



Investigations

in Number, Data, and Space®

Schools, Families, and Math
Megan Murray

Many parents and teachers of school-aged children have similar memories of their own elementary school experiences in mathematics. Desks were in rows, with the teacher at the front of the room. In a typical math lesson, the teacher presented a new procedure -- such as long division or subtraction with regrouping -- and then children practiced that procedure by doing a page of similar problems from a textbook. One perennial task was to memorize the multiplication tables. For this, some recall taking timed tests; others recall flashcards.

Today, many young students are in math classrooms that look and feel quite different from those that live in the memories of today's adults. Children sit at tables or desks grouped together. They may walk across the room to get manipulatives from a shelf, play a mathematical game on the floor in a corner of the room, or build a structure with blocks according to given constraints. They participate in energetic class discussions that require them to explain, justify, listen, evaluate, and reevaluate.

For parents, these differences often lead to questions about the teaching and learning of mathematics. Is this math? Why isn't my child getting flashcards and sheets of practice problems? Isn't this just a lot of fun and games? What was wrong with how I was taught? How will my child do on standardized tests? Schools must be prepared for these kinds of questions and concerns.

The book *Schools and Families: Creating a Math Partnership* grew out the work of the Investigations in Number, Data, and Space Implementation Center and its efforts to help administrators and teachers respond to these questions. Filled with concrete ideas for communicating and collaborating with parents on the subject of school mathematics, the book draws on many strategies used by teachers and students from around the country. The hope is that readers will be inspired to find ways to involve parents and families in their children's math education -- and keep them involved.

The book is organized into two sections. The first addresses barriers to creating effective partnerships and strategies for overcoming them, including hosting math events, communicating through homework, and helping parents see the math in their children's work. The second section offers the perspective of teachers, administrators, and parents leaders on establishing effective home-school partnerships. What follows is an excerpt from chapter 6 that discusses how homework can help parents see how their children are learning and doing mathematics in class.

Communicating Through Homework

Homework is an important means of communicating with families. Teachers can use it to share ideas about what math content is important, give families the chance to see their children working mathematically, and offer a glimpse of how the children are learning and doing mathematics in class. In Investigations there aren't homework sheets filled with rows and rows of addition or multiplication problems. Instead, there are sheets with one, two, or several problems, with plenty of room for children to show their solution process. Other homework

consists of game directions and a score sheet or a request that children collect and record some data in a way that makes sense to them.

Parents who expect nightly sheets of computational drill may worry that this curriculum is less rigorous. In fact, what Investigations is aiming for -- in homework assignments and in classwork -- is a much deeper understanding of mathematics. Children may be solving fewer problems, but those few problems require more thought. It is often not immediately obvious how to solve the problems, and there are usually several possible methods. Often these assignments require several solution attempts, the refining of strategies, and a picture or diagram showing the problem and solution. When children must find ways to clearly explain a strategy, they must articulate -- and therefore further clarify -- key math ideas. One of the teacher's jobs is to help parents understand this purpose of homework, as well as what role parents play in the process.

What Will Homework Look Like?

Because families often have preconceptions of what math homework should look like and how often to expect it, teachers need to let parents know -- in newsletters, at Back-to-School Night, and on homework sheets -- how homework is going to look and why. Families need to understand that math is about more than numbers and computation and that students will be exploring ideas in geometry, measurement, and data. At the same time, they need to be clear about the importance of number and computation in the Investigations curriculum -- that these areas will be investigated in great depth, for long periods of time, and that fluency with the facts is an important goal.

For parents who express concern about "basic facts," teachers can highlight how the children will work on learning these number combinations. Across the grades, children are asked to think about which facts are hard for them and to develop strategies for remembering them. In second grade, that process might look like this: "8 + 9 is hard for me to remember. But 9 is almost 10, just 1 less, and I know 8 + 10 is 18. I added 1 too many, so take 1 away, and I have 17." In fourth grade, the process may sound like this: "I have a hard time remembering 8 times 7. But I know 7 times 7 is 49, and 8 times 7 is 1 more 7, and 49 + 7 is 56."

When first describing the homework in Investigations, teachers can give parents a sense of the range of assignments that are likely to come home during the year. Showing typical homework assignments at their child's grade level can help make activities come to life. With these examples, teachers can explain the math involved and the strategies children will be developing as they work. To illustrate activities for newsletters or handouts, teachers can copy student work from previous years or use pictures from the Investigations units. (Figure 1 offers a first grade example.)

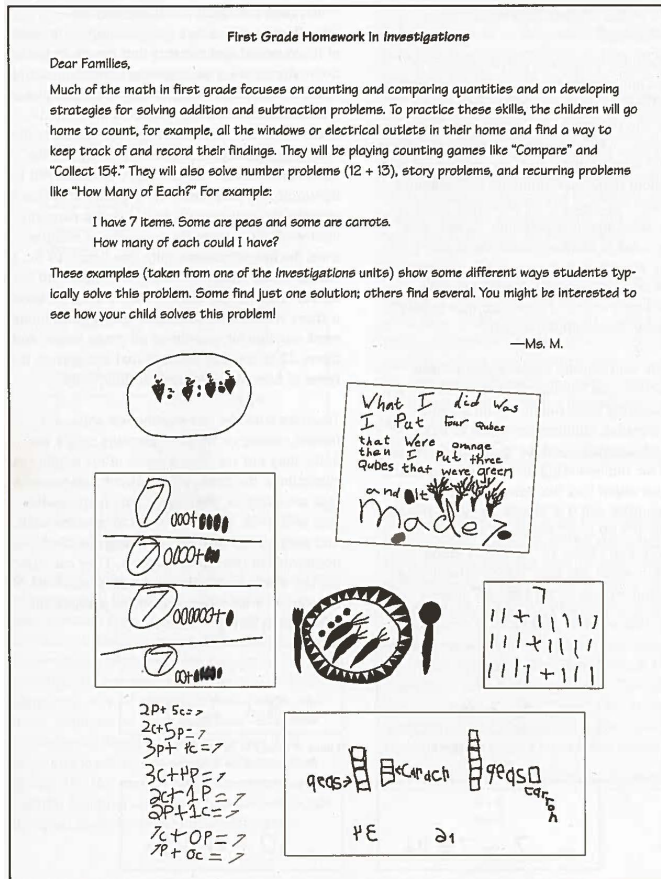


Figure 1. Parent handout giving examples of first grade math homework.

How Do I Help My Child with This Kind of Math?

Being really clear from the beginning about homework expectations and responsibilities can prevent anxiety. Everyone needs to know that homework is the child's responsibility. Children will come home understanding the assignment and what's expected of them, and parents will receive information about the homework and how they can help. At the same time, teachers find it crucial to share with parents the strategies students are likely to be using:

Parents refer back to what they understand and how they learned math... They think we're dumbing down the curriculum because we're not sending as many problems home and the practice is not there the way they remember it. The emphasis on drill is not there, and they feel we're not making children accountable for facts. One of the answers for us has been sharing examples of how a problem might be solved so that when parents do see two or three problems come home, they have something by which to gauge children's work. -- B. Pierce, special education teacher and teacher leader (Arizona)

In one district using Investigations parents received the handout shown in Figure 2. It is designed to encourage parents to listen carefully to their children and ask questions of them,

rather than simply telling them what to do, where they went wrong, or what the answer is. By helping in this way, parents mimic what teachers do in the classroom -- try to follow children's strategies, to understand their logic, and to allow children to discover and correct their own errors. Parents will discover that as children explaining their strategies aloud, they often find and fix their own mistakes.

Helpful Things to Say When Your Child Asks for Help with Math Homework...

In order to help your child become a strong and flexible problem solver, we assign a variety of math activities as homework.

Often your child will receive homework that is directly connected to the TERC math curriculum. You can recognize the TERC pages because they appear torn out of student books. On the back of these "Student Sheets" is a section called "To the Family." This section helps explain the concepts the worksheet is designed to reinforce. It also lists the necessary materials and a brief explanation of the activity. By reading this section, you can help your child successfully complete the work.

Games may also be assigned for homework. The TERC units use games as motivating ways to help children learn and master concepts. We play the games in school and expect you to play the games at home, too. Games are to be taken seriously! When your child asks you to play a math game, notice that your child has to remember and explain rules, create a strategy, and use math as well. Games challenge children's minds.

We also assign open-ended problems (multi-step word problems) or performance tasks ('measure this...', 'collect data about that...'). Many teachers call these "Problems of the Week." Often this problem of the week challenges your child to try to use all of her/his math knowledge to solve an unfamiliar problem. Sometimes children complain that "the teacher didn't teach me how to do this kind" and the children are correct, in a way. We cannot ever teach your child to do every kind of problem. Instead, we teach your child strategies to solve a wide variety of problems. When your child asks you for help, try not to jump in with an answer.

Instead, try helping your child get started by using these prompts:

Does this remind you of other problems?

What have you come up with so far?

Where do you think you should start?

What is the problem asking you to do?

Would drawing a picture or diagram help?

How can I help you (without giving you the solution)?

How Can I Help My Child Become Mathematically Powerful?			
	Early Years	Middle Years	Older Years
Money	Use money to help your child: recognize coins know the value of coins count coins	Help your child: make change find coins that make 25 cents save her/his own allowance by opening a passbook savings account	Help your child: participate in making family budgets participate in grocery shopping begin to manage her/his allowance decide how much allowance can buy
Counting/ Numbers	Involve counting and numbers in everyday activities: Count parts of the body Count things around the house Count past 10 Identify numbers on the elevator Identify numbers on street signs Setting the table helps build spatial sense and reinforces 1 to 1 correspondence (I need 4 plates for 4 people, for example)	Encourage your child to count by 2s, 5s, and 10s Count past 100 Look for patterns	Encourage your child to practice skip counting by 3s and 4s Count past 1000 (say, count from 650 by 100 "650, 750, 850, 950, 1050... for example)
Math Facts	Help your child start to memorize single digit addition and subtraction problems starting with the doubles: 1 + 1, 2 + 2, 3 + 3, etc. 5 - 5, 4 - 4, 3 - 3, etc.	By the end of 2nd grade your child should know addition and subtraction facts to 20 (1 + 19, 2 + 18, 10 + 10, etc.) Your child should also know addition pairs that equal 10 (1 + 9, 2 + 8, 3 + 7, 4 + 6, and 5 + 5)	By the end of 4th grade your child should know multiplication and division facts to 12 X 12
Time	These are some of the time concepts that you can help your child learn at home. days of the week, months of the year, seasons, minutes in an hour, hours in a day how to read a standard clock (with an hour hand and minute hand) how to schedule time (if you need to do four things, how much time will you need?)		
Measure- ment	Involve your child in activities that encourage measurement like: cooking (fractions, volume, cups, teaspoons, etc., following step-by-step instructions) reading a thermometer (measuring body temperature and measuring temperatures outside)		

Figure 2. School-wide guidelines for parents on how to help with homework, used as a handout. From J. DiBrienza, K. Casey, and S. Nye, New York City. Reprinted with permission.

What about Flashcards? Workbooks?

Some parents will ask about using flashcards and workbook pages or about teaching the "standard" algorithms at home. Teachers handle these questions differently, thinking hard about what works best with their own beliefs, their classroom style, and the particular community in which they teach.

Some teachers try to point out the practice with basic facts and the four operations that is provided in the curriculum and describe the kinds of activities that will be sent home to achieve the same goals. Parents who are worried about facts and operations are often unaware that there are other approaches; but they are often open to suggestion, so some teachers keep on hand copies of Investigations games and activities for "extra work." The more specific the suggestions, the more empowered the parent will be to carry them out.

You asked about helping Allison with her multiplication facts, and I think it's great that you want to tackle this together at home. We've been doing some activities in class that focus on multiplication pairs and would be perfect for Allison to be working on at home: Arranging

Chairs Puzzles, Multiplication Pairs, and Count and Compare. Two of these activities use array cards, which remind me of the flashcards you were asking about, except these cards are more visual. On the array card for 4 times 5, the kids can see the total number of squares (20), the dimensions (4 rows of 5 or 5 rows of 4), and how it looks compared to other facts that equal 20 (it's half as long as 2 by 10, for example). As Allison uses these cards, she will be learning to visualize the facts and their relationships, with the goal of learning to use them fluently.

It is important to start where parents are -- in their beliefs about mathematics, math education, and what their child needs. Some parents will feel that drill and practice with flashcards and worksheets, or learning the long division algorithm, are essential for their child's educational success. Teachers shouldn't expend effort telling parents what not to do, or dictating what they must do. Energy focused on helping parents understand homework, how they can help their child with it, and why it is important can establish and widen the common ground for schools and families.

How Do I Help My Child Learn and Enjoy Math?

There's a lot families can do to create a math friendly atmosphere at home. For starters, they can be encouraged to display a positive attitude toward mathematics -- even if they find it difficult or unpleasant, or think they were never any good at it. There are several good books for parents who need help overcoming "math anxiety" (see Deal with Math Anxiety on this page). Since some children think excelling in math is "uncool" or that only certain groups (boys, for example) are mathematically inclined, families can work at communicating the message that math is not only a practical necessity, it is something everyone can do and enjoy for its own sake.

Dealing with Math Anxiety: Books for Parents

Math: Facing an American Phobia by Marilyn Burns (Math Solutions Publications)

Math Power: How to Help Your Child Love Math, Even if You Don't by Patricia Clark Kenschaft (Addison-Wesley)

Overcoming Math Anxiety by Sheila Tobias (W. W. Norton & Company)

A math educator, lecturer, and workshop leader says, "One of the most significant things parents can do is to help their children understand the normalcy and the value of struggle in mathematics ... Learning math ultimately comes down to one thing: the ability, and choice, to put one's brain around a problem-to stare past the confusion, and struggle forward rather than flee" (Sutton, 1998, p. 9). Parents are proud of children who work hard to master a particular piece of music or an athletic skill. But too often in mathematics, people see struggle as the sign of a lack of ability. This belief in innate mathematical ability is damaging to all children. Those who struggle assume they just don't get it and never will. Those who do not struggle believe their success is the result of ability, but then may lose their confidence the first time they hit a

stumbling block. Parents can help their children expect, cope with, and work through the mathematical difficulties and frustrations they encounter.

Another answer for parents looking to help their child with math is to encourage them to find ways to explore math together as a family. Some parents find it helpful to think of reading with their child as a comparable example -- what's the mathematical equivalent of reading aloud to your child every day? Mathematics can be fun if families find ways to include everyone in the family and don't focus exclusively on aspects that can cause anxiety, such as speed and memorization.

Math Activities for Families

There are many books that contain mathematical activities which parents and children can do together, often in the time they already spend together.

Books

Beyond Facts and Flashcards: Exploring Math with Your Kids by Jan Mokros (Heinemann)

Exploring Everyday Math: Ideas for Students, Teachers, and Parents by Maya Apelman and Julie King (Heinemann)

Games for Math by Peggy Kaye (Pantheon Books)

The I Hate Mathematics! Book, The Book of Think, This Book is about Time, and Math for Smarty Pants by Marilyn Burns (Little, Brown). Available through Math Solutions Publications: www.mathsolutions.com

Math Games & Activities from Around the World Math Games & Activities from Around the World by Claudia Zaslavsky (Review Press)

Websites

Helping Your Child Learn Math:

http://www.kidsource.com/kidsource/Content/learnmath_index.html

Through the Glass Wall (mathematical computer game reviews):

<http://mathequity.terc.edu/gw/html/gwhome.html>

Implementing a well-balanced homework policy that takes into account the various needs and expectations of those involved can be difficult. It requires teachers to be thoughtful and purposeful in their assignments, to be respectful of children and their families, and to know well their mathematical goals for children. It is work that may seem easier if teachers

remember "the power of homework to create shared mathematical experiences and meaningful mathematical conversations between parents and children" (Raphel, 2000).

References

Raphel, A. (2000, March). Homework: Research and practice. Presentation at the Investigations Implementation Institute 2: Administrators as leaders, parents as partners. Billerica, MA.

Sutton, S. (1998). Beyond homework help: Guiding our children to lasting math success. ENC: Focus for mathematics and science education: Family involvement in education 5 (3), 8-11. Eisenhower National Clearinghouse.

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Reference

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