal.

Coaches take action. They may order new math curriculum materials to examine, organize storerooms full of math manipulatives so that teachers can find what they need to increase student engagement and understanding in their lessons, or look for math conferences and classes that align with best practice. They DO something to get the ball rolling! Math coaches take initiative.

They understand that engagement and experience are the most effective teachers. So, they model math lessons; observe, collect, and examine school data; read and reflect; develop, test, and evaluate learning theories. Coaches with intermediate teaching experience might be asked to coach in a K-6 elementary school. They know they need to experience primary grade level mathematics as a learner and as a teacher, so they may schedule some observations in a first grade room, observe classroom management skills and routines, and then jump in to teach a series of math lessons. Coaches with elementary teaching experience may do the same in secondary classrooms. In order to establish and maintain credibility with their fellow teachers, they must be able to walk the talk.

Coaches also understand that their work is never done. They celebrate significant milestones and chart the course for the next journey. They appreciate that being an educator is a lifelong pursuit.

School, Classroom, and Student Factors

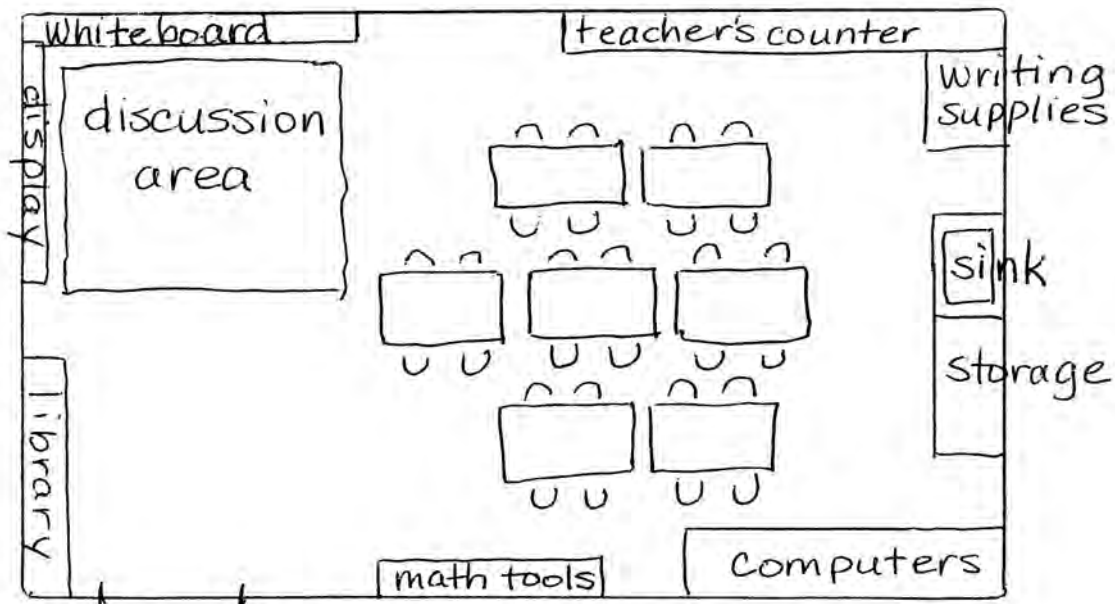
Schools that have principals with strong leadership skills and effective content coaches are likely to succeed in their mission, vision, and values. Content coaches alone will not be “the magic bullet” to increasing student math achievement.

According to Marzano’s research on *School Leadership That Works* (2005), there are eleven factors that create effective schools. Below are eight factors that are, at least partially, the responsibility of the math content coach. The first three are identified as school-level factors, the second three are teacher-level factors, and the last two are student-level factors. School-level factors are based on policy and include schoolwide initiatives or operating procedures. Teacher-level factors include instructional strategies, classroom management, and curriculum design. Most of the math content coaches’ time will be spent in this area. Student-level factors include the home atmosphere and influence.

School Factors

- ◆ **A guaranteed and viable curriculum.** Ideally the curriculum in the school is aligned to the NCTM Content and Process Standards, NCTM Focal Points and the State Standards. Once this has been established, it is imperative that there is enough instructional time allocated to teach it (viability) and that every teacher is teaching the essential content (guaranteed). In many schools, the literacy block is sacred, but the math block is frequently interrupted by school assemblies, field trips, guest speakers, early release days, and so on. By the end of the year, students may have missed almost 17 hours of math instruction. Building leadership and math coaches can help teachers schedule and protect the instructional time needed for mathematics. Coaches can help teachers identify and communicate the essential math content for all students (what do they need to know and be able to do), and with the support of building leadership, ensure that this content is addressed in every classroom in the building.
- ◆ **Challenging Goals and Effective Feedback.** The second factor requires implementing an assessment and record-keeping system that provides timely feedback and establishes and monitors rigorous achievement goals for the school and individual students. In many districts, report cards (electronic or paper) are created at the district level. This reporting system may or may not be adequate and may need to be reviewed by the content coaches. In effective schools, assessment drives instruction, and therefore coaches ensure the math assessment data is high quality and communicates specific feedback on academic progress to the students, parents, and teachers.
- ◆ **Collegiality and Professionalism.** Along with building leadership, coaches help establish norms of professional conduct and behavior that engender collaboration, encourage teachers to participate in school decisions and policies, and provide teachers with meaningful staff development in mathematics that is focused and cohesive. This factor mirrors the work by DuFour & Eaker on Professional Learning Communities.

As schools move toward “teaching to the standards,” classrooms take on a new look. Rows of isolated desks are rearranged in pods that encourage students to share their learning materials and communicate their ideas in pairs and small groups. Student access to an overhead, document camera, or interactive white board encourages student representation of mathematical ideas and promotes rich discussion of their reasoning and proof.



This classroom layout encourages student to student interaction and participation.

More than just a physical setting with desks, bulletin boards, and posters, the classroom environment communicates subtle messages about what is valued in learning and doing mathematics.

NCTM, 2000

Classroom Factors

- ◆ **Instructional Strategies.** Effective teachers and coaches have a variety of instructional strategies at their disposal. They use these strategies across all content areas, not just for math. These nine strategies are *identifying similarities and differences, summarizing and note taking, reinforcing effort and providing recognition, homework and practice, nonlinguistic representations, cooperative learning, setting objectives and providing feedback, generating and testing hypotheses, cues, questions, and advanced organizers*. Veteran and novice teachers alike benefit from an explicit review of these strategies. Math coaches make these strategies explicit during the pre-conference, modeling of the mathematics lesson, and post-conference session, and part of their professional development workshops. These strategies are often the focus of a lesson/unit study approach in a coaching cycle.
- ◆ **Classroom Management.** Teachers articulate and enforce rules and procedures, develop a respectful relationship with students, employ specific strategies to increase their awareness of special needs in the

class, and maintain a healthy emotional objectivity with their students. When coaches go into a classroom to model a math lesson, they are aware of the rules, procedures, and consequences and make clear their expectations for behavior. In the pre-conference specific student needs are identified so coaches can be responsive to them during the lesson. In some classrooms, math coaches may need to model how to manage a variety of manipulatives during a lesson and employ specific cooperative learning strategies, like a three-minute review (Teachers stop any time during a discussion and give students three minutes to review what has been said, ask clarifying questions or answer questions).

- ◆ **Classroom Curriculum Design.** Teachers and coaches make instructional decisions to adapt the content found in math curriculum materials to the needs of their particular students. These adaptations are focused on the standards and background knowledge of the students, including how to present this information in a way that is similar to some other topics students have experienced, perhaps across other content areas. Teachers and coaches consider which math skills are introductory and which ones are taught for mastery, and how to challenge students with complex tasks that require them to apply their new knowledge to generate a generalization or hypotheses. Many of these decisions are made during a pre-conference planning session. Some decisions are made “on the fly” during the lesson itself. These curriculum decisions are re-examined during the post-conference.

Home Factors

- ◆ **Learned Intelligence and Background Knowledge.** Life experiences certainly contribute to student academic success, and therefore math content coaches work with colleagues to engage students in a variety of simulations, reading, and vocabulary activities that are linked to mathematics teaching and learning. These tasks are systematically linked to the assessment practices that measure student achievement. Math coaches and teachers communicate these expectations to the families of the students they serve.
- ◆ **Motivation.** Coaches work with teachers to identify worthwhile and rigorous mathematical tasks, with multiple entry points, to enhance student motivation and engagement. These problem-based projects inspire even reluctant learners to use manipulatives, models, and real-world contexts. Students make choices, invest their time and resources and thereby increase their motivation.


Home Connections For Use after Unit Two, Session 7.

NAME _____ DATE _____

Home Connection 14 ★ Worksheet

Coins & Quick Sketches

Here is an array of quarters.



1 What is the total amount of money in this array? Use numbers, words, and/or labeled sketches to explain your answer.

2 Use the array to help solve these multiplication problems.

a $4 \times 25 = \underline{\hspace{2cm}}$ **d** $10 \times 25 = \underline{\hspace{2cm}}$
b $6 \times 25 = \underline{\hspace{2cm}}$ **e** $12 \times 25 = \underline{\hspace{2cm}}$
c $8 \times 25 = \underline{\hspace{2cm}}$ **f** $14 \times 25 = \underline{\hspace{2cm}}$

3 Rosie says she can solve 24×25 using the information above. Do you agree with her? Why or why not?

Home Connections

Home Connection 14 Worksheet (cont.)

4 Use what you know about adding and multiplying money to help solve the multiplication problems below.

example
$$\begin{array}{r} 25 \\ \times 36 \\ \hline 900 \end{array}$$
 I know there are four 25s in 100 (four quarters in a dollar). 36 is equal to 9 groups of 4. So, 36×25 is like 9×100 .

a
$$\begin{array}{r} 25 \\ \times 24 \\ \hline \end{array}$$
 b
$$\begin{array}{r} 25 \\ \times 32 \\ \hline \end{array}$$
 c
$$\begin{array}{r} 25 \\ \times 40 \\ \hline \end{array}$$
 d
$$\begin{array}{r} 25 \\ \times 34 \\ \hline \end{array}$$

e
$$\begin{array}{r} 50 \\ \times 2 \\ \hline \end{array}$$
 f
$$\begin{array}{r} 50 \\ \times 16 \\ \hline \end{array}$$
 g
$$\begin{array}{r} 50 \\ \times 24 \\ \hline \end{array}$$
 h
$$\begin{array}{r} 50 \\ \times 32 \\ \hline \end{array}$$

i
$$\begin{array}{r} 50 \\ \times 33 \\ \hline \end{array}$$
 j
$$\begin{array}{r} 50 \\ \times 17 \\ \hline \end{array}$$
 k
$$\begin{array}{r} 75 \\ \times 2 \\ \hline \end{array}$$
 l
$$\begin{array}{r} 75 \\ \times 16 \\ \hline \end{array}$$

Students in an intermediate classroom have been working on multiplication arrays and money relationships (quarters/dollar) to estimate and solve for multi-digit multiplication problems. The assigned homework directly relates to the classroom work and provides examples for support.

These factors are the joint responsibility of the principals, math coaches, staff, and families at the school. Each school site must identify and prioritize the factors based on their community needs and take action on the work that will make a positive difference. Math coaches can help ensure their time and other resources are allocated toward that work. Many schools are working very hard, but not necessarily on interventions that increase student achievement. The staff at these sites may be discouraged at their lack of progress. Focusing on the key factors, on the “right” kind of work, generates forward progress.

Personal and Professional Qualifications of Math Content Coaches

Successful coaches are people who are compassionate, have a sense of humor, have high expectations of themselves and others, are able to actively listen, and are trustworthy, and thereby make a positive contribution to the school. These personal qualifications are certainly part of a coaching relationship.

The professional qualifications are equally important. Math coaches know the current research on educational leadership, including professional development for adults, student achievement, and mathematics instruction and assessment practices. They have demonstrated success using a standards-based curriculum and instructional materials effectively and are interested in learning more and making a difference. Math coaches have an understanding of K-8 mathematics and knowledge of its connections to higher levels of mathematics. They are aware of the developmental landmarks in mastering early numeracy concepts, computational fluency with whole numbers, place value concepts, and fractions, to name a few. Math coaches use the NCTM Grade Level Focal Points and NCTM Content and Process Standards to focus their professional development work. They employ best practice for adult staff development.

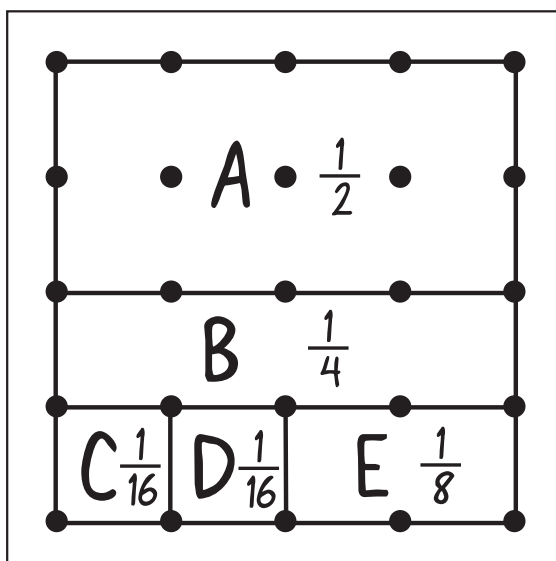
For example, a math coach may choose to use the Grade Three Focal Points (Appendix 2) to investigate fractional relationships with a third grade team of teachers.

Number and Operations: Developing an understanding of fractions and fraction equivalence.

Students develop an understanding of the meanings and uses of fractions to represent parts of a whole, parts of a set, or points or distances on a number line. They understand that the size of a fractional part is relative to the size of the whole, and they use fractions to represent numbers that are equal to, less than, or greater than 1. They solve problems that involve comparing and ordering fractions by using models, benchmark fractions, or common numerators or denominators. They understand and use models, including the number line, to identify equivalent fractions.

NCTM Focal Points, Grade 3

During the course of multiple investigations with fractions as area models (geoboards and pattern blocks), linear models (rulers and number lines), and fractions as parts-of-a-set models (colored tile and egg cartons), coaches and teachers uncover the explicit mathematics and accompanying vocabulary that is addressed in the third grade Focal Point as learners themselves. In some cases, other master teachers may also facilitate a lesson to the participants using best practice teaching strategies. These explorations are used as an opportunity to identify misconceptions the students (and some teachers) have about fractions and their equivalence. For instance, thinking that $\frac{1}{4}$ is greater than $\frac{1}{2}$ because the 4 (the denominator) is greater than the 2, or that $\frac{2}{4}$ is smaller than $\frac{3}{6}$ because 3 and 6 are greater than 2 and 4.



In this lesson, third graders determine the value of each area using a variety of proofs. They use fraction notation to represent parts of a whole.

Math coaches have a command of the district and state standards and benchmarks; therefore, they are able to facilitate an examination of assessment items used to determine proficiency with the third grade teacher team, as they align with this grade level Focal Point. They are also able to extend fraction concepts through the grades and help teachers differentiate their instruction for those students ready for additional challenges. Coaches know that adult learners are pragmatic. They want information they can take back to their classrooms and use with their students. Therefore, coaches continue to make connections to the classroom, planning for the fraction unit along with the teachers, focusing on instructional decisions, and shoring up the content knowledge of the participants through inquiry surrounding their grade level Focal Points.

Final Thoughts

Math coaching requires both these personal and professional qualities. Successful candidates must have an understanding and acceptance of diverse teaching styles and effective approaches to communicate with adults in addition to the mathematics knowledge to provide ongoing professional development. Math coaches influence the school culture, build and maintain a team, mentor other

teachers as math teachers and leaders, and improve student achievement. They are positioned at the fulcrum for change—where the challenges are. Successful math coaches work to solve the challenges in an efficient and effective way. Because they have no formal power, they must find other ways to motivate, mobilize, and lead teachers. They rely on intrinsic leadership abilities, knowledge of mathematics and group dynamics, influence, trust, and respect.