PARTNERING WITH PRINCIPALS THROUGH FORMAL AND INFORMAL PROFESSIONAL DEVELOPMENT

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Abstract

Mathematics Specialists and administrators need to define what they should see students and teachers doing in classrooms that promote proficiency and understanding in mathematics. Formal, divisionwide professional development on this topic can quickly guide and inform a large group of administrators in one setting. However, potentially more powerful professional development can occur on a small scale one building at a time through mathematics department learning walks.

Introduction

Dennis Sparks describes one role of principals as being expected to create learning communities in their schools and to engage the broader school community in creating and achieving a compelling vision for schools which typically serve increasingly diverse student populations [1]. Principals are asked to give up "command-and-control" views of leadership, choosing instead to be instructional leaders steeped in curriculum, instruction, and assessment who can coach, teach, and develop and distribute leadership to those in their charge.

This is a daunting task, as administrators are spread thin with day-to-day building responsibilities. They are required to be experts in not just general instructional best practices, but to be able to offer guidance on instruction in multiple subject areas. Collaboration between administration and instructional coaches is crucial because no one can be an expert in everything. In addition, administrators need formal and informal professional development to support them in their role as instructional leader.

Formal Professional Development, Countywide Workshop

The Chesterfield County Public Schools (CCPS) mathematics department formalized their mathematics instructional model in September 2012, explicitly laying out expectations for each part of the mathematics lesson. This instructional model was shared with all building-level administrators through an all-day professional development session that focused on mathematics instruction. Throughout the day, administrators had the opportunity to hear from representatives

from the Virginia Department of Education (VDOE), explore the mathematical process standards, and look closely at each component of the instructional model. The day began with a representative from the VDOE sharing mathematics updates and a brief overview of the mathematics process standards. The CCPS mathematics department then shared their philosophy of mathematics

> We believe that ***all*** students can learn mathematics with understanding. Learning mathematics with understanding involves thinking, reasoning, and applying knowledge and skills to problem-solving situations, not just memorizing facts and procedures to get an answer. Mathematics is a sense-making discipline that requires both conceptual understanding and procedural fluency. In building mathematical concepts, students explore multiple representations and make connections between ideas. Students then make connections between concepts and procedures. Reflective thought and reasoning is required throughout this process.
>
> Mathematics classrooms should be student-centered. Teachers are facilitators who design instruction to provide opportunities for students to use and build on their pre-existing knowledge and skills. Students at all levels should be engaged in rich discourse—questioning, explaining and justifying their reasoning, and clarifying their misconceptions—as they are learning and applying mathematics. Students should also learn to appreciate that there are multiple ways of approaching problems and finding solutions, even to basic computation exercises. The process of finding a solution is as valued as having the correct answer.
>
> Students become competent and confident problem solvers when they have developed conceptual understanding, efficient meaningful procedures, and useful problem-solving strategies and habits of mind.

Administrators were given the opportunity to discuss their interpretations of this philosophy and how it should manifest in classroom instruction. Specific focus was given to the idea of the instruction being student-centered with the teacher as a facilitator that provides many opportunities for rich discourse.

The instructional models for K-2 (see Appendix A) and grades 3-5 (see Appendix B) were shared next. These documents lay out a framework for what should happen in each component of a mathematics lesson. After discussing each part of the instructional model and detailing the "look-fors" in each part of the lesson, a video of a problem-solving lesson was

watched by the group. In this lesson from *Content Focused Coaching*, the teacher presents a problem-solving activity involving fractions [2]. Rich dialogue is prominent in both the whole-group introduction of the task as well as the small-group work completed by the students. This specific video was selected because student discourse is prominent in both the CCPS mathematics department belief statement and in each component of the instructional model.

As administrators viewed each part of the problem-solving lesson video, they were asked to focus on a series of guiding questions. Some of the questions were as simple as noting what the teacher was doing and what the students were doing. It quickly becomes clear in the video that the classroom is student-centered and mathematical talk is encouraged and valued. Many of the guiding questions focused on how the teacher keeps the focus on mathematical understanding. Administrators were continually encouraged to note how students were demonstrating their understanding by sharing their reasoning, explaining what they are thinking, and justifying why their answers make sense. Administrators were seated with their peers, and there were many opportunities for small-group discussions at their tables, as well as sharing out important ideas with the whole group.

Later in the day, an additional video of classroom instruction was shared. This video was chosen to represent very traditional instruction in which the teacher was using the latest technology and the students were reasonably well behaved. However, in this video there was no student discourse. The teacher asked many rote or recall questions, and frequently elicited a choral or chant response from the class. A similar set of guiding questions were used while watching this video. It was especially powerful to see the deficiencies with regard to discourse as well as student understanding in this traditional lesson.

Administrators noted that the most beneficial parts of this staff development day were the in-depth look at the instructional model and viewing both videos with these "look-fors" in mind. Thoroughly understanding the CCPS instructional model for mathematics prepared the principals for supporting teachers with implementation of the model in their classrooms. Viewing the videos allowed the principals to reflect on how specific pieces of the model should look in action. One administrator noted that this type of professional development helped her to understand the process of teaching mathematics, and exactly what the use of research-based best practices look like in a mathematics classroom.

Informal Professional Development, Learning Walks

In Confer and Ramirez' *Small Steps, Big Changes*, the principal states:

> I honestly have always found myself in a bind when I observe math lessons and need to talk to teachers about what I saw or need to give them feedback. I'm much more comfortable with literacy lessons since I know more about decoding and comprehension strategies. I just don't have the background in math. It's a tough thing to admit as a principal, but it's true—and really, it's not possible for anyone to know everything [3].

Informal discussions with other administrators lead to similar statements. Routinely, administrators will share that their area of expertise is language arts instruction or special education. Very few building administrators have a significant background in mathematics instruction, which isn't surprising as the Mathematics Specialist endorsement only came about in the past decade in the Commonwealth of Virginia. However, building-level administrators are expected to be instructional leaders that guide and support their staff in all content areas including mathematics.

In Fall 2012, the CCPS mathematics department began a series of learning walks. During a learning walk, a team from the county mathematics department consisting of the Instructional Specialist for Mathematics, the Elementary Math Teacher Consultant, and three Math Coaches join forces with the building-level administration to visit a school for an entire day. Additional support providers, including Special Education Liaisons and English as a Second Language Liaisons join the team depending on the demographics of each school. A schedule is developed so that pairs of observers can visit each classroom during mathematics instruction. Typically, a member of the mathematics department is paired with a building administrator or Special Education Liaison. Ideally when the schedule allows, the observation pairs stay for the entire mathematics class. When that isn't possible due to mathematics class times that overlap or a large number of teachers at a grade level, some observation pairs observe the beginning of the lesson in one room and the second half of the lesson in another room.

The entire observation team sits down at the beginning of the day and discusses protocol for the observations. Administrators have an opportunity at this time to make the team aware of building-level initiatives that are in place that they would like to monitor, as well as any concerns

or general statements about classrooms that will be visited. Pairs use a form (see Appendix C) based on the mathematics instructional model while conducting their observations. Pairs observe together in each classroom with each person taking their own notes. When a break occurs, observers return to the meeting room and debrief together, noting their observations and comments on a large sheet of chart paper for each grade level (see Appendix D). These charts are left with building-level administrators for their own records or debriefing with teachers. All of the information recorded on these charts is also recorded in a *Google Doc*™ site that is shared with all members of the observation team. Special notes of commendation and recommendation for the school and individual grade-level teams are noted as well.

Frequently, principals asked questions of the math team about mathematics content or specific strategies being used while observing together in classrooms. Several principals had commented that the recommended structure of mathematics stations for grades K-2 had confused them when they initially observed the process. Having someone from the CCPS mathematics department observing with them allowed them to ask clarifying questions that solidified their understanding. Principals noted that they are much more secure in the feedback they are giving teachers after participating in a learning walk with the mathematics team. One principal shared that her understanding of number talks grew significantly by participating in the learning walk. Her initial thought was that a number talk should look the same at each grade level. After observing in each grade level and asking questions about what mental math was being demonstrated in the kindergarten and first grade classroom number talks, she was more comfortable with what she was seeing in the primary grades.

The powerful collaboration between administrators and the CCPS mathematics department continues after the observations are completed and the pairs have an opportunity to debrief with the entire observation team. Frequently, trends emerge when the data is compiled by grade levels. These trends not only help when providing feedback for teachers, but also help the administrators determine future needs for professional development at their own schools. One principal shared that, while she had observed growth among her staff in the areas she had focused on for professional development, she hadn't realized the scale of this growth because she is embedded in the school. She sees it each day and notices the little changes, but because she's there every day she had lost track of just how far her staff had come. Having a team of people from outside the building observe provided a new view of this success, and actually allowed her to tweak her plans for continued professional development to incorporate additional topics.

Conclusion

Professional development is most commonly thought of in terms of workshops and courses, yet learning also occurs through collaborative efforts. While learning walks were not originally intended to be a form of professional development for school administrators, the comments that they have shared demonstrate that this is the case:

- "Participating in the learning walks allowed me to make observations and ask questions of our coaches for feedback. This conversation and idea sharing about what we observed is very helpful. The discussion with the math department after the observation helped to validate what I was observing."

- "I can see the strategies put into practice and discuss details of how they are being used effectively. This helps to guide in professional development in areas where they are not. Learning walks were seriously the greatest professional development days that I've attended. It is very powerful to walk with experts and compare my thinking. Now I know exactly what to look for and what feedback to provide."

References

[1] D. Sparks, *Designing Powerful Professional Development For Teachers and Principals*, National Staff Development Council, Oxford, OH, 2002.

[2] L. West and F. Staub, *Content-Focused Coaching: Transforming Mathematics Lessons*, Heinemann, Portsmouth, NH, 2003.

[3] C. Confer and M. Ramirez, *Small Steps, Big Changes: Eight Essential Practices for Transforming Schools Through Mathematics*, Stenhouse, Portland, ME 2012.

Appendix A
Instructional Model for K-2 Detailing All Lesson Components

Elementary Mathematics Instructional Model and "Look-Fors"
Grades K-2

The development of number sense is the major focus in K-2 mathematics. Opportunities for developing number sense occur during calendar math / review, the mini-lesson, independent stations, and closure.

Throughout all components of a lesson, it is critical that students demonstrate understanding by sharing their reasoning, explaining what they are thinking, and justifying why their answer makes sense.

Calendar Math / Review 10-15 Minutes
Use Every Day Counts Calendar math or a similar well-planned calendar math routine to explore patterns, build number sense and provide a cumulative review and spiraling of mathematics concepts and skills. This is also an opportunity for children to develop mathematical vocabulary and communication skills.

- Includes opportunities for students to share, explain and justify thinking
- Teachers are encouraged to include:
  - Word Problem of the Day (beginning in the second semester of kindergarten and continuing in first and second grades, a word problem of the day supports the conceptual understanding of addition and subtraction and the development of problem solving strategies; beginning in second grade problems can include two steps)
  - Questions addressing concepts across the strands that target specific student needs (number fact of the day, estimate of the day, term of the day, skill of the day, picture of the day, measurement of the day)
  - A number talk that involves subitizing with dot cards and ten frames, part-part-whole concepts, or a basic fact strategy (a number talk is a short whole class conversation where children share their reasoning and justify their answers to the question that has been posed)

Mini-Lesson 10-15 minutes
Mini-lessons are planned to address the current grade level big ideas found on the pacing guide. Refer to the CCPS Curriculum Framework for planning resources. The instructional strategies listed in the framework are sequenced to initially develop conceptual understanding and then connect and build to efficient procedures.

- Most mini-lessons will focus on concept or skill development and build on pre-existing knowledge and skills
- Multiple methods and strategies should be used
- Manipulatives and pictorial models that support the understanding of mathematical concepts are used
- Opportunities to discover concepts using hands-on inquiry activities are provided
- Some mini-lessons will be built around understanding a complex problem or performance task. A complex problem allows students to apply their mathematical understanding to new, unfamiliar situations and leads to the development of problem solving habits of mind.

Active Engagement 25-30 minutes

Independent Stations – 3 to 5 days per week	**Shared Experience** – 1 or 2 days per week
• Stations provide opportunities for students to have ongoing meaningful practice with important foundational number concepts* • May not be directly related to the mini lesson (i.e. mini lesson may be related to patterns, but stations are related to counting) • A variety of stations are provided, all related to the same big idea – during most weeks the big idea is a foundational number concept • Students choose the station at which to work, often moving between two or three stations in one session • Differentiation is provided through expandable activities that are easily leveled so that students at different levels can be working side by side at the same station • Stations target individual student's needs and levels of understanding – even if the student is below or above grade level • Students often record what they are doing in a journal or on a recording sheet • Teachers observe students as they work and interact with them to target individual student's levels of understanding and to nudge student thinking forward • Small group instruction may take place during the first 10 minutes of this time if a group of students share similar needs and those needs are best met by teacher directed instruction • The same stations stay in place for several weeks. This allows students to transition from learning how to do the activity to learning from the activity.	• Allows all children to experience the same activity so that the teacher and students can use the activity for a whole class reflection • Directly related to the mini-lesson (a continuation of the mini-lesson) • Usually a way of providing practice for lessons focusing on the strands of geometry, probability and statistics, measurement, or patterns, functions, and algebra • Students may work in groups, with partners or independently • If the mini-lesson focused on a complex problem or performance task, the shared experience focuses on solving the problem or completing the task • Teachers observe students as they work and interact with them to target individual student's levels of understanding and to nudge student thinking forward • Teacher may be able to meet with small flexible groups during this time

Closure 5 minutes

- Students reflect on new learning and make connections through discussion or journal writing
- Students reflect with the teacher on the learning environment (what went well and what could be improved)

***The foundational number concepts targeted at each grade level include:**

K – counting objects, comparing quantities, subitizing (recognizing quantities without counting), and part-part-whole

Gr 1 – comparing quantities, developing strategies for addition and subtraction, and part-part whole (internalizing number combinations through 10)

Gr 2 – part-part-whole (internalizing number combinations through 10), developing strategies for addition and subtraction, place value, and applying addition and subtraction strategies to two-digit numbers

Basic Fact Fluency

A goal of the elementary math curriculum is that students master the basic addition, subtraction, multiplication, and division facts. According to Van de Walle (2006), demonstrating mastery of the basic facts typically means that you can produce the answer in about 3 seconds or less without resorting to inefficient methods such as counting. Van de Walle goes on to say that all children can master the facts if they construct efficient mental tools. An approach for mastering facts that is grounded in using relationships between numbers not only allows children to construct the mental tools that help them learn the facts, but also helps them develop number sense.

There are three important steps to mastering basic facts.

1) Help students develop a strong concept of the operation. (What does it mean to multiply 3 x 4?) Using models and story problems aid in developing the concept.
2) Develop efficient thinking strategies to find the answers.
3) Provide appropriate practice in using the strategies until the strategies become automatic. Also provide practice in selecting strategies that are appropriate for a given fact.

A 'traditional' fact mastery program based on memorization may appear to work for some children. However, students who memorize facts miss out on developing the number sense and reasoning inherent in a strategy approach. In addition, the strategies that are used to master the basic facts can be used as mental math strategies for bigger numbers.

The following strategies have been identified by CCPS as the core strategies that are part of our approach to developing fact fluency. These strategies are referenced in the CCPS Curriculum Frameworks along with supporting activities and resources. The strategies are listed in the order they are introduced. A full day lesson is usually used to introduce or discover a strategy with short follow up sessions on subsequent days to begin practicing the strategy. A strategy should be introduced and practiced for at least a week before a new strategy is introduced and practiced. Once two strategies have been introduced, strategy selection activities can occur. Learning facts should be spread out over time and cannot simply be a two-week unit.

Addition:	**Subtraction:**	**Multiplication:**	**Division:**
Counting On One More Than/ Two More Than Doubles Near Doubles Terrific Tens Bridging Through Tens	Think Addition Counting Back Counting Up One Less Than, Two Less Than Bridging Through Tens	Twos (doubles) Tens (think place value) Fives (half of 10x) Ones and Zeros (think about the concept) Nines (one set less than 10x or patterns) Fours (double and double again) Threes (double and one more set) Helping Facts (any unknown fact) Elevens (10x and one more set) Twelves (10x + a double)	Think Multiplication

Monitoring Progress

An understanding of individual learning styles and a differentiated approach to instruction requires a rethinking of the idea that all students learn their facts in the same amount of time. Timing children before they have had the chance to develop efficient strategies can emphasize speed and guessing rather than number sense and accuracy. Timed activities should only be used occasionally (no more than every two weeks) to determine which facts a student already knows and to plan activities tailored to each student's needs. Alternative ways of assessing progress (like observation during a game or activity or a low key interview) can be used with all students, especially those that are anxious when timed. Ideally students will have mastered most addition and subtraction facts by the end of second grade and most multiplication and division facts by the end of fourth grade. Students who have not mastered the facts by fifth grade will need continued ongoing review and practice.

Appendix B

Instructional Model for Grades 3-5 Detailing All Lesson Components

Elementary Mathematics Instructional Model with "Look-Fors"
Grades 3 – 5

Throughout all components of a lesson, it is critical that students demonstrate understanding by sharing their reasoning, explaining what they are thinking, and justifying why their answer makes sense.

Check For Understanding and Review 20 Minutes
This portion of the lesson should ideally include all of the components listed below. It is difficult to address every component listed below in a 20 minute session. Within a week most of the activities listed below should occur. Teachers will need to make decisions about what to include daily. If the main lesson is focused on developing a basic fact strategy then the basic fact fluency portion could be eliminated for that day. If the main lesson is from a unit focused on computation, the number talk or word problem could be eliminated if the lesson lends itself to a similar goal.

Cumulative Review

- A deliberate and carefully planned review of previously taught skills, concepts, and vocabulary unique to the needs of students in each classroom
- Keeps skills and understandings fresh, reinforces previously taught material, and gives students a chance to clarify their understandings
- Includes time for students to share, explain and justify thinking
- Every Day Counts Calendar Math (if available) or similar well planned calendar math routine can serve as cumulative review
- Could include:
  - Word Problem of the Day (single-step or multistep; if multistep – more time will need to be allowed and other components of the Check for Understanding and Review time will need to be eliminated)
  - 3-5 questions that address concepts across the strands and target specific student needs (number fact of the day, estimate of the day, term of the day, skill of the day, picture of the day, measurement of the day)
- Review skills should be included in ongoing assessment

Number Talks

- A 5-10 minute classroom conversation or discussion crafted around purposefully chosen computation problems
- Students learn to mentally solve problems accurately, efficiently, and flexibly
- Promotes number sense and computational fluency
- By sharing and defending their solutions and strategies students are provided with opportunities to collectively reason about numbers

Basic Fact Fluency (see Basic Fact Fluency page for more detail)

- Provides practice in the use of efficient mental strategies and the selection of strategies after they have been developed. These strategies are based on relationships which encourage the development of number sense.
- Provides opportunities to apply and demonstrate knowledge of basic facts
- Could include:
  - Strategy selection activities or sorts
  - Use of Origo Box of Facts materials (if available)
  - Fact fluency games

Homework Check for Understanding

- When homework is reviewed the focus is on explanation and understanding, not on checking for right answers
- Fewer assigned problems and a meaningful review enable the focus to be on "Why?" "How did you get that?" "Who has a different way?" "What do others think?" "Is that reasonable?"
- Homework review should take no longer than 5 minutes

Instructional Unit 35 minutes
Refer to the CCPS Curriculum Framework for planning resources. Most lessons will focus on concept or skill development. Some lessons will be built around a complex problem or performance task. A complex problem allows students to apply their mathematical understanding to new, unfamiliar situations and leads to the development of problem solving habits of mind.

Concept/Skill Lesson	**Complex Problem Solving Lesson**
In the CCPS Curriculum Framework, instructional strategies for each big idea are sequenced to initially develop conceptual understanding and then connect and build to efficient procedures. **Concept/Skill Development** • Build on pre-existing knowledge and skills • Use multiple methods and strategies • Incorporate manipulatives and pictorial models that support the understanding of mathematical concepts • Provide opportunities to discover concepts using hands-on inquiry activities • Build conceptual understanding, then link to procedures • Pose questions (both teachers and students) including higher order thinking questions • Include opportunities for discourse • Provide a variety of instructional opportunities including whole class, partner, and small group activities **Concept/Skill Practice** • Use games, journal writing, stations or paper pencil activities as practice opportunities • Observe students as they work and interact with them to target individual student's levels of understanding and to nudge student thinking forward • Meet with small flexible groups as determined through observation and assessment data while other students practice independently or with partners • Provide opportunities for practice in groups, pairs or independently • Assign independent practice or homework only after checking for understanding	Students work through the steps for problem solving: Understand, Plan, Solve, and Look Back. Early in the year teachers may need to guide students through the four step process and gradually release responsibility to students • Pose a complex problem that students can access in a variety of ways depending on their prior knowledge • Encourage reasoning through discourse • Value the use of multiple representations • Provide opportunities for students to share solutions and justify their answers • Allow students to solve problems in a variety of class structures including whole class, small group, partners and individually • Use a problem solving lesson at any point during a unit for formative assessment

Closure 5 minutes

- Students reflect on new learning and make connections through discussion or journal writing.

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Appendix C
"Learning Walk" Observation Form

CCPS Elementary Mathematics Learning Walk Form

Grade _____ School _____ Date _____

Time Observed	Instructional Components	Narrative
	Check For Understanding □Cumulative Review □Calendar Math □Problem of the Day □Number Talk □Basic Fact Review □Homework Check	Opportunities for students to share their thinking □Many □Some □Limited
	Instructional Unit **Grades K-2** □Mini Lesson □Shared Experience □Independent Stations □Student Choice □Focused on same big idea □Differentiated within each station □Teacher interaction **Grades 3-5** □Concept/Skill Lesson □Concept/Skill Practice OR □Problem Solving Lesson □Small Group Instruction/Remediation □Group Work □Partner Work □Independent Work	Opportunities for students to share their thinking □Many □Some □Limited
	Closure □Discussion □Written	Opportunities for students to share their thinking □Many □Some □Limited

Appendix D
Combined Notes for Observations in a Series of Grade 4 Classrooms