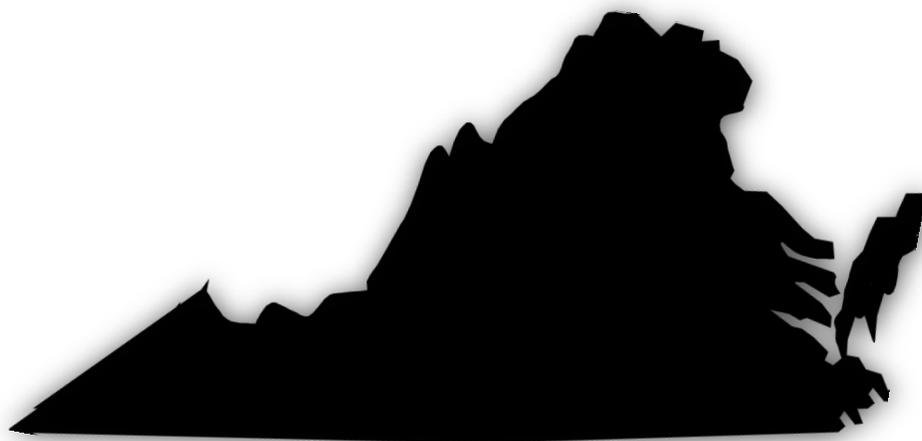


VIRGINIA MATHEMATICS SPECIALIST HANDBOOK



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CHAPTER 1

Mission, Vision, and Goals

Chapter 1– Mission, Vision, and Goals

Virginia Mathematics Specialists Mission Statement

The Virginia Mathematics Specialists is a community voice for the development of mathematical understanding for all teachers and students. We will inspire teachers and collaborate with them to develop, plan and implement equitable mathematics experiences of the highest quality. These experiences will assist students in gaining knowledge through exploring, reasoning, and communicating about mathematics; and to connect ideas within mathematics and other intellectual activities. The Virginia Mathematics Specialist will further serve as educational leaders and resources through attending and providing professional development and research on current best practices.

Vision for Virginia State Mathematics Specialists

We, Virginia State Mathematics Specialists, envision mathematics classrooms where every student has access to a high quality, engaging mathematics program. There are high expectations for all with accommodations for students who need them. Teachers have an understanding of the content they teach, have appropriate resources to support student thinking, and are continually growing as professionals. Students are learning mathematical concepts and procedures with understanding. Their experiences are enhanced with technology. Students engage in rigorous mathematical tasks drawing from their “toolbox” of mathematical understandings. They explore ideas (independently or with a partner) and make conjectures approaching the problem from different perspectives or representing the mathematics in different ways until they find methods that enable them to make progress. Students are flexible, reflective, and resourceful problem

solvers with the guidance of their teachers. Students communicate their ideas and results effectively. They value mathematics as well as the ideas and thinking of others.

Goals for Virginia State Mathematics Specialists

1. To provide a rigorous mathematics program so that every child becomes mathematically proficient.
2. Improve student learning by improving teacher understanding of mathematics content and the application of that content through relative problem-based instruction.
3. To develop assessment tools to monitor student development and understanding, student interests, and student misconceptions.
4. Collaborate with teachers to review and analyze data, in order to assess student development and to inform instruction (develop and implement intervention plans as needed).
5. Develop and implement a parental involvement program for the purpose of educating parents in why and how they can support their child and providing strategies and materials for that support.
6. Provide professional development for teachers to strengthen areas of weakness shown in district or local school data.
7. Influence teachers to develop mathematics climates in which students are working independently or collaboratively to solve relevant tasks and justify their thinking while respecting the thinking of others.

CHAPTER 2

Assessment

Chapter 2 – Assessments

“Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.” This statement was issued in *The Assessment Principle of Principles and Standards for School Mathematics* (2000).

“Assessment should be the servant of teaching and learning. Without information about their students’ skills, understanding, and individual approaches to mathematics, teachers have nothing to guide their work.” Mokros, Russell, and Economopoulos (1995, p.84)

The term assessment is defined in the *Assessment Standards* as “the process of gathering evidence about a student’s knowledge of, ability to use, and disposition toward mathematics and of making inferences from the evidence for a variety of purposes” (NCTM 1995,p.3). It is important to note that “gathering evidence” is not the same as giving a test or quiz. Assessment should happen every day as an integral part of instruction. Assessment should help students grow, and inform instruction. Assessment must be planned along with goals for your lesson and, thus, occur nearly every lesson. The evidence must be interpreted daily in order to make good decisions in planning for tomorrow’s lesson.

When assessment is an integral part of mathematics instruction, it contributes significantly to all students’ learning. Assessment should be more than merely a test at the end of instruction to see how students perform, rather, it should be an integral part of instruction that informs and guides teachers as they make instructional decisions. Assessments should not be done to students, rather it should be done for students, to guide and enhance their learning.

Tasks used in an assessment can convey messages to the student about what kinds of mathematical knowledge and performances are valued. In turn, that message can influence the decisions of students (and teachers) as where to apply effort in studying. Activities that are

consistent with (or even the same as) the activities used in instruction should be included. When teachers use assessment techniques such as **observations, conversations and interviews with students, rubrics, or interactive journals**, students are likely to learn through the process of articulating their ideas and answering the teachers' questions.

Classroom discussions in which students present and evaluate different approaches to solving complex problems can sharpen their sense of the difference between an excellent response and a mediocre response. Through the use of good tasks and the public discussion of criteria for good responses, teachers can cultivate both the disposition and the capacity to engage in self-assessment and reflection on their own work and ideas put forth by others.

To ensure deep, high-quality learning for all students, assessment and instruction must be integrated so that assessment becomes a routine part of the ongoing classroom activity rather than an interruption. Teachers should continually gather information about their students' progress through informal means, such as **questioning** during the course of a lesson, **individual student interviews**, and **writing prompts**. The instructional decisions made by teachers—such as how and when to review prerequisite material and with whom, how to revisit a difficult concept and with whom, or how to adapt tasks for students who are struggling or those who need enrichment—are based on teacher inferences. Assessment is a primary source of the evidence on which these inferences are based, and the decisions that teachers make will be only as good as the evidence. Teachers need to have a clear sense of what is to be taught and learned, and assessment should be aligned with their instructional goals. It should reflect the mathematics that all students should know and be able to do, and should focus on understanding as well as procedural skills. Assessments should allow for multiple approaches, giving a well rounded picture and allowing each student to show his/her strengths.

Following is a list of some suggested assessment instruments. This list is not conclusive but offers suggestions for diverse methods of gathering data.

Questionnaires	<p>Can get candid anonymous comments and suggestions</p> <p>Questions are standardized for all respondents</p> <p>Gives respondents time to think</p>
Interviews	<p>Allows people who can't read or write to answer</p> <p>Flexible, can pursue unanticipated lines of query</p> <p>Depth, can probe responses</p>
Observations	<p>Can be built into lesson</p> <p>Students feel no pressure as it is informally done</p> <p>Observer can see what students actually do, not what they say they do</p>
Performance Tasks; Projects; Demonstrations	<p>Provide actual sample of students' work</p> <p>Provide diagnostic information about student work and instruction</p> <p>Credible method for assessing complex skills and processes</p>
Portfolios	<p>Provide a broader range of student work</p> <p>Provide students opportunities to reflect on work and personal growth</p> <p>Encourage integration of instruction and assessment</p>
Archival Information Past test scores, attendance, discipline, teacher records	<p>Records already exist</p> <p>No administrative costs</p>

Classroom discussions & questioning	Part of the lesson Avoid interruptions Teacher can observe child’s thinking in informal setting
Rubrics	Student understands what skills are valued Student can monitor own progress
Interactive journals/writing prompts	Students have an opportunity to express their personal thinking about the mathematics Teacher gets insight into child’s understanding and/or misconceptions
Published Achievement Measures	Quickly scored Inexpensive to score Clear methods for interpreting results

CHAPTER 3

Professional Learning

Chapter 3 – Professional Learning: Topics, suggestions, tips

The goal of professional learning and professional development is to improve students' learning, by improving teachers' instruction. Professional development can be a powerful tool to impact teacher learning and teaching if conducted effectively. An effective professional development can (1) Improve teachers' mathematical knowledge and pedagogy (2) Improve teachers' understanding of student learning and how to use this knowledge to provide effective instruction (3) Impact teachers' beliefs and dispositions about mathematics (4) Foster a community of learners that support each other.

Selecting an appropriate topic is an important factor to consider when planning a professional learning or professional development session. The mathematics specialists should select topics based on several criteria. Teachers' need should be a prime consideration. Do the teachers need professional development with content, pedagogy, assessment or the district's curriculum? Informal observations of teachers and student data analysis are two good tools to use for determining teachers' need. Administrative suggestions should also be considered as well as mandates by the district.

There are an almost an endless number of topics that are appropriate for professional development. Therefore the mathematics specialist needs to have clear specific goals in mind before selecting a topic. One method to use to make sure that the goal is clear is to ask the following question, "What do I want the teachers to learn or take away from the session?" If you can verbally articulate the answer to this question you are ready to begin to select your topic. Below are some suggestions for professional development topics. These topics can be used for large groups such as a whole faculty, for small groups and for individuals as well. Based on the

goals of the professional development, the mathematics specialist must choose where to place the focus of the professional development. The focus may be on helping teachers understand the content itself or on the pedagogy. For example the topic “**Using Models and Representations with Decimals**” can be approached with two different goals in mind. The specialist will need to decide if the area of need is the content. If so, then the mathematics specialists will need to focus the professional development on activities that will help teachers improve their own understanding of how to represent and use manipulatives to show decimals. If however the specialist determines the need is in the area of pedagogy, then discussions about student learning, appropriate materials and activities, along with effective strategies should be the focus.

<p>Number Concepts and Number Sense</p>	<ul style="list-style-type: none"> • Helping Teachers Understand the Concept of Counting (Counting involves two separate skills: verbalizing standard number words in order and connecting this sequence with items using one-to-one correspondence. • Understanding Place Value • Understanding Number Relationships (“more than,” “less than,” and “equal to”), • Using Models and Representations with Whole Numbers • Using Models and Representations with Fractions • Using Models and Representations with Decimals • Using benchmarks to compare Fractions and Decimals • Using benchmarks to compare Fractions and Percents • Composing and Decomposing numbers, using a variety of manipulatives and representations • How to apply knowledge of number and number sense to investigate and solve problems.
<p>Computation and Estimation</p>	<ul style="list-style-type: none"> • Understanding the different meanings of addition and subtraction • Understanding the different meanings of multiplication, and division • Strategies for developing proficiency with basic addition, subtraction, multiplication, and division • How to model basic facts and algorithms. • Developing and using strategies and algorithms to solve problems • Using models, benchmarks, and equivalents to add and subtract fractions • Strategies for addition and subtraction of decimals
<p>Geometry</p>	<ul style="list-style-type: none"> • Understanding how to construct, draw, measure, compare, and classify geometric figures • Investigating, points, lines, line segments, rays, and angles. • Classifying triangles. • Investigating solid figures • Investigating plane figures

	<ul style="list-style-type: none"> • Exploring symmetry, congruence, and transformations.
Measurement	<ul style="list-style-type: none"> • Exploring the Real world : Length (Focus on non-standard, standard and or metric) • Exploring the real world: Weight/mass, • Exploring the real world: Capacity • Exploring the real world: Time • Exploring the real world: Temperature • Exploring the real world: Area and Perimeter • Volume (May be done separately) • Money, Money, Money • Connecting measurement with fractions and geometry
Probability and Statistics	<ul style="list-style-type: none"> • Developing and investigating data collection • Exploring the concept of chance • Using spinners, counters and dice, to explore possible outcomes • Graphing and Understanding Data • Exploring attributes and properties by sorting, comparing, and classifying • Patterns: Watch how they Repeat and Grow
Other Suggestions	<ul style="list-style-type: none"> • Strategies for Solving Real World and Story Problems • How to Differentiate Instruction • How to Effectively Manage Learning Centers • How to create common grade level assessments • Connecting the mathematics across the grade levels (Example: What are the student learning expectations for fractions in grades K-8?) • How to analyze student data • How to use student data effectively • Effective Remediation Strategies • How to get the most from the districts mathematics curriculum

A teacher's time is a valuable commodity. Therefore when planning a professional development the mathematics specialist should make every effort to ensure that the time is well spent. Below are some suggestions to keep in mind as you plan your next professional development.

Involve and get input from the teachers and administrators. Begin by sharing and analyzing student data. Then discuss with them the areas in which they would like to have additional support. By doing this the focus will stay on professional development as a means of improving student achievement.

Consider having a classroom teacher help facilitate the professional development. You will probably not want to do this every time but, calling on the expertise of the teachers themselves will not only build an atmosphere of collegial respect but will also start the process of building leaders within the school.

Have specific goals and objectives for the professional development. Say them aloud. Write them down. Make sure they are clear in your mind. Also consider the amount of time allotted for addressing the objectives. You don't want too many and have to rush nor do you want too few and not take full advantage of the time that you have.

Make sure your goals and objectives are aligned with student achievement. We all get excited about a new concept or activity especially after a conference. However if the activities are not in an area of need an entire professional development is not warranted. Save them for another venue. A mixed bag of activities will not make an effective professional development.

Be prepared and organized. Make all of your copies at least 2 days ahead of time. Copiers do breakdown. If this happens you will have at least 2 days to make other arrangements. Make sure you have all of the materials that you and the participants will need. Don't wait to the day of

your presentation to cutout or bag materials. Sharpen pencils, gather scratch paper and check to make sure calculators work. Make sure your markers are not dry.

Look over the room where you are presenting. Does it have what you need ? Whiteboard? Smartboard? Computer? Document camera? Where will you stand? Are there enough seats for the participants?

Rehearse the Professional Development. Yes, it may seem funny to do this but it helps! Set up everything as if you were doing the presentation. Say and do everything that you plan to say and do. Everything that you plan to explain, do so. By doing this you will catch those areas and concepts that we “just know” but never realized that we didn’t know how to explain. Do all of the activities. Make sure they work and flow. This is not a good time to try a brand new activity.

Include a variety of activities. Make sure that you do not lecture the whole time. Participants should have an opportunity to share, do activities and/or move around. Keep them engaged!

Announce the professional development. Make a creative flyer or make an interesting announcement to create interest about the professional development. Not only will it pique interest, it will allow teachers time to mentally prepare.

The conclusion of the professional development is not the end. Make sure you have a follow up embedded in your workshop. What will the teachers do next? How will you know?

CHAPTER 4

General Words of Wisdom

Chapter 4 – General Words of Wisdom

Things to do – things to avoid

Mathematics Specialists have the unique privilege of having a job that can be very daunting and yet very rewarding. Specialists wear many hats and fulfill many roles. Many times a specialist will find himself facing unexpected challenges. Things may seem overwhelming at times.

However, there are some steps that you can take that will make your job more manageable.

Below are some words of wisdom that may help you avoid some of the roadblocks and obstacles that may come your way.

Develop good working relationships with the teachers and staff in the building. It's difficult to follow the lead of a person that you don't know or respect.

Get to know your administrator. Your relationship with your administrator will have a great impact on how you will be able to carry out your role as mathematics specialist.

It's okay to laugh at yourself. No one is perfect we all make mistakes. Avoid creating the perception of being a "know it all".

Help teachers in little ways. Make copies for them when they are in a rush. Watch their students when they need to use the restroom.

Listen to teacher's concerns and keep their confidences. There are times when you will have to be a counselor. Teachers may sometimes share work and personal concerns with you,

Talk with teachers. Every conversation does not have to be about mathematics.

Make sure teachers know that you are there to support them. You are not a pseudo principal.

Respond to teacher requests in a timely manner. This sends the message that you consider the teachers' work important.

Follow through. If you said you will do a task, do it! If you said you will be there, be there! You want to have the reputation of being reliable.

Be prepared and organized for meetings. A teacher's time is important. Have an agenda and all materials ready when meeting with teachers. This sends the message that you respect them and their time.

Meet with teachers and grade levels that you may not be assigned to work with. Your goal is to impact the mathematics of the whole school. You can only do this if you interact with the majority of the school.

Participate in grade level meetings. This is a great opportunity for learning how math is viewed and taught in the building.

Conduct professional development. This is how you address the needs of the teachers and the school as a whole.

Help teachers analyze their data. Assist teachers in making data a friendly tool.

Try to get to school early and leave later. Working your contract hours sends the message that you are not working as hard as the "regular teachers".

Be a part of the school. Do some of the daily school tasks. Assist with bus duty, cafeteria duty or hall duty.

Continue your own professional learning. There is always something new for to learn.

Share your excitement about the mathematics that you see taking place. Tell your administrator. Tell other teachers. Be the public relations person for mathematics in your building.

Don't take it personally! A rejection of your ideas or plans, is not a rejection of you as a person.

Continue to show respect to teachers that are resistant to your ideas. Everyone doesn't change at the same time. We are all a work in progress.

Try to plan with teachers before working with them in their classroom. Everyone should know the purpose, plan and expectation of the work that is to be done.

Show excitement when students demonstrate a strategy. Teachers will pick up on this and follow suit.

Become known as the encourager or the optimist. Find something encouraging in the data, in the teaching that you see and in the school as a whole. Avoid negative conversations.

Remember that you are a guest in the teacher's classroom. Respect the teacher and his/her space.

If you visit a teacher's room, touch base with him/her doing the day. Acknowledge something positive about being in his/her classroom.

Invite teachers to assist with or present professional developments and other workshops. They have a wealth of knowledge to share.

Meet with your principal on a regular basis. He/she should know the names of the teachers you are working with and your goals for the work you are doing.

Listen to your principal's concerns and keep all confidences. Most of the conversations you have with your principal should not be repeated.

Encourage teachers to display student work. Hall work is great for quick reviews.

You need a support system. Find someone with a similar job with which you can share your successes and frustrations.

CHAPTER 5

Collaboration With Teachers

Chapter 5 - Collaboration with Teachers

Building Rapport

Developing a relationship with the teachers in the building is the key to impacting change in mathematics instruction. It is important for teachers to see the mathematics specialist as one who works with them side-by-side, not over them. During the first few weeks of school, it is sometimes advantageous to offer to help teachers with tasks such as bulletin boards. It's an opportunity to get to know one another and to talk informally about instruction. Be careful not to neglect mathematics specialist tasks or to give the impression that you have too much time on your hands.

Another way to get to know the teachers in the building and their classes is to offer to go in during the first few weeks to read a math story, do a number talk, or introduce a math game. The children will quickly get to know you as the math person, and they will love sharing math successes with you. Teachers will see that you are there to promote mathematics.

Team Meetings

Meeting with teachers during team planning is a good opportunity to engage teachers in the mathematics they will be teaching. The mathematics specialist will want to discuss the state curriculum framework to make sure teachers understand each bullet under the standard. Team planning is also a good time to discuss with teachers how they can connect concepts so they are covering big ideas in mathematics and not isolated skills. Team meetings are also a good time to have teachers work with manipulatives.

Planning, Co-Teaching, and Reflecting

When the data indicates, the mathematics specialist may be asked to work one-on-one with a specific teacher. The mathematics specialist will help the teacher identify goals and objectives for the lesson as well as plan the best activities to address those goals. The

mathematics specialist and the teacher should decide how they will share the responsibilities of teaching the lesson. The teacher may want the mathematics specialist to provide feedback on a certain part of the lesson, and both the teacher and mathematics specialist will want to observe students as they do the math. After the lesson, the teacher and the math specialist will want to reflect on what went well and what may need to be improved.

Disaggregating Data

Another important way that the mathematics specialist and teachers will work collaboratively is when they analyze data. Results of various tests—benchmark, bi-weekly, county-made, etc.—should be use to inform or drive instruction. The mathematics specialist will help teachers form flexible groups and plan differentiated lessons. It is important to note areas of strength and weakness and to encourage teachers to share instructional strategies. Data discussions should always be positive and upbeat.

10 ways to collaborate for teaching and learning...

1. Open the door.

Let go of the idea that you have to teach in 'your way' in 'your space'. Team teach. Invite people in. Share spaces. Learn together.

2. Talk.

Collaborative planning is a constant conversation. Share what worked and what didn't. Build on each others' ideas. Talk about how you'll use shared spaces.

3. Be open-minded.

There is more than one way of doing things. Be open to new ways of thinking and new ways of learning. Learning can look different from the way it did when you went to school.

4. Include your students.

Ensure you are part of their learning community rather than boss of the learning. Ask for feedback. Talk about the process of learning. Listen to their voices. It's their learning.

5. Make learning trans-disciplinary.

Learning takes place when we connect new knowledge or ideas with what we already knew. The more connections, the stronger the learning. Create opportunities for connections across disciplines.

6. Share.

Share your time, your ideas and your expertise. Share tasks and resources between team members. Share responsibility with your students.

7. Focus on the arts.

Work with the art teacher and the music teacher. Use the arts to enrich learning in any subject area.

8. Establish an in-school PLN.

Learn from and with your personal learning network. It might be your grade level team, teachers of the same subject or, best of all, a mixed group. Share practice. Build on each others' ideas.

9. Establish an online PLN.

Use social media to connect and collaborate with educators anywhere, any time. Get the most out of Twitter. Ask someone to help you get started on building an online network. (I will)

10. Create a global collaboration.

Use Skype or Voicethread to collaborate with a class in another country. Exchange ideas and beliefs. Learn from each other.

CHAPTER 6

Easing Into the Mathematics Specialist Position

Chapter 6 – Easing Into the Mathematics Specialist Position

The Summer Before

By about mid-July, most teachers are ready to start thinking about the upcoming school year--scooping up all those back to school specials, planning bulletin boards, designing units, putting together notebooks, and stopping by school occasionally to begin putting the classroom together. It's all different for a new mathematics specialist; however, there are things that can be done to help prepare for the upcoming year.

Reviewing the Curriculum

The new mathematics specialist is probably very familiar with the mathematics curriculum for the grades that he/she taught, but when the school year starts, the mathematics specialist will have to be prepared to discuss the curriculum for all of the grade levels in the school. It is a good idea during the summer before assuming the new position, to take time to review the state curriculum framework for each grade level. Also, check with the mathematics supervisor to see if the district provides a curriculum pacing guide or map. The mathematics specialist may want to chart the concepts that are being taught in the first benchmark period in each grade level. It is also a good idea to review the resources available to teachers in the school for each concept. The mathematics specialist can then begin putting together ideas and resources to support those areas. It is also a good idea to review the textbook that teachers will be using, noting lessons that may work well for students as they are written and/or lessons that the mathematics specialist can work with teachers on to raise the cognitive demand. Recent test data, which the principal or mathematics supervisor can provide, may show areas of weakness, which the mathematics specialist can also use to develop lessons or pull resources. In addition, the mathematics specialist may want to read some research on those areas so that he/she is prepared to discuss those concepts and best teaching practices with teachers.

Check out the Work Space

The new mathematics specialist may want to visit the school where he/she will be working to see where he/she will be stationed within the school. Some mathematics specialists have a classroom with plenty of space to store math materials and work with small groups. If that is the case, then shopping the school supply sales is probably a good idea!! The mathematics specialist will want to have glue, scissors, pencils, paper, etc. available to students when they come into the room for a center or small group lesson. Other math specialists have an office or even a converted closet in which to work and store materials. In that situation, the mathematics specialist will want to limit what he/she takes into the space.

The First Weeks

Without a doubt, the new mathematics specialist will feel growing pains during the first few weeks of school. This is an exciting time for teachers as they get to know who their new students will be, organize their classrooms, prepare notes to go home, develop their schedule, etc. The new mathematics specialist may feel like a “fish out of water.” He/she may even find him/herself wondering what he/she should be doing. This will be typical throughout the year—those days and weeks that are the most hectic and busy for classroom teachers actually turn out to be the slowest for the mathematics specialist. It takes a little getting used to!!

Inventory Materials

One very important role of the mathematics specialist may be to keep track of the mathematics materials within the school. During that week when teachers are busy setting up their classrooms, the mathematics specialist may want to inventory all available materials and decide on a check-out policy so that he/she can keep up with the inventory. It’s also a good idea to create a wish list of materials in case there are funds available to purchase mathematics

supplies for the school. In addition to snap cubes, pattern blocks, rulers, scales, etc., the mathematics specialist will want to have a variety of mathematics literature books available to teachers. Stuart Murphy is one author who has written many children's mathematics literature books. An example of one mathematics library is included in this handbook.

Meet the Teachers

During the work week, the mathematics specialist may want to arrange to meet with each team to introduce him/herself and explain what his/her role will be within the school. During that meeting the mathematics specialist could offer to come in and read a book or do a brief mathematics activity with the class during the first couple of days so that he/she can get to know the children. This time with the class will give the teacher a chance to see the mathematics specialist at work, and the teacher may actually have a few minutes to address an issue or work on paperwork. This short time spent in the classroom can be very meaningful in building rapport with the teachers and his/her students.

Gathering Data

The mathematics specialist should familiarize him/herself with the testing process for the district. Many schools give a pretest during the first few days of school. The mathematics specialist may also be involved in collecting benchmarking data for the school. The mathematics specialist should check with the principal or data specialist to see what his/her role will be in the testing process.

Planning a Schedule

It is very important for the mathematics specialist to sketch out a schedule; however, it is equally important to remember that the schedule may never be carried out!! It is a good idea to schedule a meeting with the principal to discuss priorities. The mathematics specialist may have

duties within the school, such as bus or hall duty. He/she may also be assigned to work on various committees. If the mathematics specialist is assigned to co-teach daily with one teacher, then that time becomes a priority. It is not unusual for the mathematics specialist to get stopped in the hall with a question that ends up thwarting the best designed plan. The mathematics specialist will quickly learn how to multi-task and prioritize as the days go by.

Inventory of Mathematics Literature Books

Title	Author	Math Content	Number of Copies
How the Second Grade Got \$8,205.50 to Visit the Statue of Liberty	Nathan Zimelman	addition	1
Animals on Board	Stuart J. Murphy	addition	1
12 Ways To Get To 11	Eve Merriam	addition	1
Alexander, Who Used to Be Rich Last Sunday	Judith Viorst	addition	1
Ben Franklin and the Magic Squares	Frank Murphy	addition	1
Mall Mania	Stuart J. Murphy	addition strategies	1
Two of Everything	Lily Toy Hong	addition strategy of doubling	1
Hamster Champs	Stuart J. Murphy	angles	1
Bigger, Better, BEST!	Stuart J. Murphy	area	1
Spaghetti and Meatballs for All!	Marilyn Burns	area/perimeter	2
Ready, Set, HOP!	Stuart J. Murphy	building equations	5
Pepper's Journal	Stuart J. Murphy	calendars	1

*Borrowed from C. Standley, Math Specialist
Culpeper County Public Schools*

Room for Ripley	Stuart J. Murphy	capacity	1
A House for Birdie	Stuart J. Murphy	capacity	1
Sir Cumference and the Dragon of Pi	Cindy Neuschwander	circles	1
Sir Cumference and the Isle of Immeter	Cindy Neuschwander	circles	1
Sir Cumference and the First Round Table	Cindy Neuschwander	circles	2
Dave's Down-to-Earth Rock Shop	Stuart J. Murphy	classifying	1
Clocks and More Clocks	Pat Hutchins	clock	1
I.Q., It's Time	Mary Ann Fraser	clock	1
Game Time!	Stuart J. Murphy	clock	1
The Best Vacation	Stuart J. Murphy	collecting data	1
The Sundae Scoop	Stuart J. Murphy	combinations/tree diagrams	1
Just Enough Carrots	Stuart J. Murphy	comparing amounts	1
More or Less	Stuart J. Murphy	comparing numbers	1
The Best Bug Parade	Stuart J. Murphy	comparing sizes	1
Mighty Maddie	Stuart J. Murphy	comparing weights	1
The Fly on the Ceiling	Dr. Julie Glass	coordinate points	1
Every Buddy Counts	Stuart J. Murphy	counting	1

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Culpeper County Public Schools*

How Many Feet In The Bed?	Diane Johnston Hamm	counting	1
Quack and Count	Keith Baker	counting	1
Ten Black Dots	Donald Crews	counting	1
Ten Items or Less	Stephanie Calmenson	counting	1
The History of Counting	Denise Schmandt-Besserat	counting	1
Two Ways to Count to Ten	Ruby Dee	counting	1
The King's Commissioners	Aileen Friedman	counting	1
Spunky Monkeys on Parade	Stuart J. Murphy	counting by 2's, 3's, and 4's	1
Leaping Lizards	Stuart J. Murphy	counting by 5s and 10s	1
The Penny Pot	Stuart J. Murphy	counting coins	5
Jack the Builder	Stuart J. Murphy	counting on	1
Brown Bear, Brown Bear, What Do You See?	Bill Martin Jr.	counting patterns	1
Chrysanthemum	Marilyn Burns	counting the letters in names	1
Tikki Tikki Tembo	Arlene Mosel	counting the letters in names	1
Bug Dance	Stuart J. Murphy	directions	1

*Borrowed from C. Standley, Math Specialist
Culpeper County Public Schools*

17 Kings and 42 Elephants	Margaret Mahy	division	1
A Remainder of One	Elinor J. Pinczes	division	2
Divide and Ride	Stuart J. Murphy	division	8
The Doorbell Rang	Pat Hutchins	division	1
One Hungry Cat	Joanne Rocklin	division	1
Sluggers' Car Wash	Stuart J. Murphy	dollars and cents	1
Double the Ducks	Stuart J. Murphy	doubling numbers	1
Dinosaur Deals	Stuart J. Murphy	equivalent values	1
Betcha!	Stuart J. Murphy	estimating	2
Great Estimations	Bruce Goldstone	estimating	1
Too Many Pumpkins	Linda White	estimating/number concepts	1
Estimate	Katy Pike	estimation	1
Even Steven and Odd Todd	Kathryn Cristaldi	even and odd numbers	2
Missing Mittens	Stuart J. Murphy	even and odd numbers	1
Among the Odds and Evens	Priscilla Turner	even and odd numbers	1
Safari Park	Stuart J. Murphy	finding unknowns	1
Jump, Kangaroo, Jump!	Stuart J. Murphy	fractions	1

*Borrowed from C. Standley, Math Specialist
Culpeper County Public Schools*

The Hershey's Fractions Book	Jerry Pallotta	fractions	1
Give Me Half!	Stuart J. Murphy	fractions	1
From Simple Shapes to Geometry	Jerry Pallotta	geometry	1
Lemonade for Sale	Stuart J. Murphy	graphing	5
Tiger Graphing		graphing	2
It's About Time!	Stuart J. Murphy	hours	1
Same Old Board	Stuart J. Murphy	making predictions	1
Mapping Penny's World	Loreen Leedy	map skills/shortest distance between two points	1
Treasure Map	Stuart J. Murphy	mapping	1
A Pair of Socks	Stuart J. Murphy	matching	1
Seaweed Soup	Stuart J. Murphy	matching sets	1
Mathamusements	Raymond Blum	math puzzles	2
Tell Me About Measures	Alain Gree	measurement	1
Super Sand Castle Saturday	Stuart J. Murphy	measuring	1
How Big Is A Foot?	Rolf Myller	measuring length	1
Inchworm and A Half	Elinor J. Pinczes	measuring length	1

*Borrowed from C. Standley, Math Specialist
Culpeper County Public Schools*

Who Sank the Boat?	Pamela Allen	measuring weight	1
Polly's Pen Pals	Stuart J. Murphy	metrics	1
Jelly Beans For Sale	Bruce McMillian	money	1
A Quarter From the Tooth Fairy	Caren Holtzman	money	1
Once Upon a Dime	Nancy Kelly Allen	money	1
G is for Googol	David M. Schwartz	multiple concepts	1
How Do Octopi Eat Pizza Pie?		multiple concepts	1
The Case of the Missing Zebra Stripes		multiple concepts	2
Too Many Kangaroo Things To Do!	Stuart J. Murphy	multiplication	4
Bunches and Bunches of Bunnies	Louise Matthews	multiplication	1
Amanda Bean's Amazing Dream	Cindy Neuschwander	multiplication/division	2
One Hundred Hungry Ants	Elinor J. Pinczes	multiplication/division	1
Less Than Zero	Stuart J. Murphy	negative numbers	1
One...Two...Three...Sassafras!	Stuart J. Murphy	number order	1
First Concepts Numbers	Robert Tainsh	number recognition	3
100 Days of Cool	Stuart J. Murphy	numbers 1 – 100	1
The 50 Hike	B.Y. Wral	numbers to 50	1

*Borrowed from C. Standley, Math Specialist
Culpeper County Public Schools*

On Beyond a Million	David M. Schwartz	numbers	1
The Greatest Gymnast of All	Stuart J. Murphy	opposites	1
Seven Blind Mice	Ed Young	ordinal numbers	1
Snowbear's Christmas Countdown	Theresa Smythe	ordinal numbers	1
Henry The Fourth	Stuart J. Murphy	ordinal numbers	1
Beep Beep, Vroom Vroom!	Stuart J. Murphy	patterns	1
The Grizzly Gazette	Stuart J. Murphy	percentage	1
Racing Around	Stuart J. Murphy	perimeter	1
A Place for Zero	Angeline Sparagna LoPresti	place value	1
Count to a Million	Jerry Pallotta	place value	1
Earth Day—Hooray!	Stuart J. Murphy	place value	2
Place Value	Katy Pike	place value	1
Marvelous Math	Lee Bennett Hopkins	poems	1
The Greedy Triangle	Marilyn Burns	shapes	2
Probably Pistachio	Stuart J. Murphy	probability	1
Candy Counting	Lisa McCourt	problem solving with addition and subtraction	5
What's Your Angle, Pythagoras?	Julie Ellis	Pythagorean Theorem	1

*Borrowed from C. Standley, Math Specialist
Culpeper County Public Schools*

Rodea Time	Stuart J. Murphy	reading a schedule	1
Circus Shapes	Stuart J. Murphy	recognizing shapes	1
A Fair Bear Share	Stuart J. Murphy	regrouping	2
Math for All Seasons	Greg Tang	riddles	1
Roman Numerals I to MM	Arthur Geisert	Roman numerals	1
Rabbit's Pajama Party	Stuart J. Murphy	sequencing	1
The Shape Game	Anthony Browne	shapes	1
Goldie Locks and the Three Squares	Grace Maccarone	shapes	1
A Cloak for the Dreamer	Aileen Friedman	shapes	1
3 Little Firefighters	Stuart J. Murphy	sorting	1
Smart Kids Play and Learn Sorting	Jo Rigg	sorting	1
Things Are Alike and Different	Illa Podendorf	sorting	1
Elevator Magic	Stuart J. Murphy	subtracting	1
Monster Musical Chairs	Stuart J. Murphy	subtracting one	1
Shark Swimathon	Stuart J. Murphy	subtracting two-digit numbers	1
Let's Fly A Kite	Stuart J. Murphy	symmetry	1
Tally O'Malley	Stuart J. Murphy	tallying	1

*Borrowed from C. Standley, Math Specialist
Culpeper County Public Schools*

Grandfather Tang's Story	Ann Tompert	tangrams	1
Captain Invincible and the Space Shapes	Stuart J. Murphy	three-dimensional shapes	1
Get Up and Go!	Stuart J. Murphy	time lines	1
Equal Shmequal	Virginia Kroll	understanding "equal"	1

*Borrowed from C. Standley, Math Specialist
Culpeper County Public Schools*

CHAPTER 7

Collaboration With Parents

Chapter 7 – **Collaborating with Parents**

Parents play a large part in the success of the students. Unfortunately, many parents will say that they were "bad" in math and aren't surprised if their child follows suit. The math specialist needs to find ways to help encourage parental involvement.

Newsletters

Newsletters are one way to inform parents about the mathematics students are going to be learning. Newsletters should include the strands as well as some simple math tasks or activities the parents can do with their children. See the Newsletter Template at the end of the chapter.

Web Pages

Many families have internet access in their homes, and those that do not usually have access to free internet access through the public library. There are a multitude of free math games and activities online, and the mathematics specialist can help the parents by creating a web page with links to those sites. Some free web pages can be built through www.portaportal.com and www.angelfire.com.

Math Bags or Math Boxes

Math bags or Math Boxes have been used to increase parental involvement. The math specialist may want to create 2 or 3 of these per classroom for each 9 weeks period. Students take the bag or box home on Friday and return it on Wednesday, which gives the math specialist time to restock the bag with any consumables. The key is to give the parents and students an enjoyable way of practicing their math skills.

Math bags are created from backpacks or other cloth bags. They can contain a book with a mathematics link, a game(s) or activity for the child to complete with their parent, and a journal

for the family to write about their experience completing the activity together. One math specialist incorporated baking in her math bag and included a mix and muffin pan in the math bag.

Math boxes are made with pencil boxes, and follow the same principal as the math bags. The games provided will need very simple materials.

When creating Math Bags or Math Boxes it is important to remember a few things:

1. **Include an inventory sheet** – this will help the parents when they are gathering the things at home to put back into the bag/box and help the math specialist to restock.
2. **Make the directions clear and simple** – if the parents have a difficult time trying to figure out the game or activity, they will not want to participate. The math specialist may even want to go into the classroom and model playing the games before sending them home.
3. **Provide instructions for ELL students** – if possible, offer the instructions in the child's native language. This will help the parents feel part of the school community.
4. **Keep it simple** – do not put so many games or activities in the bag/box that it overwhelms the parent and child. Their out of school time is important, and this should be a fun family activity.
5. **Remember siblings** – the math specialist may want to include directions for making the activity a little easier to accommodate younger siblings playing or a little more challenging for the older siblings.

6. **Never penalize** – if a child returns their bag/box and has not done any of the activities, do not penalize the child, but use it as an opportunity to contact the parent. There may have been a family emergency, or the parent may not have understood the activity, either case the student did not have control over completing the activity.

Parent Workshops

Parent workshops are another good way to get parents involved in their children’s mathematics success. It may be helpful to give a quick parent survey during Back to School Night to find out what the parents’ interests and available times would be.

Parent Survey	
1. When would be the best time to attend a Parents’ Workshop?	
<input type="checkbox"/> morning	<input type="checkbox"/> afternoon
<input type="checkbox"/> evening	
2. What day of the week would be the best for a Parents’ Workshop?	
<input type="checkbox"/> Monday	<input type="checkbox"/> Tuesday
<input type="checkbox"/> Wednesday	<input type="checkbox"/> Thursday
3. What topics would you discuss at a Parents’ Workshop? (Check all that apply)	
<input type="checkbox"/> Homework	
<input type="checkbox"/> New Virginia Mathematics Standards of Learning (SOL’s)	
<input type="checkbox"/> Basic Facts at Home	
<input type="checkbox"/> Understanding Test Scores	
<input type="checkbox"/> Other: Please Specify	_____
Name	_____
Phone Number	_____
Child’s Name	_____
Grade	_____

Once the times and topics have been determined, it is time to plan the actual workshop. Some things to take into consideration are:

1. **Advertising** –

- Posters should be made and posted throughout the school two weeks prior to the workshop. Some posters could be bilingual, if possible.
- A parent letter should be written which gives a quick description of the workshop. At the bottom of the letter there should be a tear off portion for the parents to return. This portion should include parent name, child's name and grade, and a phone number to reach the parent.
- A letter should be sent home initially two weeks before the workshop. A repeat of the letter should then be sent one week before, and finally two days before the workshop. Sending it home multiple times ensures that the parent will see it at least once.
- Telephone – many school systems have a mass calling system. A call announcing the workshop might be made one week before the workshop and then again the night before the workshop.

2. **Activities** – How will the mathematical activities the parents do during the workshop be linked to the mathematics the students are learning?

3. **Materials** – What materials will be needed during the workshop? Will the parents be making anything during this workshop that will need extra supplies?

4. **Child Care** – If the workshop is during the school day, some parents may have preschoolers with them. What activities (crayons, blocks, puzzles, etc.) can be available so the parent can participate? If the workshop is after school, are there teachers or other

parents who would volunteer to provide activities for the children so more parents can participate?

5. **Seating** – How will the parents be sitting? Will the seating arrangement be conducive to parent discussion?
6. **Refreshments** – Parents feel welcomed when there are some type of refreshments offered to them.
7. **Incentives and Prizes** – Everyone loves to win prizes, so have something to give away at the workshop! Prizes could be as simple as homework passes for the students, school supplies, or \$1 calculators, to a little more expensive prize such as paperback books. [One excellent resource for paperback books is *We Both Read* books, by **Treasure Bay** (webothread.com). These books have one page for the parent to read and one page for the student to read and they offer questions for the parent to ask the child. These books come in fiction and nonfiction, and are available in English, Spanish, and Bilingual.
8. **Time** – The math specialist needs to be very mindful of the parents' time. The workshop should begin and end on time. If there is a parent or two who would like to go into a deeper discussion, offer to speak to them after the workshop or make an appointment to meet with the specialist at a later time.
9. **Sign In Sheets and Certificates** – It is good to keep documentation of the parents who have attended workshops during the year, especially if school funds are being used for refreshments, materials, and/or prizes. Some parents also like to receive certificates at the end of a workshop as their documentation of attending.

Family Math Nights

Family Math Nights are usually the biggest event put on by the math specialist and teachers.

Many schools will have the family math night in April, National Mathematics Education Month.

During a family math night, parents and children work and talk together while learning about mathematics. A successful family math night requires a lot of planning and good teamwork.

First the specialist should form a team. It would be advisable to choose at least one teacher from every grade level to help plan. This will help ensure that there are age appropriate activities for every student who attends. It also gives teachers buy-in to participate since they part of the planning. Also, having a team approach makes this a school's function, not just the math specialist's function.

Next the team should choose a theme. The math specialist could use the school data to determine which mathematical skills are weaker in the students, then choose a theme which would encompass those skills. The themes can be as creative as your team would like to be! Some possible themes could be:

- Math Olympics
- Kitchen Math
- Storybook Math

Once a theme has been chosen, the team should gather mathematics games and activities to use during family math night. The math specialist may want to check the mathematics involved with the games and activities to ensure that the games meet the learning objectives for the evening.

Below are examples of activities chosen for Measurement Olympics.

1. Straw Javelin Throw

- Place your feet on the starting line. Throw the straw (one throw only).
- Estimate the distance (in centimeters) that you threw the straw. Record your estimation on your card.
- Measure the distance from the starting line to the position of the straw. Record your actual measurement on your card.
- Find the difference between your estimation and what you actually threw. Write the difference on your card.

2. Paper Plate Discus

- Place your feet on the starting line. Throw the paper plate (one throw only).
- Estimate the distance (in centimeters) that you threw the paper plate. Record your estimation on your card.
- Measure the distance from the starting line to the position of the paper plate. Record your actual measurement on your card.
- Find the difference between your estimation and what you actually threw. Write the difference on your card.

3. Marshmallow Shot Put

- Place your feet on the starting line. Throw the marshmallow (one throw only).
- Estimate the distance (in centimeters) that you threw the marshmallow. Record your estimation on your card.
- Measure the distance from the starting line to the position of the marshmallow. Record your actual measurement on your card.
- Find the difference between your estimation and what you actually threw. Write the difference on your card.

4. Right Handed Marble Grab

- With the right hand only, grab a fistful of marbles from the container. Place the marbles on a balance scale.
- Estimate (in grams) the mass of marbles you grabbed in your right hand. Record your estimation on your card.
- Measure the mass of the marbles. Record your actual measurement on your card.
- Find the difference between your estimation and what the actual mass was. Write the difference on your card.

5. Sponge Squeeze

- With the hand you don't write with, pick up the sponge out of the bucket and squeeze the water into the container (one squeeze only).
- Estimate the amount of water (in ml) you squeezed out of the sponge. Record your estimation on your card.
- Measure the water squeezed and record the actual volume of the water.
- Find the difference between your estimation and what the actual volume was. Write the difference on your card.

6. High Jump

- Stand next to the wall. Stretch your arm high in the air, keeping your feet flat on the ground. Have a parent or friend mark the highest point you can reach.
- Place the marker in one hand. Jump as high as you can and make a mark on the wall.
- Estimate the distance (in centimeters) that you were able to jump. Record your estimation on your card.
- Measure the distance between the two marks to find the height of your jump. Record your actual measurement on your card.
- Find the difference between your estimation and what you actually threw. Write the difference on your card.

7. Long Jump

- Stand behind the starting line. Jump from the standing position as far as possible. Have a parent or friend mark where your toes first landed.
- Estimate the distance (in centimeters) that you were able to jump. Record your estimation on your card.
- Measure the distance from the starting line to where your toes landed. Record your actual measurement on your card.
- Find the difference between your estimation and what you jumped. Write the difference on your card.

8. How Hot is Hot

- Estimate the temperature of a glass of water by putting one finger in the water.
- Record your estimated guess on the worksheet.
- Use the thermometer to measure the temperature in Celsius.
- Record the actual temperature.
- Determine the difference between your estimate and the actual measurement. Record.

9. Bubble Gum Chew

- Start the timer when you put the chewing gum into your mouth.
- Begin the activity by chewing the gum. When the gum is ready, blow a bubble.
- Record the time that your bubble is complete.
- Draw your handicap card; add the handicap time to your end time.
- Subtract the start time from the new end time to determine the elapsed time

10. Little Foot

- Trace around your foot, with your shoe off, on a sheet of paper.
- Cut a piece of string equal to the perimeter of your foot.
- Tape your foot string in the shape of a square on a sheet of grid paper.
- Figure the perimeter and record it.
- Figure the area and record it.

11. One Minute Challenge

- Working with a partner, one person will toss the number cube repeatedly and call out each result. The other person quickly puts that number of beans aside. This is repeated for one minute.

- Count how many beans were set aside and record that number in the first box.
- Repeat, with the partners changing places.
- Count how many beans were set aside the second time and record that number in the second box.
- Find the difference between the two numbers and record it.

When the activities are chosen, the math specialist may want to make a list the activity and the materials needed to complete each activity, as shown in the table below for Measurement Olympics:

Math Olympics

ACTIVITY	TO BUY	COLLECT FROM SCHOOL
Straw Javelin Throw	Straws	Meter Sticks Masking Tape
Paper Plate Discus	Paper Plates	Meter Sticks Masking Tape
Marshmallow Shot Put	Marshmallows	Meter Sticks Masking Tape
Marble Grab	Bowls Marbles	Balance Scales Gram Weights
Sponge Squeeze	Buckets Sponges	
High Jump		Marker or Chalk Rulers or Tape Measures
Long Jump		Meter Sticks Masking Tape
How Hot is Hot	Cups/Bowls Jug for Water	Thermometers
Bubble Gum Chew	Bubble Gum	Timers
Little Foot	Yarn	Paper Scissors Centimeter graph paper Glue/Tape
One Minute Challenge	Beans	Timer

At this point, the team may want to assign games to different grade levels to decorate and run during the family math night event. Five committees should be formed for the final planning of math night.

1. **Advertising Committee** – This committee will make posters and flyers for Family Math Night. Students can be enlisted to help with this. As with a parent workshop, posters should be displayed two weeks prior to Family Math Night, and flyers should go home 2 weeks before, one week before, and three days before. Also a phone call home a week before and two days before is also helpful. Flyers home should include a portion for the parents to fill out to show how many people will be attending, especially if dinner will be provided.
2. **Refreshment Committee** – Providing a light supper will encourage more families to participate. The committee needs to decide what food will be provided and when (before or after the activities) it will be provided.
3. **Prize Committee** – This committee will determine what prizes and incentives they would like to give to the students. Homework passes for attending are always welcomed by the students! A class party may be given to the class with the most students in attendance. Prizes may be donated by local businesses and organizations. During the Math Olympics, each student was given a card, as shown below

Name			
Event	Estimate	Actual	Difference
Straw Javelin Throw			
Paper Plate Discus			
Marshmallow Shot Put			
Marble Grab			
Sponge Squeeze			
High Jump			
Long Jump			
How Hot is Hot			
Bubble Gum Chew			
Little Foot			
One Minute Challenge			
Total Differences			

Since one of the goals was to get the children to estimate more accurately, at the end of the evening, the students used calculators to add up the total differences between their estimate and the actual measurement. Then one child from each grade who had the lowest total differences won a larger prize.

4. **Set Up Committee** – These committee members are responsible for making sure that all of the activities are set up with the materials necessary for each station.
5. **Clean Up Committee** – This should be the entire team, but a few people should be in charge of making sure materials are returned to the correct classrooms.

The better planned a Family Math Night is, the smoother it will run. Planning it as a team ensures that the entire school will be excited to participate!

Other Math Family Activities

Food Lion Family Math Night – Food Lion has worksheets for students in K – 5 that the students and their parents take and complete within the store. Once the worksheet is complete, Food Lion provides refreshments for the students and parents. The only responsibility of the math specialist is to advertise the event, attend the event, and bring calculators for fourth and fifth grade students. Contact your local Food Lion to get more details about this wonderful program.

St. Jude’s Math-A-Thon – Students raise money for St. Jude’s Hospital by getting sponsors and completing a math workbook provided by St. Jude’s Hospital. This encourages community service through doing math – a win – win situation!

The Gator Mathematics Newsletter

Carolyn Doyle, Mathematics Resource Specialist

September, 2011

Strategy Corner

Grocery Store Math

The next time you go to the grocery store, take your child with you! As you pick up an item to buy, encourage your child to add the total in their head (older students) or on a piece of paper. See how close they get to the actual total at check out. Younger students may count out the money to give to the cashier.

Word of the Month

Number Sense

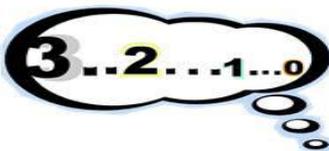
Number sense can be thought of as **flexible** thinking and intuition about numbers.

Solve It!

How many different ways can you solve this problem?

$$125 \times 4 =$$

(Completing this task requires **number sense**.)



Something to Think About!

The Gators are going to hold a pancake breakfast. Ms. Doyle will need to buy 114 eggs for the pancake batter. If the eggs are sold in cartons of 12 and 18, how many of each size carton will she need to buy to get exactly 114 eggs? Can you find more than one way to solve this problem?

Math News

Food Lion Family Math Night will be on Thursday, November 10 from 6:00 pm until 8:00 pm. Join us for a great time of doing math and get a special treat from Food Lion for completing your worksheet!

parent Workshop

Homework, Habits, and Hugs

October 27

9:00 – 11:00 am in the Media Center

Join us for refreshments and a good time of learning!





K – 1: One Monday Morning by Uri Shulevitz

One Monday morning, a king, a queen, and a prince try to visit a boy, but find he is not at home. They return on Tuesday with a knight, but the boy is still not at home. The group of visitors keeps returning and growing until the boy is at home. Have your child predict how many visitors will come on the next day.

2 – 3: The King's Commissioners by Aileen Friedman

A king has so many advisors that he loses track of how many there are. He calls in two advisors to help count them, but one counts by twos and the other counts by fives. The king needs the help of a princess to find out there is more than one way to count. Find things around your home or in stores that are grouped, for example an egg carton is a group of 12. Talk about skip counting with your child.

4-5: Math Curse by Jon Scieszka

A girl thinks her teacher has put a curse on her, a math curse, which makes everything turn into a math problem. After reading this book, you and your child can write math problems about your day.

Math Website

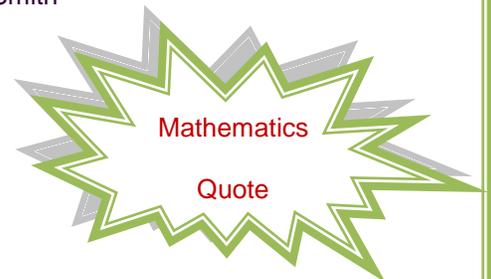
Math Cats

www.mathcats.com

At first glance, this site might seem just for the very young, but includes interactive activities for all ages, such as multiplication tables, exploring fractions, mind boggling tessellations, and so much more.

What would life be without arithmetic, but a scene of horrors?

– Sydney Smith



Questions?



If you have any questions about the mathematics program, please feel free to contact me at

Ginter Park Elementary School

(XXX) 780-XXXX

Or email me at

mathspecialist@???????

**How else can you show
35 other than with 3 tens
and 5 ones?**

CHAPTER 8

Collaboration With Principals

Chapter 8 – Collaboration with Principals

A Mathematics Specialist who develops a strong working relationship with their principal receives benefits that could possibly have a positive impact on their job. A supportive principal can play a key role in helping Mathematics Specialist find a teacher to mentor, take part in identifying professional development opportunities, and take full advantage of being a part of the school's administrative and instructional teams.

One of the most important steps in developing a positive, working relationship with administration is to have an initial conference. This conference provides an opportunity to establish an understanding of what the administration perceives as the role of the mathematics specialist. It also allows the administration to clarify their expectations. This discussion should include input from the administration and the math specialist. Below are some suggested questions that may be used to guide this discussion.

1. How would you describe the current school's mathematics program?
2. What are the strengths and weaknesses of the school's math program?
3. How is the math assessment data used to drive instruction in the school?
4. What is your vision as how I, as the mathematics specialist, can act as catalyst in moving the mathematics program forward?

In addition to giving teachers formal opportunities to learn and collaborate, principals boost morale simply by taking time to work alongside teachers, coaches and staff.

Tips for Building a Relationship with the Principal

- Ask for professional development opportunities;
- Seek assistance in setting up a mentor relationship if a program is not already in place;
- Request that a principal visit a classroom in which you are modeling a lesson, or co-teaching a lesson and ask for constructive feedback prior to the formal evaluation period;
- Request a regular time each month to meet with your principal to discuss content, data and future plans of action for the mathematics program.
- Share the successes /growth you observe in both students and teachers.
- Share copies of articles with your principal that he may find helpful. Pinpoint sections you want him to focus his attention on.
- Share your research that highlights good mathematics instruction and effective teaching strategies that you and the teacher find most helpful.
- Sometimes being a principal can be a very stressful and lonely job. Be supportive, lend a listening ear and honor the confidences he shares with you.
- Be sure to include the principal in invitations for workshops, classes and professional developments.

How does Mathematics Specialist/Principal Collaboration Look?

According to Catherine Miles Grant and Linda Ruiz Davenport in their article Principals in Partnership with Math Coaches. “Principals have a significant role to play in enabling coaches to support the implementation of a sound math curriculum.” Davenport, C. M. (Summer,2008). They suggest the math coach and the principal work together to establish priorities for the mathematics program. Principals and coaches should work together to plan a math program designed to strengthen teacher instructional practices as well as student

performance. The coach and the principal should work together to establish a professional development topic for the staff and they should be active participates and learners in these professional developments.

The more you as a coach can get your principal to understand what good mathematics looks like, the more effective you can be as a coach. Show your principal that mathematics is about relationships that children can construct by actively using concrete models and manipulates and by talking about the connections they see. The coach must ensure the principal realizes this is about conceptual understanding and this type of learning will not happen overnight. It must be developed over time and through each individual student's experiences. Discuss with your principal ways to incorporate mathematics discussions and strategies into staff meetings.

(Confer, 2006)

The strength of the principal and math coach relationship is one of the main factors contributing to a strong and effective mathematics program for both the teachers and the students. It is important that you extend yourself to make the mathematics program in your building is strong, effective and successful.

Interventions for Challenging Situations

There are challenges in all relationships. Although we strive to establish positive interactions, there are challenges that may arise which may require additional interventions.

- 1. If your relationship is going well but you've noticed that many other teachers have problems with your administrator,** this may be the opportunity for you as the math coach to act as a go between. Develop a relationship with the staff and buffer them from the administration. Provide the staff with the necessary tools for more effective classroom instruction. This will hopefully produce positive results in the classroom and keep the administration happy.
- 2. If you feel things are not going well with a difficult principal,** start documenting all incidents that may occur between you and the principal. Keep a log of all conversations, the subject matters, dates, times, and durations of meeting (both formal and informal). Your uneasiness of a possible problem may in time prove to be false, but it can't hurt to cover all bases to protect yourself.
- 3. If you start to feel victimized,** stay calm, remain focused and polite, and work with him to create a plan of action to resolve any concerns. This action plan should include goals. These goals should reflect you as well as the principal. Be concise, and it should reveal a way to achieve the goals he seeks as well as include the goals you seek. Continue to give the principal the respect his position entitles him to receive.

If your relationship is going smoothly, then enjoy your job! Life is good and there's nothing better than a supportive principal. This type of principal makes for a school filled with happy teachers, which makes your job easier.

As Mathematics Specialist please remember that principals are people, too, and perfection should not be expected from them. But they can definitely be seen as powerful, especially on the elementary school level. So it's imperative to develop a relationship that has a solid foundation, built on mutual respect for position and content knowledge.

Works Cited

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CHAPTER 9

Resources

Chapter 9 - Resources

Calendars

The mathematics specialist job changes so quickly from day to day that the key to being successful is to be organized. This organization begins with calendars. A hard copy calendar is good to carry around with you; however, electronic calendars, such as Google calendar, are indispensable. With the electronic calendar, the specialist can set reminders that will either be emailed to the specialist or give a pop-up message on your computer or mobile device.

Another calendar to use can be a year-long calendar (See **Template 1**). Once holidays and weekends are listed, the calendar can be used to map out the year in order to plan long term projects, such as a lesson study, monthly professional developments, or parent workshops.

The specialist and principal may also want to use a calendar which lists holiday and national observations to plan school activities which coincide with those dates. **Template 2** is an example of this calendar filled out by instructional leadership team of the school.

It is also helpful to develop a monthly checklist (see **Template 3**) to ensure that important tasks are not overlooked in the midst of the various tasks given to the specialist. The checklist should be developed with the principal. These checklists can include the “non-negotiables,” (Kanold 2011) specific expectations the specialist wants to monitor throughout the school year.

Observation Tools

The mathematics specialist’s job is not to do evaluative observations of teachers, but to observe classrooms to see how students are responding to and understanding the mathematics being taught. There are several observation protocols which can be used, but remember that the simpler the form, the easier it will be to observe and take notes about what you see. See **Template 4** for a simple observation protocol from Stafford County. The Virginia Department of

Education also offers a “Sample Student ‘Look-fors’ based on Virginia’s Process Goals for Students in Mathematics” found online at: <http://www.doe.virginia.gov/> or see **Template 5**

To help the teachers feel less stressful about the specialist’s observation visit, the specialist should send a note. It is important to assure the teachers that you will only share these notes with them. See **Template 6** for some suggestions for notes.

Teacher Tools

Sometimes teachers may want extra support or assistance for planning their mathematics lesson. Teachers may tell the specialist as they are going to another task, and it is very easy for the math specialist to forget the request. The following is an example of a request form a specialist may want to use.

Request for Math Support and Resources
Name _____ Rm ____ Grade ____ Date _____
I am planning to teach a math unit on _____. (SOL skill/ concept)
Please help me by:
___ finding related literature
___ finding meaningful activities/lesson
___ model or help with a lesson or activity
___(other)_____

At times, the mathematics specialist is called upon to model a lesson for a teacher. Giving the teacher an observation form can help her focus in on the most important part of the lesson.

See **Template 7** for a Student Observation Form from Stafford County.

Manipulatives

The mathematics specialist usually has the responsibility to keep track of the math manipulatives at the school. This is important for three reasons. First taking the inventory gets the teacher to be aware of the manipulatives she has in her classroom. There have been times where manipulatives have been packed away from a previous teacher and the current teacher is unaware of what is in the classroom. This also lets the specialist know what manipulatives are available to the teachers and students for meaningful lessons. Finally, with school budgets getting tighter, care must be taken of the resources within the school.

Inventories should be taken in the beginning and end of the year. A spot check should be made by the specialist 4 – 6 weeks before state testing, to make sure students have all tools needed. **Template 8** is a sample inventory for the teachers that can be given at the beginning and end of the year. The specialist may want to transfer the information into a spreadsheet to help with record keeping.

Math Specialist Hats

My first week as a math specialist, my principal asked me to give a presentation to the faculty to let them know what I would be doing in the school. I wasn't quite sure what my job actually would be, and I wished the principal would just tell me what my job would be so I could tell the faculty. **Template 9** is a list to explain what the mathematics specialist job is about. These are not listed in order of importance, because they are all important. It is not complete, nor will it ever be! **Template 10** is a letter which can be given to the teachers to explain the role of the math specialist in the school.

Template 1 – Year Calendar

July	August	September	October	November	December
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9
10	10	10	10	10	10
11	11	11	11	11	11
12	12	12	12	12	12
13	13	13	13	13	13
14	14	14	14	14	14
15	15	15	15	15	15
16	16	16	16	16	16
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18	18	18	18	18	18
19	19	19	19	19	19
20	20	20	20	20	20
21	21	21	21	21	21
22	22	22	22	22	22
23	23	23	23	23	23
24	24	24	24	24	24
25	25	25	25	25	25
26	26	26	26	26	26
27	27	27	27	27	27
28	28	28	28	28	28
29	29	29	29	29	29
30	30	30	30	30	30
31	31		31		31

January	February	March	April	May	June
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9
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29	29	29	29	29	29
30		30	30	30	30
31		31		31	

School Year Monthly Celebrations

Month	Holidays and Observances	Possible school activities
September	<ul style="list-style-type: none"> • Library Card Sign-Up Month • National Courtesy Month • National School Success Month • Read-A-New-Book Month 	<p>PTA Back to School Night</p> <ul style="list-style-type: none"> • Enroll parent volunteers for classroom assistance • Librarian comes to Back To School Night to sign up for cards
October	<ul style="list-style-type: none"> • Adopt-a-Shelter-Animal Month • Computer Learning Month • Family History Month <p>1st Week - Fire Prevention Week</p>	<p>Harvest Festival</p> <p>PTA SOL – Family Literacy Night</p> <p>SPCA fundraiser</p> <p>3rd Grade – Mali Griot</p> <p>Begin computer/keyboarding</p> <p>Parent Workshops on computers</p> <p>Food Lion Family Math Night</p>
November	<ul style="list-style-type: none"> • National Career Month • 2nd Week - National Children's Book Week • 3rd Week - American Education Week 	<p>Career Day</p> <ul style="list-style-type: none"> • Children’s Book Week Dress up as favorite character • Guest Author
December	<ul style="list-style-type: none"> • Hi Neighbor Month • Read A New Book Month • Write to a Friend Month 	<p>Book Exchange (bring a book, take a book)</p> <p>Writing Prompts: Friendly Letters</p> <p>Lion Mail – (Wednesday / Fridays)</p>
January	<ul style="list-style-type: none"> • National Staying Healthy Month • National Thank You Month 	<p>Writing Prompts: Thank you notes</p> <p>Parent Workshop: Healthy Living</p>

February	<ul style="list-style-type: none"> • Black History Month • International Friendship Month 	PTA – Black History 100 th Day of School
March	<ul style="list-style-type: none"> • Music in our Schools Month • Youth Art Month <u>Week Long Observances</u> <ul style="list-style-type: none"> • 1st Week - Newspapers in Our School Week 	Read Across America – Dr. Seuss Day PTA – Music Concert Parent Workshop – Newspaper in Education Friday Art Shows K/1/2 & 3/4/5 group shows
April	<ul style="list-style-type: none"> • National Humor Month • National Mathematics Education Month • National Poetry Month • Stress Awareness Month 	PTA – SOL Night – Family Math Night Math-A-Thon School-wide <ul style="list-style-type: none"> • write poetry or jokes (class books) • Share a joke or poem on announcements Poem in your Pocket Day
May	<ul style="list-style-type: none"> • 1st Week - National Postcard Week • 1st Week -Teacher Appreciation Week • 2nd Week - National Pet Week • 2nd Week - National Police Week • Last Week - National Backyard Games Week 	SOL Testing

Template 3 – **Monthly Checklist Sample**

Adapted from Stafford County Schools Mentor Checklist

August
(Before School Begins)

✓	Task	Comments
	Meet with teachers. Explain the role of a math specialist.	
	Locate curriculum guides, materials, manipulatives, and resources.	
	Review curriculum guides, textbooks, curriculum maps, and SOL's.	
	Introduce Counting the Days of School with ten-frames to teachers.	

September

✓	Task	Comments
	Discuss long-range plans/strategies	
	Help teacher plan and structure lessons	
	Schedule an observation – Explain the purpose of the observation	
	Begin discussion of the standardized testing programs and strategies for preparing students.	
	Review curriculum guides, textbooks, curriculum maps, and SOL's.	
	Check rooms for Counting the Days of School with ten-frames.	

October

✓	Task	Comments
	Talk about the impact of special activities or special days can have on instructional schedule.	
	Discuss the needs of the children in class.	
	Discuss ELL/ Special Needs ideas with the teacher.	
	Do the first observation.	
	Review curriculum guides, textbooks, curriculum maps, and SOL's.	
	Check rooms for Counting the Days of School with ten-frames.	

Classroom Observation

Teacher _____ Grade _____ Time _____ Date _____

Learning Objective

Activities

Classroom Discussion

Student Learning Behaviors

Extension/Follow-up Ideas:

Template 5

Mathematical Process Goals - “Student Look-fors”

School:	Teacher(s):	Course/Period:	Start/End Times:		
Mathematical Topic(s):					
Mathematical Problem Solving		Mathematical Communication		Mathematical Reasoning	
<input type="checkbox"/> Understand the meaning of the problem and look for entry points to its solution <input type="checkbox"/> Analyze information (givens, constraints, relationships, goals) <input type="checkbox"/> Make conjectures and plan a solution pathway <input type="checkbox"/> Monitor and evaluate the progress and change course as necessary <input type="checkbox"/> Check answers to problems and ask, “Does this make sense?” <hr/> Comments:		<input type="checkbox"/> Use definitions and previously established causes/effects (results) in constructing arguments <input type="checkbox"/> Make conjectures and use counterexamples to build a logical progression of statements to explore and support their ideas <input type="checkbox"/> Communicate and defend mathematical reasoning using objects, drawings, diagrams, actions <input type="checkbox"/> Listen to or read the arguments of others <input type="checkbox"/> Decide if the arguments of others make sense and ask probing questions to clarify or improve the arguments <hr/> Comments:		<input type="checkbox"/> Make sense of quantities and relationships in problem situations <input type="checkbox"/> Represent abstract situations symbolically and understand the meaning of quantities <input type="checkbox"/> Create a coherent representation of the problem at hand <input type="checkbox"/> Consider the units involved <input type="checkbox"/> Flexibly use properties of operations <input type="checkbox"/> Continually evaluate the reasonableness of intermediate results <hr/> Comments:	
				Mathematical Connections	
				<input type="checkbox"/> Apply prior knowledge to solve real world problems <input type="checkbox"/> Look for patterns or structure, recognizing that quantities can be represented in different ways <input type="checkbox"/> Recognize the significance in concepts and models and use the patterns or structure for solving related problems <input type="checkbox"/> View complicated quantities both as single objects or compositions of several objects and use operations to make sense of problems <input type="checkbox"/> Notice repeated calculations, look for general methods and shortcuts, and make generalizations based on findings <hr/> Comments:	
Mathematical Representation		Use appropriate tools strategically		Mathematical Precision	

<ul style="list-style-type: none"> <input type="checkbox"/> Apply prior knowledge to solve real world problems <input type="checkbox"/> Identify important quantities and map their relationships using such tools as diagrams, tables, graphs, flowcharts, and formulas <input type="checkbox"/> Make assumptions and approximations to make a problem simpler <input type="checkbox"/> Represent abstract situations symbolically and understand the meaning of quantities <input type="checkbox"/> Check to see if an answer makes sense within the context of a situation and change a model when necessary <hr/> <p>Comments:</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Make sound decisions about the use of specific tools. Examples might include: <ul style="list-style-type: none"> <input type="checkbox"/> Calculator <input type="checkbox"/> Concrete models <input type="checkbox"/> Digital Technology <input type="checkbox"/> Pencil/paper <input type="checkbox"/> Ruler, compass, protractor <input type="checkbox"/> Use technological tools to visualize the results of assumptions, explore consequences and compare predications with data <input type="checkbox"/> Use technological tools to explore and deepen understanding of concepts <hr/> <p>Comments:</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Communicate precisely using clear definitions <input type="checkbox"/> State the meaning of symbols, carefully specifying units of measure, and providing accurate labels <input type="checkbox"/> Calculate accurately and efficiently, expressing numerical answers with a degree of precision <input type="checkbox"/> Provide carefully formulated explanations <input type="checkbox"/> Label accurately when measuring and graphing <hr/> <p>Comments:</p>	<p>Additional comments:</p>
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Additional notes:

Non-evaluative visitor(s): _____ **Date:** _____

Adapted from work by Jon Wray and Howard County Public Schools, Maryland for the VDOE Mathematics SOL Institutes, September 2011

Template 6 – **Sample Notes to Teachers for Observation**

Adapted from Stafford County Schools

MATH SPECIALIST VISIT

Hi _____

I'm planning to visit your math class on: _____ at _____

PLEASE let me know if this is NOT a good time and give an alternative time. If the time is okay, I'll see you then!

Looking forward to seeing your students in action.

_____, Math Specialist

One of my responsibilities as a math specialist is to observe during math in each classroom. When I come into your classroom, I will be listening to what the students are saying and doing so that I can get a feel for their understanding of the mathematics that is being taught. Please complete this and put it into my mailbox by _____, so that I can begin scheduling observations. Thanks!

Name _____

Schedule for Teaching Math _____

I would like to observe your class during math on _____ at _____. If this is not good for you, please let me know so I can reschedule. Thanks a billion!

Template 8 – Manipulatives Inventory for Teachers

Teacher Name _____ Room _____
 Date _____

Please take an inventory of the manipulatives in your classroom and return it to me as soon as possible. Thank you for your help!

Please <u>CHECK</u> if you have the following in your classroom.	Please write the <u>NUMBER</u> of these in your classroom
_____ Unifix Cubes	
_____ Colored Tiles	_____ Clocks
_____ 2-colored counters	_____ Rulers
_____ Base-Ten Blocks	_____ Meter Sticks
_____ Money	_____ Yard Sticks
_____ Gram Weights	_____ Tape Measures
_____ Customary Weights	_____ Calculators
_____ Graduated Cylinders	_____ Balance Scales
_____ Cup Measurers	_____ Geoboards
_____ Pattern Blocks	_____ Protractors
_____ Geometric Solids	
_____ Fraction Bars	
_____ Fraction Circles	

The Many Hats of a Mathematics Specialist



A Math Specialist

- Raises the visibility of mathematics within the building
- Analyzes assessment data
- Creates and uses informal assessments
- Helps to identify students at risk of failing and needing acceleration
- Work with small groups of students
- Identifies appropriate mathematics instructional resources for enrichment or for intervention
- Conducts observations/ gives informal feedback
- Co-teach classes with a teacher and/or work with students and debrief
- Models lessons
- Identifies appropriate mathematics resources
- Assists teachers in developing units and planning instruction
- Offers professional development on mathematics content, instructional strategies and informal assessment
- Facilitates study groups
- Facilitates lesson study
- Gives staff development on grade level
- Offers in-house staff development in the school
- Mentors first and second year teachers
- Provides assistance and staff development for paraprofessionals and volunteer tutors
- Plans and coordinates parent workshops
- Coordinates Family Math events

Adapted from work by Susan Kutt, Stafford County Schools

Template 10 –

Dear Teachers,

As a Math Specialist I am excited about collaborating with you during mathematics instructions. Here is a list of the many ways we can work together. I will

- Attend team meetings to dialogue about math instruction. Do mathematics together, and examine student work.
- Participate in grade level curriculum planning as well as assist you in planning individual lessons by doing the mathematics ourselves and carefully articulating a mathematical agenda as part of that planning
- Work with individual teachers, grade level teams, and assessment groups to learn from, analyze, and make decisions based on student work.
- Do demonstration lessons in your classroom for you to observe and for us to talk about afterward
- Co-teach classes with you and/or work with students, and debrief
- Talk about ways to utilize the grade level curriculum check-ups with your class
- Model or assist you in implementing units or lessons
- Assist you in your math class as an “extra pair of eyes and ears”
- Support you in identifying and working through your yearly goals in mathematics
- Assist you in implementing the grade level math assessments, preparing for SOL testing, analyzing test results and resulting student work
- Present in-services or mini-workshops for large or small groups of teachers/assistants
- Attend parent-teacher conferences, talk with parents about math, do a presentation about math for our PTA
- Gather, create, and share resource materials/tools and professional literature.

Contact me by email (_____), or find me in room _____, or just tap me on the shoulder! Let me know how I can support your math instruction!

Looking forward to a great school year,

Adapted from Culpeper County Public Schools

CHAPTER 10

How Does Good Questioning Look?

Chapter 10 - How Does Good Questioning Look?

As a mathematics specialist, it is your responsibility to ensure the teachers in your building practice asking questions that will promote higher mathematical thinking and help students develop the “big” mathematical picture. In most elementary and middle schools, the time given to the mathematics instructional block is long enough. Therefore, it is necessary the time given not be wasted because the teacher does not ask “cognitively demanding” questions. This is where teachers struggle. They often do not know how to ask these types of questions.

Questions the Teacher Should Consider When Planning the Lesson with the Specialist

Questions to ask before the lesson taught:

- What is the mathematics that you want the students to engage in as they do the work?
- How will the activity you are planning to use, give you any information about the students’ understanding of the mathematics?
- What questions will you ask as you monitor and observe the students as they are working?
- What do you expect to learn from your questions, observations and the student work?

Questions to ask after the lesson is taught:

- What did you observe during the lesson? What specific did the students say and do?
- What did you learn about the students’ “mathematical” thinking?
- What surprised you? What pleased you?
- What would you do differently if you were to do this lesson again?

Through modeling good questioning, math specialist can assist teachers to better understand a student's thinking and guide them in constructing new understandings of a concept. The specialist should nudge the teachers away from showing the student how to "do it right," try asking a question that will guide them toward deepening their understanding of the concept.

The following is a set of questions, which may be helpful in guiding inquiry as an instructional strategy to deepen and expand students' mathematical thinking and problem-solving abilities.

Help students work together to make sense of mathematics:

- "Who agrees? Disagrees? Who will explain why or why not?"
- "Who has the same answer but a different way to explain it?"
- "Who has a different answer? What is your answer and how did you get it?"
- "Please ask the rest of the class that question."
- "Explain to your partner your understanding of what was just said."
- "Convince us that makes sense."

Help students learn to reason mathematically:

- "Does that always work? Why or why not?"
- "Is that true for all cases? Explain."
- "What is a counter example for this solution?"
- "How could you prove that?"
- "What assumptions are you making?"

Help students learn to conjecture, invent, and solve problems:

- "What would happen if _____? What if not?"
- "Do you see a pattern? Explain."
- "What about the last one?"
- "How did you think about the problem?"
- "What decision do you think he/she should make?"
- "What is alike and what is different about your method of solution and his/hers? Why?"

Help students connect mathematics, its ideas and its applications:

- "How does this relate to _____?"
- "What ideas that we have learned before were useful in solving this problem?"
- "What problem have we solved that is similar to this one? How are they the same? How are they different?"
- "What uses of mathematics did you find in the newspaper last night?"
- "What example can you give me for _____?" (Ed Tech Productions, 2012)

How to Use Questioning As a Teaching Tool in the Classroom

Questioning is a necessary component of effective teaching. Questioning serves many purposes, it not only deepening student understanding of the mathematics, but also nurturing logical thought processes and encouraging imagination and creativity. Questions may even be used to motivate students, generating interest in the content at hand. From the mathematics specialist standpoint, questioning can serve to assess student understanding, reveal misconceptions and diagnose strengths and weaknesses.

It is necessary for the mathematics specialist to assist the classroom teacher in creating an accepting environment in which students feel comfortable expressing their thoughts, even if technically incorrect. Answering a question poses the potential risk of embarrassment for students. Ensure that students are not put down by either you as the instructor or by their peers. When assisting in the design of the lesson plan, include a variety of high-level questions which require students to comprehend, analyze, synthesize, evaluate or apply information. Also, include divergent, open-ended questions that lack a singular correct answer. Allow wait time. Wait at least three to seven seconds after asking a question before eliciting a student response. Students need this time to process the question and formulate

possible answers. Studies show that increased wait time leads to more thoughtful answers and enhanced understanding of the subject matter. Ask for the rationale. Present a follow-up question that requires students to further elaborate and justify their responses. For instance, try asking probing questions such as "Why do you believe that to be the case?" or "How did you arrive at that solution?" As for other the ways it was solved, other ideas or approaches to the problem. Ask open-ended, higher order questions which have multiple possible answers. "Did anyone solve this problem another way?" or "What other factors contributed to this outcome?" are examples of questions that encourage a more thorough investigation into the topic at hand. (How to Use Questioning As a Teaching Tool in the Classroom)

Types of Questions

There are two levels of questions: low-level questions and high-level questions. Questioning strategies are necessary mathematics specialists to assist teachers in effectively planning class participation activities, for designing homework assignments, and for writing exams. The strategies help mathematics specialists and teachers to match their goals or objectives for an assignment with the actual components of the assignment. Other functions of questioning strategies are as follows.

- to motivate and to interest
- to reveal prior misconceptions
- to evaluate
- to guide thinking
- to discipline, manage, or control
- to encourage involvement of passive learners
- to diagnose strengths and weaknesses
- to understand how students form concepts
- to help students form the habit of reflection
- to gain insight about students' interests
- to increase students' incentive to inquire
- to help students learn to construct meaning
- to help students set realistic expectations

- to summarize information
- to relate concepts
- to provide student feedback
- to give listening clues

(Responsibive Teaching, Best Practices for Differenated Instruction, 2008-2012)

Summary

Good questioning techniques are an integral part of any successful mathematical experience. Good questioning makes students think and help them make sense of the mathematics in an activity. Questioning is an important tool in the introduction of a topic, in any mathematical discussion. Good questioning relies on knowledge of content and development. For the process to work well, the specialist must help the teacher learn to engage in active listening and appropriate responses.

Good questioning can effectively introduce a topic.

“What do you know about...?”

“What do you want to know about...?”

These two introductory questions can help a teacher pinpoint areas of misunderstanding as well as provide a starting point for instruction. These **open-ended** questions allow all students to participate and explore mathematical ideas. When using questioning with an individual, small group or whole class it is important not only to use **wait time** before responding, but also to allow all students the time to think through their answers. Questioning should lead to discussion, not end it. By not affirming or denying a response, the teacher allows the

students to continue the mathematical sense making. This is often very hard for the teacher to do, since they have been conditioned to immediately give positive feedback. Unfortunately, immediate positive feedback has the undesired result of shutting down any other thought on the topic! (Students will also want an immediate verification; comments such as “but I gave that answer” will have to be answered.)

“Does anyone agree or disagree with this answer?”

“Does anyone have another idea?”

These questions allow all the students to think and explore the question asked.

Good questioning can help a student with higher level thinking skills.

“What if...?”

“How many ways...?”

“Can you find another way...?”

“Why isn’t...?”

“When would we use...?”

These questions help students explore different possibilities and methods in mathematics.

Good questioning helps teacher assess what has been understood and where misunderstanding are.

“Why is...?”

“Why can’t we...?”

“How do you know...?”

“What’s wrong with...?”

“What if I...?”

Students must communicate their thoughts and reasoning, often clarifying and making sense of the mathematics while doing so. The specialist's role is to help the teacher help the student make the mathematical connections, to help them see, and to make sense of the concept.

(Developing Mathematical Thinking with Effective Questions)

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