



Math Work Stations

Independent Learning You Can Count On, K-2



Debbie Diller



Math Work Stations

Independent Learning You Can Count On, K-2



Debbie Diller

 **Routledge**
Taylor & Francis Group
NEW YORK AND LONDON
A Stenhouse Book



Pembroke Publishers

First published 2011 by Stenhouse Publishers and
Pembroke Publishers

Published 2024 by Routledge
605 Third Avenue, New York, NY 10017
4 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

*Routledge is an imprint of the Taylor & Francis Group, an
informa business*

Copyright © 2011 by Debbie Diller

All rights reserved. No part of this book may be reprinted
or reproduced or utilised in any form or by any electronic,
mechanical, or other means, now known or hereafter
invented, including photocopying and recording, or in
any information storage or retrieval system, without
permission in writing from the publishers.

Trademark Notice:

Product or corporate names may be trademarks or
registered trademarks, and are used only for identification
and explanation without intent to infringe.

Library of Congress Cataloging-in-Publication Data
Diller, Debbie, 1954–

Math work stations : independent learning you
can count on, K–2 / Debbie Diller.

p. cm.

Includes bibliographical references.

ISBN 978-1-57110-793-0 (alk. paper)

1. Mathematics—Study and teaching (Early
childhood) 2. Early childhood education. I. Title.

QA135.6.D55 2010

372.7—dc22

2010032048

Cover design, interior design, and typesetting by
Martha Drury

ISBN 13: 978-1-57110-793-0 (pbk)

ISBN 13: 978-1-03-268165-8 (ebk)

DOI: 10.4324/9781032681658

To Dad, a math guy—
You'd have loved this one!





Taylor & Francis

Taylor & Francis Group

<http://taylorandfrancis.com>



Contents

<i>Acknowledgments</i>	<i>vii</i>
1 What Is a Math Work Station?	1
2 Organizing and Managing Math Materials	19
3 Getting Started with Math Work Stations	43
4 Beginning Number Concepts Work Stations	69
5 Addition and Subtraction Work Stations	101
6 Place Value Work Stations	133
7 Geometry Work Stations	159
8 Measurement Work Stations	183
<i>Picture Glossary of Math Materials</i>	<i>211</i>
<i>Appendix</i>	<i>217</i>
<i>References</i>	<i>287</i>
<i>Index</i>	<i>291</i>



Taylor & Francis

Taylor & Francis Group

<http://taylorandfrancis.com>



Acknowledgments

After I had been speaking and writing about literacy work stations for years, teachers began raising the question, “Could we do this in math, too?” Absolutely! So, to you, the teachers wondering how to create math work stations, I thank you for encouraging me to study this topic. I knew the management would be similar, but what about the math content?

In order to make math stations work, strong math instruction had to be the starting point. Although I presented math workshops in the 1990s, I’d devoted most of my time since then developing expertise in the field of literacy. I’m indebted to my friend and colleague Christe Cantu, a trained Math Recovery teacher and math coach, who read and responded to early drafts of this book with much on-the-spot assistance.

In the 1970s, I studied the work of Dr. Lola May under the tutelage of Professor Joseph Rousseau at Millersville State College in Pennsylvania, and I am grateful for the foundation they provided about the importance of “hands-on” math instruction, a new idea at the time. Mary

Baratta-Lorton’s *Workjobs* (1972), followed by her classic *Mathematics Their Way* (1975) and Marilyn Burns’s *The I Hate Mathematics! Book* (1975) were also new on the scene. I am so thankful for the work of these mathematics pioneers.

More recently, I had the privilege of working with the following teacher pioneers as we explored how to teach with math work stations:

- Maria Diaz-Albertini, first-grade teacher at Lawhon Elementary, Pearland ISD: Muchas gracias! Getting organized made all the difference. Thanks for being my stations partner.
- Mary Brown, first-grade teacher at Martin Elementary, Alief ISD: I love you and your sweet kids! I’m so pleased that you’re becoming a Math Recovery teacher. You are an amazing small-group math teacher. Thank you for being open to my “new ideas.”
- Heather Gaines, literacy/math coach at Lovett Elementary, Houston ISD: You rock! Thank you for setting up math stations and doing so much work behind the scenes. You devoted

countless hours to this project, and I am indebted to you. Thanks, too, to your son, Austin, who had to wait on us many days after school.

- Katherine Kraitman, kindergarten teacher at Lovett Elementary, Houston ISD: I am grateful for the chance to work with you and your fabulous students. Thanks for opening your classroom to the possibility of math work stations.
- Jamila Steen, second-grade teacher at Walnut Bend Elementary, Houston ISD: What fun we had making over your classroom and your math stations! You gave me so much insight into how to meet the needs of diverse learners in math.
- Patty Terry, retired first-grade teacher in Alief ISD (and now an interventionist in Katy ISD): It all started with you, girl! You showed me it could be done in our earliest attempts at Hearne Elementary in Alief. We'll never stop teaching and learning.
- Heather Thrash, former kindergarten teacher at Creech Elementary, Katy ISD, and third-grade interventionist at Briargrove Elementary in Houston ISD: You are one of the most thoughtful, intentional teachers I've ever met. Your questions and thinking always take me deeper. Thank you for your help with the Literature Links sections, too.

I couldn't have gone into schools to study without the support of the principals who opened their doors to me. A big thank-you to Susan Monaghan of Lovett Elementary, Julie Fernandez of Walnut Bend Elementary, and Mechiel Rozas of Gabriel Mistral Center for Early Childhood (all in Houston ISD). Thanks also to Sandy Taylor at Martin Elementary in Alief ISD and to Raymond Stubblefield and Kristin Fox Craft, both principals in Aldine ISD.

I am very blessed to work with my friends at Stenhouse Publishers. Your support means so much to me. Philippa, thank you for once more trusting me to tackle a new topic and become a "crossover artist." You believed in my vision for a math work stations book and made it happen (in color, no less). To Toby, my new math editor, it's been an amazing journey! Thank you for your encouragement along the way; you kept nudging me forward and turned me into a math writer.

A special thanks to Jay, Chris, Erin, and Martha, whose production work, design, and cover art made this book come alive, and to Dan and Nate, for your guidance and support (and for going with me to visit an old friend in Philly!). To Chuck, your help with my spring and summer institutes has been invaluable. And to Zsofi—I am loving the blog and Facebook.

Also, I appreciate the work of all the behind-the-scenes folks who answer the phones, process the orders, ship the books, and so on. You are the best! Thanks, too, to the Stenhouse and Pembroke reps for being at conferences and conventions on my behalf and making sure teachers get those books in their hands.

This book would not have been written without a group of friends who gave me special encouragement during a difficult time in my life. Laura Robb, your picture hangs in my office, reminding me to keep on writing. Thank you for your wisdom and loving care. Tangye Stephney, your stories about high school kids and teachers you work with keeps me pursuing that foundational understanding of mathematics in primary grades. And to my Friday Night Out group and prayer partners—you help to ground me.

Math Work Stations was written in many places—in airports, on Southwest flights, in hotel rooms while traveling to schools across the country—and over countless hours in hospital waiting rooms. Special thanks to all the pilots, chefs, hotel workers, doctors, and nurses who kept me moving along.

As I write these final pages, I sit at MD Anderson Cancer Center in Houston alongside my dear husband, Tom, as he continues to receive treatment during a stem cell transplant. Thank you, Tom, for all you do to help me. You are my partner for life—for richer, for poorer, in sickness, and in health. I need you on the road with me.

Finally, heartfelt appreciation to all my friends at Debbie Diller & Associates. Kelly Simmons, you are an angel sent from Chevy Chase. Gretchen Childs, Pam Pierce, and Christe Cantu, I couldn't do any of this without you. You have supported me through the best and worst of times. And you were right—I did finish the book!



Taylor & Francis

Taylor & Francis Group

<http://taylorandfrancis.com>

1

What Is a Math Work Station?

It's noon on a Friday and I've just arrived in one of my favorite primary classrooms to see what the children are doing in math. The students rustle in from the playground after lunch, and we greet each other eagerly. "Good morning," I say to Kiarah, and then quickly correct myself as I look at the classroom clock overhead. "I mean, good afternoon. It's 12:02."

"It's p.m.," replies Kiarah. "We talked about that last week. It was a.m., but now it's p.m. because it's after 12:00 in the afternoon, and that's when we have math!" Kiarah is ready to settle in for math time, because her teacher has created clear structures for her children through daily routines. Students know what to expect and are ready to learn.

Children gather near their teacher on the floor in the whole-group teaching area. "I need some helpers to stand up here in front," says the teacher as she calls several students by name and arranges them in a line. By doing this, she gets the children's attention and prepares them to think about the math concept being studied—patterns. After she

has lined up the children, she asks the rest of the class to turn and quickly talk to a partner about her questions, "What do you notice? Why do you think I arranged the children in this way?"

In less than a minute, students' hands shoot up into the air as they share their thinking. "I see white, white, red; white, white, red. It's a pattern!" says Victor. The others nod their heads in agreement. "It's an AAB pattern," volunteers Lilli. "We learned about that last year."

The teacher acknowledges their responses and says, "We look for patterns all the time. Every day we talk about patterns when we have calendar time. At lunch, we line up in a boy, girl, boy, girl pattern. Do you notice a pattern on my slacks today?" In unison, children respond, "It's blue, white, blue, white," as they study the striped pants their teacher is wearing. She asks them to name the pattern another way, and many respond, "AB."

The teacher repeats this activity, lining up a new set of students. I listen in to snippets of students' paired conversations: "It's not blue, blue, blue, white." "Is it short, tall, short, tall?" "No, that



The teacher arranges students in front of the room and asks the class to tell what they notice.

doesn't work." "Is it skirt, shorts, skirt, shorts?" Finally, they get it. "It's boy, girl, boy, girl." To check their thinking, the teacher walks behind each child in the line as the class says the pattern together: "Boy, girl, boy, girl . . ." When she gets to the last student, the teacher asks, "Who would come next if we continued the pattern?"

"A boy," the students say enthusiastically.

"Why?" asks the teacher.

"Because the last person was a girl, so next would be a boy. It's boy, girl, boy, girl," says William. "Just like we were lining up for lunch." The teacher also has students say the pattern: A, B, A, B . . ." as she walks behind each child in line again. She's teaching them to think in flexible ways about patterns.

Following this brief warm-up, the teacher tells the children, "Here's a new book from one of our favorite math authors, Stuart J. Murphy [2000]—*Beep Beep, Vroom Vroom!* Do you hear a pattern already? I think you'll enjoy this story about a little sister named Molly who plays with her big brother's cars while he is out of the room. As you listen, pay attention to the patterns in this book."

As the teacher reads aloud this book, the children quickly catch on to the patterns and participate in naming how Molly arranges the cars. They mention the colors of the cars, and some notice the

cars' shapes. A few even catch on to the pattern of sounds in the book: *beep, beep, vroom, vroom, crash, crash*. However, we notice that some students are reading the pattern from right to left. So we are explicit in telling students to read the patterns from left to right, just like when reading a book.

At the end of the story, the teacher lines up colored cubes to match the cars in the book (yellow, red, blue, purple, and orange). She places them in the chalk tray behind her and has students take turns showing some of the patterns Molly could make with the cars. Students volunteer their ideas:



The class names the pattern as the teacher moves from one child to the next: ABAB, or girl, boy, girl, boy.



The teacher reads aloud *Beep Beep, Vroom Vroom!* to the class to introduce the concept of repeating patterns.

“Molly could make a purple, green, purple, green pattern. That’s an AB pattern.” “Or she could do green, green, purple, green, green, purple—an AAB pattern.” “If she shared with Kevin, they could put them together and do red, yellow, green, purple, blue . . . or all kinds of patterns!”

The teacher has planted a seed with this book and will return to it on another day to reinforce the idea of repeating patterns. Over time, she will

extend the children’s thinking to growing patterns and ultimately to number patterns.

The children have been sitting for a while, so she moves them to their desks and distributes pattern blocks to each table. Using a projection device, she models how to make an AB pattern with her blocks and demonstrates that she wants students to “make it, say it, write it.” She makes her pattern, reads it in several ways (“ABAB”; “triangle, square, triangle, square”; “green, orange, green, orange”), and then she shows students how to represent their work on paper by drawing a picture and labeling the pattern.

As children work independently building three different patterns (AB, then ABC, then AAB), the teacher walks around the room to confer with individuals. She helps one child build the pattern from left to right instead of right to left. She asks another to name his pattern. He says AB, so she extends his thinking by asking, “Can you say it another way?” and helps him to name the pattern with colors and then with shapes.

At the end of this hands-on lesson, the teacher asks students what they have learned and then



After the read-aloud, children make AB patterns with pattern blocks. The teacher circulates among them, conferring with individuals about their work. She has them “make it, say it, and write it.”



summarizes with them: “Today we worked with patterns. We made AB, ABC, and AAB patterns that repeat. Let’s pay attention to patterns all day long. I’ll bet we’ll notice many!” The materials she has used in her lesson will be added to a math station for practice with patterns over the next few days.

One Week Later

When I return to this classroom a week later, I visit during math stations time. They have just finished whole-group math instruction, and the teacher announces that it’s time to go to stations. The children cheer, and the teacher reminds them to find their name and photo on the stations management board. She calls a few students at a time to move smoothly to their places by saying, “If you are wearing a red shirt, you and your partner may go to your first station.” All children work with a partner using familiar materials from previous whole-group (and sometimes, small-group) lessons.

The materials are stored in plastic, lidded containers on a wooden shelf. Each container is labeled with a number from 1 to 10. Students take turns getting their math bin and taking it to a numbered spot in the room that corresponds with their numbered container. In pairs, they walk quickly and quietly to gather materials and set to work immediately. After all students are situated, the teacher goes to the small-group table to join the four students whose names on the management board show that they’ll meet with her. She begins a lesson matched to their needs.

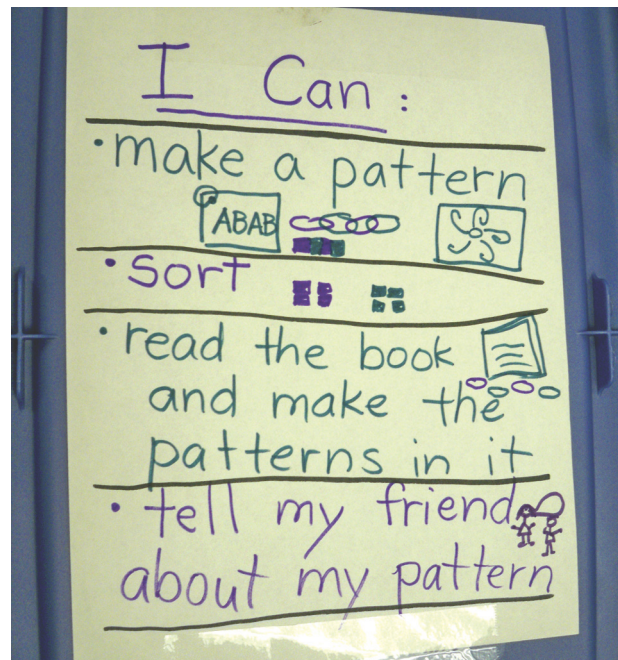
The class works productively for about thirty minutes—at the first station for fifteen minutes and at a second station for fifteen minutes—while the teacher works with two different small groups, focusing on the particular needs of students in those groups. Some days she may walk around the stations observing and noting the children at work; other days, like today, she meets with one or two groups. Children switch to their second station,



Two children work at a math station using connecting cubes and task cards to make an ABC pattern.

which is also noted on the management board, when the teacher rings a bell.

Students in the math stations are engaged in a variety of tasks. At some of the stations they are using materials the teacher included in the previous



An “I Can” list made with the class helps students remember what to do at this station on working with patterns.

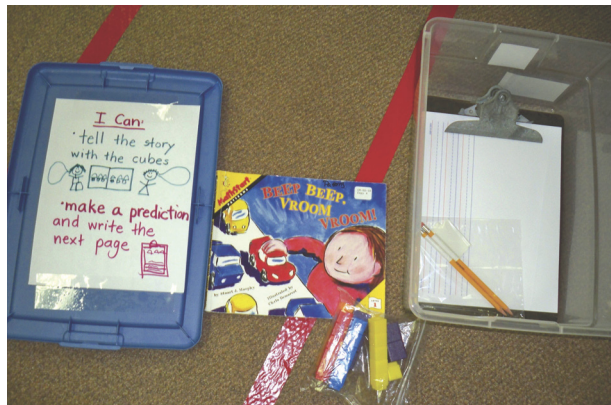
week's lessons on patterns. For example, I see a pair of children seated at desks, using connecting cubes to make patterns much like they did in whole group a week ago. They use task cards on a ring to help them decide which pattern to make. "Look, Mrs. Diller, we made an ABC pattern," they tell me proudly. "We are doing make it, say it, write it!" They use an "I Can" list to keep them focused so they don't finish early and start building towers. (See page 52 for more information on "I Can" lists.)

At another station, I spot children using the *Beep Beep, Vroom Vroom!* book from the previous week. They are working with cubes that match the colors of the cars in the illustrations. They sit beside each other on the floor and use the book to act out the story as they re-create patterns found there. When they get to the last page, they make new patterns using these familiar materials. They use paper provided and draw the pattern they think Molly and Kevin will create next. Behind them, two more children sit on the carpet playing a counting game that was introduced several days earlier.

In another work station, two children are collecting data. They are armed with clipboards and are taking a survey of other students in the classroom. "Which do you like better, reading alone, buddy reading, or when an adult reads to you?" they inquire of a classmate. They walk quietly around the room, stopping off to question a few of their peers



A pair of students uses the book *Beep Beep, Vroom Vroom!* to create patterns using colored connecting cubes that match the colors of the cars in the book.



Familiar materials and an "I Can" list are included at this station, where children work with patterns.

who are playing another counting game. They will share what they learned at the end of math time.

The rest of the children are working at other math stations with partners or are meeting with the teacher in small group. At the end of stations time, the teacher rings a bell as a signal to clean up and meet on the carpet in the whole-group teaching area. The children promptly put away all their materials and gather on the floor. The teacher leads a short discussion during which students take turns showing and telling about what they did and learned this day in small group and/or at math work stations. The teacher asks, "What did you do? What did you explore? Were there any problems at






Two students take a survey as part of math stations work for data collection and analysis. They ask their classmates about how they prefer to read, and then record the results. Over time, they will create graphs too.

Name _____

SURVEY

Which do you like better?

reading alone	buddy reading	adult reads
		

stations today, and how did you solve them?" These questions and others are written on sharing time cards (found on page 224 in the appendix) to help the teacher lead the discussion. The teacher chooses one or two questions a day to keep the children engaged during this five-minute sharing time.

A child who worked with the *Beep Beep, Vroom Vroom!* book tells how much fun he and his partner had making patterns with cubes and shows a drawing of some of the patterns they made. Some of the other kids comment that they can't wait to go there. Students from the survey station show the data they

collected. "We counted 5 kids that like to read alone," says Austin.

"And 3 said they like buddy reading the best," adds his partner.

"How many students liked having an adult read to them?" prompts the teacher.

"Oh, 6," the surveyors say. "It was the one that got the most votes."

Andrea raises her hand and shares, "We had a problem today. Sam and I liked the counting game at our station, but somebody didn't put the dice back where they belong." The class decides to place a small container on top of the math stations shelf with extra dice, so students won't waste time looking for these materials if needed. If someone finds an extra die, he or she can simply put that material in this container, labeled *dice*.

Student Engagement

As you can tell from this classroom scenario, providing quality instruction with connected independent practice through math work stations is a structure that highly engages students. Instead of sitting at their desks filling out worksheets while the teacher monitors their work, the children in the classroom described are motivated to practice and learn. This



At the close of math stations time, a student shares his ideas on how to solve a problem with the rest of the class.

frees up the teacher either to meet with differentiated small groups or to observe and take anecdotal notes about children working at stations.

I began using the term *work stations* rather than *centers* to remind the children that what they are doing during this time is their work. It is not like indoor recess or a free play time. The term *work stations* also helps signal to teachers that these are not an extra. They are not something students turn to when their work is finished. Work stations are for all children. The tasks that students do at their work stations take the place of worksheets. The emphasis is on hands-on learning and problem solving that engages students.

While visiting numerous classrooms across the United States and Canada, I have never met a child who told me he or she didn't like work stations. In fact, students often hug me and tell me how much they love going to stations. They are eager to participate in this format.

Eric Jensen writes about getting the brain's attention in his book *Teaching with the Brain in Mind* (1998). He suggests that to increase students' intrinsic motivation and keep their attention, teachers should provide choices, make learning relevant and personal, and make it engaging (emotional, energetic, and physical). These are exactly the factors that make math work stations successful in classrooms.

Jensen writes that a change in location is one of the easiest ways to get the brain's attention. At math work stations, students move to various places in the classroom to participate in learning with partners. Jensen also suggests that teachers provide a rich balance of novelty and ritual. In contrast to seatwork, math work stations provide novelty as children partake in a variety of tasks around the classroom. In each chapter that follows I show how to maintain novelty in work stations and thus engage students (and reduce behavior problems). See the sections titled "Ways to Keep Stations Going Throughout the Year" in Chapters 4 to 8 for ideas.

Teachers can do much to set up success for students by considering what students pay attention to and what engages them. To increase students' attention to tasks, have them do these things:

- Play a game.
- Make something.
- Talk with a partner.
- Act something out.
- Tell a story.
- Solve a problem.
- Record ideas by writing or drawing.
- Move.
- Do something new.

Math work stations provide all of the preceding and more.

Defining Math Work Stations

Math work stations are areas within the classroom where students work with a partner and use instructional materials to explore and expand their mathematical thinking. During math stations, a variety of activities reinforces and/or extends prior instruction, allowing children the opportunity to develop their mathematical understanding. Math work stations are a time for children to practice problem solving while reasoning, representing, communicating, and making connections among mathematical topics as the teacher observes and interacts with individuals at work or meets with a small group for differentiated math instruction.

Areas Within the Classroom

The physical setup of math stations is somewhat different from literacy work stations. For many literacy stations, teachers use existing classroom furniture, such as an easel for a big book station, a tape recorder for a listening station, and a pocket chart

for a pocket chart station. With math work stations, because there are so many manipulatives, you may want to use portable containers stored in one area. I like clear plastic tubs with lids (and handles, if possible). Label the front of each container with a number (these are *math* stations!). Number the stations from 1 to 10 if you have twenty to twenty-four students. If you're fortunate enough to have a smaller class size, adjust accordingly. If you have more than twenty-four students, add a math station for every additional pair of children. Before you panic, know that you may duplicate stations to make this more manageable. Also, don't worry about setting up all of these immediately. You will want to introduce them one at a time over several weeks early in the school year. A system for doing this will be described in Chapter 3.

Each station will house materials for students to share with a partner at various places around the room. Choose a central location to keep these numbered math stations. You might use a shelf or countertop that is easily accessible to your students.

It is possible to use some of your literacy work station areas for math station areas if you'd like. For example, if you have a pocket chart literacy station, you might want to use math activities involving a pocket chart in that same location during math time. Simply post a numeral there to correspond with the appropriate numbered container of math pocket chart materials. Likewise, the computer can be used for both literacy and math stations. (See the sections titled "Technology Connections" in Chapters 4 through 8 for ideas for a math computer station.) A computer is a "computer station" for literacy work stations and may be "station 3" during math stations time. The "writing station," which is a place to write stories, letters, and responses during reading time, can also be a place to make math-related books or write problems during math time, when it would be called "station 6."

Students take their numbered containers to places around the classroom that are labeled with corresponding numerals. Use every inch of your



Math stations are organized in numbered clear plastic tubs with lids and handles in one kindergarten classroom. This system makes it easy for students to find and return their station materials. The tubs are stored on a shelf that's easy for children to access. A basket on top holds oversized materials that don't fit in the tubs.

classroom to spread kids all around the room. Use student desks, the floor (or carpet squares on the floor if needed), carpet space (if you have it), even pocket charts that may hang on a bulletin board or stand. You might also have some students work at computers or with your interactive whiteboard, if you have one. If your desks are arranged in groups of four, you might seat just two students at each group to minimize noise. By having some kids sit at



Math stations are stored in numbered clear plastic containers with lids on a countertop in a second-grade classroom.



A shelf unit on wheels holds numbered math stations with lids in a first-grade classroom.

their desks and others on floor spaces, the noise in your room will decrease and will be distributed to make the room feel quieter and calmer. Also, children won't mix up their materials with another pair's seated at the table.

Sit at your small-group table and look around the room to be sure you can see every student at all of the math stations. If you can't, move furniture around to be sure you have clear visibility. You'll want to keep an eye on the students to check their engagement during times when you're working with small groups.



Students work in pairs around the room with portable math stations materials. Some work on the floor. Others are at tables.



Two children sit at a table to work at a measurement station. Their teacher observes and talks with them as they weigh plastic farm animals using a balance scale.



In this second-grade classroom, the teacher meets with a small group for math while the rest of the class works at stations around the room. Some use the computer station. Others work in pairs on the floor or at their desks.

Working with Partners

Many teachers tell me their classrooms get too noisy when students are at centers. To decrease the noise level, try reducing the number of students working together. Pairing students reduces the amount of interpersonal work they must do. It's easier to take turns, share, and even discuss when there are just two people involved rather than three or four. Increased student engagement occurs with students in pairs, too. When there are just two students, each

has to do a bigger share of the work (and the thinking). At the start of the year, pair students who get along well together. Later, you can try other flexible ways to pair children based upon need.

Sometimes, students will work in a parallel fashion, individually exploring or investigating a problem. But when playing partner games, you really need to require that partners sit side by side (instead of face to face) in order for them to view the numbers the same way while they work together.

Occasionally, you'll have an odd number of children. What do you do then? You have several options. Sometimes you'll have children who prefer working alone at times and actually do better working on their own. You might have individuals work on the computer. Or you could create a group of three students who work well together. Be flexible and work to meet the needs of all students in your classroom.

Using Instructional Materials

Instructional materials *previously* used in whole-group lessons go into the math stations. The idea is for the teacher to model how to use the materials first by using them with the students multiple times, then move them into the math stations for independent exploration and practice. Students need to play partner games several times in whole-group instruction with the teacher facilitating *before* moving those same games into math stations for independent work time. If you move materials too quickly into stations, students don't remember how to use them and then off-task behavior often occurs.

I used to make and use lots of games with file folders, but I found that the children who were most successful with them were usually those who didn't need the practice. Likewise, commercially made math centers usually don't produce the desired results for exploration and deeper thinking. Students often have trouble reading and following the directions on these products. They look very

tempting in the catalogs, but there is no quick fix for quality teaching and practice. In Chapter 8, you'll read about one team's struggle to move from these instant measurement *centers* to more thoughtfully planned measurement *stations*. You'll find out how they charted what to teach and how they built their stations based on their own classroom instruction. You may want to visit the opening of Chapter 8 now for an example on how to plan for stations that will directly connect what you're teaching to the stations you'll introduce.

Use things you're already teaching with and move those materials and activities into stations. If you use a core program for math instruction, you already have a storehouse of ideas for math stations. Use the partner games, suggestions for math workshop activities, software, and other materials that come with your series for independent work at math stations as well as in whole-group instruction.

Here's an example of moving materials from whole group to math stations for more independent work. Your teacher's edition recommends that, during whole-group time, you model with 3-D objects, such as a basketball (sphere), an oatmeal container (cylinder), a die (cube), and a crayon box (rectangular solid). Students also explore wooden



A second-grade teacher points to parts of a box as she teaches mathematical vocabulary like *edges*, *faces*, and *rectangular solid*.



Students work with 3-D wooden objects as part of a whole-group lesson on geometry.

3-D objects, comparing them to each other and to your examples while they learn new vocabulary, such as *cubes*, *faces*, and *solid figures*. After introducing and teaching with 3-D shapes over several days, move some of these materials to several math stations for further investigation. At this time, all the stations don't have to focus on 3-D shapes. Some of



Two students play Guess My Shape using 3-D shapes at a math station.

them may contain materials for students to review mathematical concepts taught before your exploration of 3-D shapes. You don't teach new concepts or skills one day and move it to a station the same day for practice. Wait until you've taught and reviewed a math concept several times before moving it to stations for independent exploration.

After teaching with three-dimensional shapes, partners work at several geometry-related stations doing activities such as Guess My Shape, Shape Sort, and Shape Hunt, which are all described in Chapter 7, "Geometry Work Stations." Remember to look at your math curriculum documents for ideas, too.

Variety of Activities

Choice is an important feature in making math work stations successful. Over time, a station should include a variety of things for children to choose from, but there shouldn't be so many choices that the children feel overwhelmed. Aim for what I call "controlled choice." Provide just a few choices of materials or activities within a work station. For example, if you're using a core program such as Investigations or Everyday Math, integrate activities that you've used in whole-group work as choices. So, if you used color tiles or pattern blocks in a geometry lesson on symmetry, students should use those same materials at a station to further explore with them. You might also include small mirrors at this station and a picture book about symmetry. Any of the choices at a station should provide opportunities for exploration and/or practice, but allowing the child to choose the activity will enable him or her to learn more.

You might place in the station container two or three different things students can choose from that relate to the same topic. For example, in math station 2, I might put two counting games from resources I already have taught with (perhaps from a core math program or training I've attended where we made partner games), with each game in

its own plastic ziplock bag, as well as a picture book about counting. In this way, children are thinking about those mathematical concepts throughout the entire work period at that one station. I've found it helpful to include all the materials students need for a math station's activities in that numbered container—spinners, dice, counters, pencils, paper, or whatever is needed to do those activities. This cuts down on interruptions and movement around the room to find materials.

Having a few choices at a station gets rid of the problem of the "early finisher." Students don't have to put away the station or get up and move about the room to find something else to do after playing one game because they're done. They can simply choose another activity from the same container. This minimizes interruptions such as asking the teacher what to do next or moving around the room to get more materials. It makes management a bit easier for everyone.

If the idea of putting two or three things at each station seems overwhelming, take a deep breath and relax. Remember that early in the school year, stations are introduced one at a time (see Chapter 3), so you won't need to worry about having ten stations with multiple activities in each to begin. At first, you will probably start with just one activity per station and layer on more as the year progresses. One of the choices at a station can be reading a math picture book that highlights the same concepts that are being reinforced by the games or activities there. Another way to simplify is to have the same activities at two or three stations.

Opportunities for Independent Exploration

The emphasis at math work stations is on giving children opportunities to explore and develop mathematical understanding through independent practice. It is a time for children to work with concepts already introduced in whole group. Thus,

activities placed at the math work stations can grow out of either your core math program or other resources that develop the mathematical concepts you're teaching.

Worksheets are not put into the containers and called "work stations." Students aren't just playing simple Bingo games or flashing fact cards to each other. There is real thinking, learning, and conversation about math going on. You will hear math talk as children make connections between their new learning and what they already know. While second graders work with 3-D shapes at a math work station, you might hear, "This sphere is like the basketball we use during P.E." or "This cone is different from the cylinder. Both are for food, like an ice cream cone and an oatmeal container." Students practice using new math vocabulary and pose questions and wonderings to each other. For example, in second-grade classrooms I've heard talk like this at a geometry station: "What is the name of that shape again? Oh, it's a pyramid." "How many faces does it have?" "How are these shapes different?"

At math stations, students work on tasks where they must solve problems and use reasoning skills. They are asked to represent what they are learning through drawing, writing, and even dramatizing or telling stories. At a station where they work with addition, they might make up stories using numbers and objects. In this case, the children pull materials out of a ziplock bag—two dice made from wooden cubes with zero to five dots on each face, a work mat made of a plain plastic placemat, five little plastic pigs, and five small plastic cows (from a bag of dollar store farm animals). One child rolls the dice and gets a 4. She picks up four little pigs. The other child rolls a 1 and picks up one cow. Together they make up a story about the farm animals: "Once upon a time there was a farmer. He had 4 pigs and 1 cow. They were friends. There were 5 happy farm animals." They draw a picture of their story and plan to share it with the class after math stations during sharing time.

Differentiated Math Instruction

While students work independently at math stations, the teacher may choose to observe individuals at work and gather data to inform decisions about meeting student needs individually or in differentiated small groups. Many days, the teacher will meet with one or two small groups during this time.

For example, a teacher may have been teaching *counting on* as a strategy for adding two numbers during whole-group instruction. During math stations time, she observes that there are still a few children who count all the numbers, beginning with 1. She will want to work with those students in a small group to focus on number sense and help them first identify the greater number and then count on the second quantity without having to count both amounts to find the sum. Likewise, after observing during math stations time that several other students are advanced in counting skills and are ready to count by tens, the teacher will want to bring them together for a small group and work with them using larger numbers and counting on using ten-frames.

As you observe children at math stations and/or in small group, collect valuable information about students' understandings and misconceptions by taking notes to plan further instruction. While observing, it's helpful to record what children are doing and saying. You might use an anecdotal note system (just like you do when teaching reading) to write down what you see and hear.

Many teachers have found that carrying a clipboard around the classroom helps them record their observations, which in turn aids planning. Index cards can be useful for this. Begin by writing each child's name on the bottom right-hand corner of an index card. Prepare a card for each student. Then, tape the first card to the clipboard so it is aligned with the bottom of the clipboard. Layer the second



A clipboard with an index card for each child taped onto it can be useful in assessment.

card over the first so that both the first card's name and the second card's name are visible. Continue taping cards to the clipboard until all are attached and each child's name is showing. If you use a clipboard like this during independent reading, keep a separate clipboard with cards of a different color for your observations during math stations time.



A teacher takes notes while observing students playing a domino game. Kindergartners match up dots to make a domino train.

Jot down notes about individual students' mathematical understanding. Be sure to date each entry and keep it brief. Just take notes on a few children each day. You might start by observing the students you are most puzzled about—the ones you're least sure how to help.

Here are some examples of what you might record:

- Improving one-to-one correspondence.
- Counted on fingers.
- Counted on from 10.
- Made and named ABC pattern with Unifix cubes.
- Using straws for place value is helping.
- Drew picture to solve addition problem. Groups of 5.
- Wrote 7 and 2 backward.
- Compared 3-D objects using correct vocab.
- Used objects to solve problem. Extended it, too.
- Confusing minute and hour hand.
- Used cubes for nonstandard measurement accurately.

After a child's card is full, simply tear it off and save it with your records for that child. Then replace it with a new card so you can continue to take notes throughout the year. It's important to observe students, and it's even more valuable if you record what you notice and use your notes for planning differentiated instruction.

When you observe students at work and use your observation notes to plan small-group instruction, each math small-group lesson should look a bit different from the other groups' lessons throughout the week. At times, you may want to use the materials from a small-group lesson for a station for independent practice for just the kids in that group (because other students don't need the practice). Those materials might be put in a ziplock bag with a colored dot on it for just that group. For example, with the struggling group described several para-

graphs ago, give them smaller numbers to work with. Put those materials in a container with a colored dot on it to show that it is just for their group.

Gradual Release of Responsibility in Math

The best way to guarantee success at math work stations is through lots of modeling both for conceptual understanding and procedures, with teachers gradually releasing more responsibility to the children. Pearson and Gallagher's gradual release model of instruction (1983) outlines this principle (see Figure 1.1). To best train students for math work stations routines, begin by modeling—showing students how to do something, such as how to play a new partner game from your core program or how to use the stamps at the pattern station. Show them how to get the materials out of the container and organize them on the table, one piece at a time rather than dumping the whole bag. Model how to place materials on a work mat to keep noise at a minimum and model how to play the game. Demonstrate how to clean up the materials so it will be easy for the next students to use them.

Remember that the best way to ensure student independence is to have modeled well with instructional materials before moving them to a station for practice. Students need to see and participate in several demonstrations of how to use materials or do tasks, such as playing partner games, before they can do them well on their own. Simply showing something once isn't enough for most learners, even adult learners.

Brian Cambourne's conditions of learning model (1988) identifies demonstration as an important prerequisite for language learning. Students will have math language to learn and experiment with at stations. Expect students to use "math talk" at stations by modeling this language with them and letting them know you want them to use these words as well. Throughout this book,

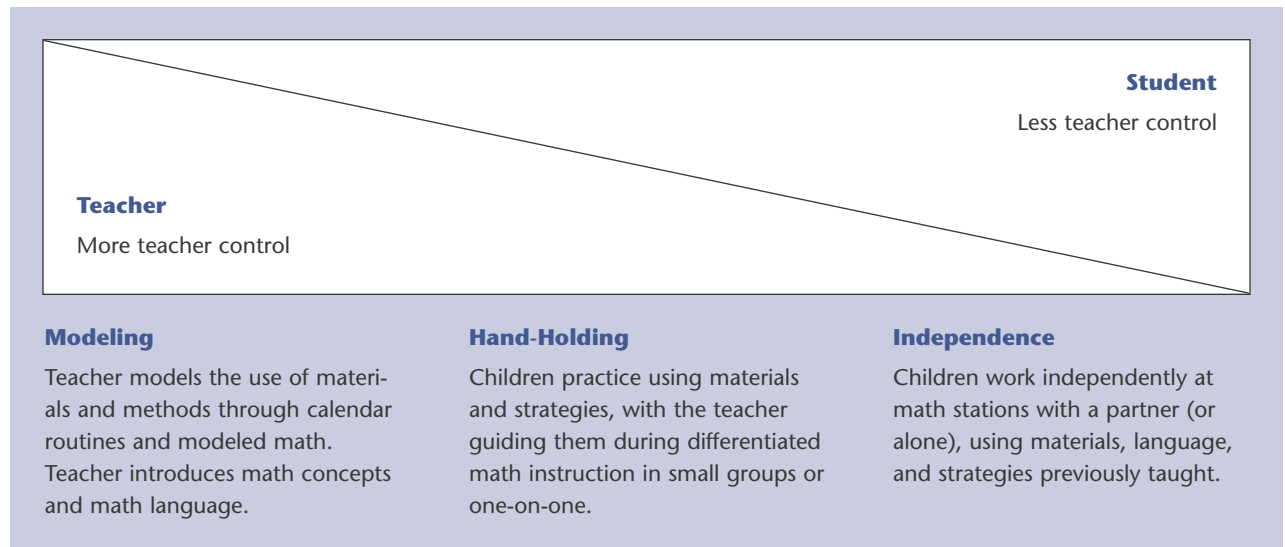


Figure 1.1 Gradual Release of Responsibility Approach (Diller 2003, adapted from Pearson and Gallagher 1983)

you will find many examples of math talk cards to teach with in whole group and move to math stations for practice.

When planning for math stations, be sure that children *can* do what is asked of them at the station. If activities are too easy or too hard, students will disengage (which also brings about discipline problems). Have high expectations but make them realistic.



A math talk card made from an index card provides math language support for an English language learner while she plays a counting game with a partner.

Math Work Stations Versus Traditional Math Centers

A math work station is fundamentally different from a traditional math center in several ways, as shown in Figure 1.2. The emphasis when using math stations is on teacher modeling and students taking responsibility for their own learning. In traditional learning centers, teachers often did too much of the work. They would, for example, think of ideas for the materials, make the materials, laminate them, cut them out, explain them, explain them again, and clean up after the materials were used. In addition, teachers would decide when to change the materials (usually *every* Friday afternoon!) and what would be done with them. In math work stations, students share in the decision making. They help decide when to change materials and they negotiate ideas for what they'd like to try at each station. No longer does the teacher change the centers weekly. This process is explained in more detail in Chapter 3.

There are many benefits to teaching with math work stations. My favorite is that *all* students get to participate in work stations daily. The natural result

Math Work Stations

Materials are used by the teacher and students during instruction first. Then they are placed in the work stations for independent use.

Stations do not change weekly. Instead, materials are changed to reflect children's levels of math understanding, strategies being taught, and topics being studied.

Stations are used for students' meaningful independent work and are an integral part of each child's instruction. All students go to work stations daily.

Materials are differentiated for students with different needs and levels of math understanding.

The teacher observes individuals at work or meets with differentiated small math groups during math work stations.

Traditional Math Learning Centers

New materials were often placed in the center without first being used in teaching. The teacher may have shown how to use the materials once, but they were often introduced with all the other new center materials at one time.

Centers were often changed weekly with units of study or even a theme.

Centers were often used by students when they "finished their work." Centers were used for fun and motivation, for something extra.

All students did the same activities at centers. There was not usually much differentiation.

If the teacher met with small groups, each group often did the same task.

Figure 1.2 Differences Between Math Work Stations and Traditional Math Learning Centers

of this is that the children will usually work harder because they are doing something they enjoy. No longer will you have bored students squirming in their seats or children popping up and down asking endless questions about how to do a worksheet. Nor will you have children speeding through their seat-work carelessly so they can go to centers. All students have equal access to the engagement that math work stations provide.

Another benefit is that math stations allow you to differentiate for the various levels within your classroom. Instead of assigning the same tasks to all children, you can suggest different activities or materials for particular children so as to better meet their needs at a particular station. For example, at station 7, which focuses on addition and subtraction, a blue dot stuck on one ziplock bag denotes differentiated materials to be used by the blue math group. These students have fewer numbers of dots on their dot dice to accompany the game they will play, because that is their level of mathematical understanding. The teacher simply reminds them to

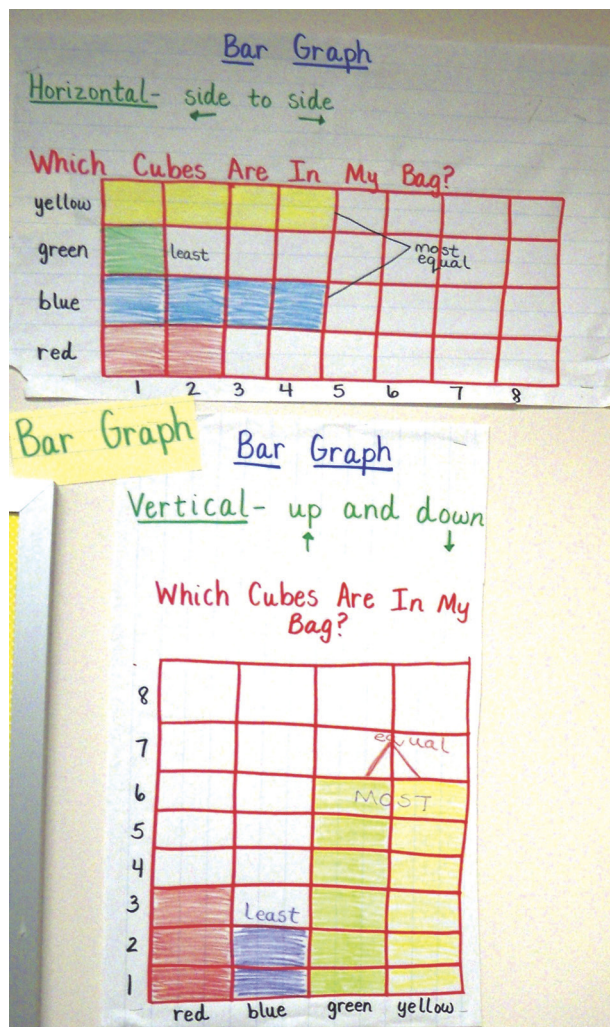
use the blue-dot bag when they work at that station. Chapters 4 through 8 each include a section devoted to ideas for differentiation.

Improved student behavior is an additional plus that comes from math work stations. When students are involved with hands-on activities, such as playing partner games or creating and sharing stories involving math, rather than filling out math worksheets, they generally behave better and interrupt the teacher less often. Discipline problems arise when students are asked to work without the teacher's support on things that they don't find interesting or relevant. Skills students would traditionally practice with paper and pencil work can be made more manipulative at the work stations. For example, instead of having students fill out page after page of math worksheets individually, you might accomplish the same goal by having students work with a partner at a station. At that station, the students can utilize just one or two of the same worksheets on an overhead as transparencies and solve the problems using manipulatives. (Choose

just a few of the best workbook pages for this adaptation.) Or they might use the SMART Board station, working with the same kinds of problems you did with them on an interactive whiteboard during whole-group instruction. For assessment, you can quickly glance at the board to see how they're doing and make note of any issues you need to address individually or in a small group.

Finally, students at math work stations internalize new concepts because they have a direct opportunity to practice a skill just as it was modeled. Children apply what they are learning by successfully completing tasks, which might include acting out a story with objects to represent dividing cookies among three friends or making a three-page math book about their schedule in school. Students get to connect old learning to new. They think back to what they learned during whole-group problem solving as they're working in stations. After a whole-group lesson involving bar graphs, students at a station might grab cubes out of a bag, saying, "We could show what we found by making a bar graph!" Best of all, students in work stations are constantly solving problems, reasoning, representing, communicating, and connecting while working with numbers and mathematical concepts. They practice using math vocabulary and interact with a partner to help cement this new learning. At math work stations, children are engaged learners.

Teachers sometimes tell me that they've tried centers in the past, and this approach just doesn't work. They say, "We used to do this many years ago. It didn't work then, and it won't work now." I challenge you to try something new. Think of work stations as a new twist on an old idea. Old ideas cycle around, but there's always a twist. I wore bell bottoms in the 1970s; they returned in the twenty-first century with a new name: "boot cut" or "flares." But they have a new twist—today they're made with Lycra. And what's not to love about that? Look for the Lycra in math work stations. There are many new twists that will engage your twenty-first-century students.



Students use anchor charts made in whole-group lessons, like these about bar graphs, when working at a math station. These visuals help kids remember what was taught. At this math station, they pull cubes out of a bag and make their own graphs.

As you read this book, you will find suggestions for managing time, materials, and student behavior in the first three chapters. Each remaining chapter (Chapters 4 through 8) focuses on specific skills, strategies, and activities that students might work on at math stations related to the National Council of Teachers of Mathematics (NCTM) and Common Core State Standards in your K–2 classroom. If you teach a higher grade level, you may be able to adapt the ideas in this book for your students too.

I organized the ideas for independent work around the following big ideas: beginning number concepts; addition and subtraction; and place value. These are all part of the Number and Operations content strand. There is also a chapter on geometry stations and one on measurement stations. These chapters all stand alone, and each is organized in the same way to make it easy to find what you need. Dip in and out of them depending upon your curriculum demands.

Instead of writing a separate chapter on algebra stations, I included ideas for exploring patterns as well as properties of arithmetic and equality throughout the book. Likewise, I integrated data and probability suggestions into existing stations in the beginning number concepts, geometry, and measurement chapters (Chapter 4, 7, and 8). This book is not intended to be a math program or curriculum. Rather, my intent is that it will support and extend the high-quality, standards-based math instruction that you are already doing in your classroom.

Reflection and Dialogue

To help you make the most of the ideas presented in this book, each chapter concludes with a list of ideas for discussion and questions for personal reflection. These may be used as part of a book study. Following is the list for this chapter:

1. Share your new ideas about math work stations with a colleague. Discuss the definition of math work stations provided in this chapter (on page 7).
2. If you are already using literacy work stations, what parallels did you see between literacy and math work stations?
3. Think about your students and their level of engagement during math. What specific things engaged them most recently? What ideas did you get from this chapter that you will try in order to increase student engagement?
4. How will what you teach in whole group impact the work students do at math stations? Share some examples of what you might move from whole-group math instruction to math stations.
5. Determine how and where you'll set up your math work stations. Use the pictures on page 9 for ideas and inspiration.
6. Discuss how math work stations can support differentiated math instruction.

2

Organizing and Managing Math Materials

“I really want to use math work stations effectively in my classroom,” second-grade teacher Jamila told me when I visited her room. “I have lots of materials we can use. Most of my math manipulatives are in one closet, but I know I have too much stuff.” While working with Jamila (and many other teachers), I noticed that when our talk turned to math stations, it often turned to “stuff” and centered around the question, What stuff do I have that I can put out in tubs? We often find ourselves looking for premade materials that could easily work for independent stations practice. It seems like the fastest route.

However, in thinking about this question, another, better question emerged: How will I teach this math concept and what materials will I use? If we think about instruction *first* and then plan for stations practice based upon what we’ve taught using materials students are already familiar with, we will simplify the process and ensure that our students are developing conceptual understandings rather than just doing busywork.

This new question led Jamila and me to talking about improving the organization of her math

materials so she could more easily access what she needed for teaching. Most teachers agree that math instruction should be hands-on to help our students understand the concepts we are teaching. But that requires math manipulatives with all those little pieces! If we knew (and organized) exactly what we had and started to plan instruction using those easily accessible materials, we could start to improve the quality of our math stations. Jamila had most of her math materials in one place, but they weren’t really organized to maximize their use. We needed a system for storing and finding her stuff quickly. By having a system, she had whatever she needed right at her fingertips to maximize time on task and make planning and teaching simpler. She was ready!

Spring Cleaning: Math Manipulatives Makeover

As Jamila and I looked at her current math stations (mostly commercial games in tubs), she agreed to let me look in her math closet and help her create

Step 1: **Sort** your stuff. **Stay** put while you sort!

Step 2: **Purge** things you don't use for teaching.

Step 3: Put what you'll keep in **containers (containerize)** and place them in storage areas (**assign** a home).

Step 4: Maintain your storage system. (**Equalize** every day.)

Start with just your math materials. Take everything off the shelves (one shelf at a time) and empty containers to see what you've got. Spread it all out. Don't walk away from this space! (You could get distracted.)

Get a friend to help, if needed. If you haven't used it this year (and it is your personal property), don't keep it in your classroom.

Now put all those containers to use. Match containers to the size of materials to better utilize space. Label everything!

Every day, put things away. Get students to help you.

Figure 2.1 How to Organize Your Math Manipulatives

a system for all those materials. We decided to work on this project during spring break. It was a perfect time, because her students would not be in the classroom and we'd have a chunk of uninterrupted time. It was hard to carve out the time, but Jamila told me it saved her countless hours in the long run. If you identify with Jamila, you might plan for a time to get your math materials better organized. You might choose to do this in the summer or on a Saturday or even after school hours over the course of several days. Jamila found that when she could easily find what she needed for instruction, her teaching *and* her planning for math stations went much more smoothly.

In helping Jamila, I used a tried-and-true formula from Julie Morgenstern, an organizing expert and author of *Organizing from the Inside Out* (2004). It involves five steps that match the acronym SPACE: Sort, Purge, Assign a Home, Containerize, and Equalize. This procedure (see Figure 2.1) makes organizing all your math stuff (or even your closets at home) simple and doable. It's a system I have used successfully many times, both in my home and in classrooms.

Step 1: Sorting Your Stuff

The first step in sorting is to remove all the items from one storage area. Julie Morgenstern recom-

mends that you begin with just one shelf (or cabinet) at a time, and so do I. This makes the process manageable. If you experience success with one shelf, you will be motivated to try another. Caution: Don't leave this space! Sometimes we're tempted to start putting things away in another part of the room, and we get distracted. Commit to finishing this space before moving on to another. You'll find that when you get one small space organized, you'll be inspired to move on to work on another.

When we began, Jamila told me that all her math manipulatives were stored in one cabinet and all her literacy materials were in another. So we started in the math cabinet, only working with that space. We opened the doors of the math closet, pulled everything off the shelves, and put the contents on the floor and surrounding desks so we could see exactly what she had. Sometimes things were already in containers, but we took everything out and stacked the containers off to the side so we could really see what was there. Warning: It will look quite overwhelming with all that stuff everywhere, but it is the only way to really see what you have for math instruction. Work with a colleague to help you stay on task.

Jamila teaches in a recently constructed school in Houston, Texas, so closets and shelves were built into her classroom. Not everyone has a closet or