Guided Math in Action

Building Each Student's Mathematical Proficiency with Small-Group Instruction

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About the Author

Dr. Nicki Newton has been an educator for more than 20 years, working in inner-city schools on both the East and West Coasts, with student populations ranging from pre-kindergarteners through doctoral students. Having spent the first part of her career as a literacy and social studies specialist, she built on those frameworks to inform her math work.

She has worked on developing Math Workshop and Guided Math Institutes around the country. Most recently, she has been helping districts and schools nationwide to integrate the Common Core State Standards for Mathematics and think deeply about how to teach these within a Math Workshop Model.

Dr. Nicki works with teachers, coaches, and administrators to make math come alive by considering the powerful impact that a small-group learning structure can have on student achievement. She is also an avid blogger (www.guidemath.wordpress.com) and Pinterest pinner (drnicki7).

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1

Guided Math: An Introduction

When I first started teaching, I met a master teacher named Coco Aguirre. She was loud and funny and really smart. She worked with her kids in small groups and taught them all how to read, write, and do arithmetic. A big sign over the threshold of her door said, "If kids don't learn the way you teach, then teach the way they learn." Simple but true. And so that's what I did.

Fortunately, the school that I landed my first teaching job in had an early bird–late bird structure. Half our kids came early in the morning and left about two, and then the other half came about an hour later and stayed late. The idea was to work with children in small groups for reading and math.

So I could say that this pathway of small guided math groups was laid out for me from the beginning. I believe that when you work with students in small groups, you reach them in a different way than in the whole group. You get to look straight in their eyes and listen carefully to each word that comes out of their mouths. You get to teach each one with a bit more intention than in the whole group. You get to invite each student to a front-row seat—as a participant, not a spectator.

Students get to get in the game, play hard, and learn lots. They each get to talk, to show their thinking, to question others, to engage deeply in rich mathematical conversations. They get to get on friendly terms with numbers, to take risks and to go from triumph to triumph at that kidney-shaped table. Here, in a guided math group, we foster mathematical thinkers, one problem at a time, in these small spaces. Guided math is an opportunity for teachers to provide specific mathematical interventions. Let's take a look now at one of those lessons in action.

A Guided Math Lesson in Action

Welcome to room 307. The class is in the middle of math workshop. It is the middle of the year and the students are working on place value. Mrs. Johnson has been working with her math coach to find meaningful ways to

engage her second graders. Mrs. Johnson has a diverse class of students, so she has grouped them so that they are challenged according to their current skill level.

Mrs. Johnson is at the kidney table working with a novice-level guided math group. The students are in the middle of a chapter on two-digit subtraction and still struggling with understanding the idea of regrouping. Mrs. Johnson knows this from a look at their latest quiz. So, in this group, she is working on building conceptual understanding of two-digit subtraction. She has chosen to use the first level of manipulative with this group, meaning bundles of sticks, instead of a more abstract manipulative like base-ten blocks, which she uses with other groups. Each student has a bundle of sticks grouped in tens.

Introduction: Mini-Lesson

During the mini-lesson, Mrs. Johnson wants to tap into prior knowledge, grab the students' attention, and hook them into today's lesson. She also wants to make sure they have a handle on the vocabulary so they can describe their thinking in math language.

Mrs. Johnson: Hello, everyone. Today we are going to continue our work with subtraction. Who can tell me in your own words what subtraction means?
Tom: Take away.

Here, in this first question, Mrs. Johnson has tapped into prior knowledge, stressed vocabulary, and set the purpose for today's lesson.

Mrs. Johnson: Okay, would someone like to elaborate on that; say some more about subtraction?
Sue: It's like if I have 25 dolls and I give you 16, that's subtraction.
Mrs. Johnson: Okay, so today we will be practicing more subtraction problems. We will be using these bundles. Remember, we were using these the other day. They help us see how we break tens to get ones. What do the bundles represent?
Carol: They are tens.
Mrs. Johnson: And when they are loose sticks, what do we call them?
David: Those are the ones.
Mrs. Johnson: Everyone hold up a bundle of tens. Now, hold up enough bundles to make 30. Okay, now on your mats, put out enough bundles and ones to show what 45 looks like. Okay, now. Let's start with the problem Sue gave as an example. Say I have 25 dolls. Everyone show me enough tens and ones to represent 25. Okay, now I want to give 16 away. What do I need to do? Who can explain?

Maria: Well, you don't have enough ones to just take 6 away so you have to break a ten.

Mrs. Johnson: Thumbs ups if you agree, thumbs down if you don't, thumbs sideways if you are not sure. (She checks around and then continues.) Okay, who can explain what happens next?

Tom: If you break a ten, you have 1 ten and 15 ones.

Mrs. Johnson: So can I now take 16 away?

Carol: Yes, you take away 6 ones and you take away the ten. You have 9 left.

Mrs. Johnson: Okay, does everybody see that? Any questions? Okay, let's try another one together before you all do one by yourselves. Let's say I have 32 marbles. Everybody set that up. Okay, say I want to give 15 away. What do I do?

Maria: You have to break 1 bundle of ten. Now you have 12 ones and 2 bundles of ten. So you can take 1 bundle of ten and 5 ones. So there is 1 bundle of ten left and 7 ones. You have 17 left.

Mrs. Johnson: Does everyone agree with Maria? Okay, now I am going to give each one of you a problem and I want to watch you do it. Then I will have you explain it to the group.

Student Work Period

During the work period, the students work on the problems by themselves. Sometimes they work in pairs. The idea is that children get to do some independent practice after the guided practice. During the work period, the teacher checks in with the students, taking anecdotals and asking questions. Each student has two problems to solve. After they finish, they share their solutions with the group.

Kayla: My problem was 27 take away 9. I didn't have enough ones to take away 9, so I had to break the ten pack. Then I took 9 away and I had 18 left.

John: My problem was 21 take away 12. I counted the ones, but I didn't have enough to take away 2, so I broke the ten pack. I took away 1 ten pack and 2 ones. I had 9 left.

After everyone has a chance to share, Mrs. Johnson moves on to the next part of the lesson.

Share Period

The share period is a crucial part of the lesson. It is when the teacher concretizes the learning for the day. It is a time to facilitate more discussion about the math concepts, strategies, and ideas worked on and it is also a time to make clarifications, address confusions, and add other comments.

At the end of the share period, the teacher gives directions about the follow-up center work as well as differentiated homework specifically for this group. After everyone has a chance to share, Mrs. Johnson asks some closing questions.

Mrs. Johnson: So who can tell me what was the math we were working on?
Mike: Take aways.
Mrs. Johnson: Yes, we were taking away. What is another name for this?
Tyrone: Subtraction.
Mrs. Johnson: Who can explain what we were doing in order to subtract?
Kayla: We had to break the tens to get more ones.
Mrs. Johnson: Why?
John: Because there wasn't enough in the ones place.
Mrs. Johnson: Okay, so this group is going to work on the Race to Zero center. You know the game where you start with 50 sticks in bundles of 10 and you roll the dice and take that number away until you get to 0. For homework, you all will take a baggie of sticks and 10 subtraction problems to complete on the homework sheet.

Mrs. Johnson then dismisses this group and begins to circulate around the room where the other children are working on differentiated, standards-based center activities. At the first table, four children are working on subtraction problems with the number grid. They have 10 problems that they must use the number grid to help them solve. At the second table, six children are working in pairs. One person rolls two dice and makes the largest number possible and the other person must subtract ten. They can use the number grid or the number line as a resource. Then they check the answer with the calculator. At the third table, the children are working on the computer. They are working in pairs on base-ten activities from the National Library of Virtual Manipulatives. At the fourth table, the children are working at a "hot topics center" reviewing money. They are playing a money match card game in which they match the amount to the coins. At the fifth table, the children are playing a game in which they roll a number and add 10 more.

Mrs. Johnson walks around the room taking anecdotals on three children whom she has chosen to watch for the day. She is getting ready to give the Big Switch signal on the xylophone (which is her cleanup signal), so that all the children will quickly and quietly prepare to come to the rug to discuss their math work for the day. Mrs. Johnson writes a note to herself that tomorrow she should definitely do a math interview with Daniel about subtracting double-digit numbers because she thinks he might be ready to move to a more challenging group.

This scenario shows the benefits of a guided math group. Mrs. Johnson understands the benefits of differentiated, targeted, standards-based practice. In this structure, she has the flexibility to pull small groups and provide instruction at their current level of understanding while the other students stay engaged in meaningful practice in standards-based math centers.

Summary of the Guided Math Lesson

During this guided math lesson (see Figure 1.1, page 8), Mrs. Johnson worked with a group of struggling mathematicians to build conceptual understanding. Her focus for the lesson was for the students to get a hands-on feel for subtraction with two-digit numbers. This is very often taught at a procedural level, teaching students the steps to regrouping. However, often students know how to do it but cannot explain what they are doing. So, with this group, the teacher has not yet started to work with abstract numbers, but has rather focused on using a primary-level manipulative to build mathematical understanding of subtraction in the base-ten system. The introduction of her lesson took about five minutes. She led students through a series of guided problems, so they could talk out the steps together as they worked. The independent student work that followed the guided practice took about seven minutes. Here, the students practiced regrouping and applied this skill to new problems. They also had to explain their thinking. Then Mrs. Johnson concluded with a share period.

Goals of Guided Math

The goal of guided math is for students to become proficient mathematicians who have conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and mathematical confidence. Guided math aims to get students comfortable with numbers, operations, and mathematical concepts so they can independently work with them in new and different contexts. In guided math groups, students can work on developing content knowledge and "habits of mind" and "ways of doing" math.

In guided math groups, we group children by targeted areas of need in order to teach at each child's instructional level. Guided math is an interactive space where children are doing the math with each other, by themselves, and with the teacher. The teacher's main role is to watch, observe, coach, and assess. The teacher also models and prompts as the students work. During guided math, students work on "just right" problems in their zone of proximal development. The level of instruction is not too easy or too hard but "just right"—that is, just enough of a reach that students learn from each new mathematical encounter.

Students are placed in flexible, homogeneous groups according to their performance on a variety of mathematical assessments, depending on the

Figure 1.1 Mrs. Johnson's Guided Math Lesson Plan

Date: December 10, 2012

Group: Blue Trapezoids

Teaching Focus: Subtraction using regrouping

Vocabulary and Phrases:
Bundles of ten
Tens
Ones
Regrouping
Breaking a ten

Mini-Lesson:
Connect to prior knowledge
Reinforce vocabulary
Guided practice problems/Checking for understanding

Student Activity:
Students will solve their own problems using the manipulatives
Student must explain their work using math words

Share:
Reinforce procedure of regrouping
Reinforce vocabulary

Assessment:
Check each student's individual work
Also note ongoing conversation and contributions to overall discussion

Notes:
Carlos had trouble explaining what he did
Maria got confused on 37–29, but she was able to figure it out with guided questions

Center Activities:
Race to Zero and basic subtraction flash cards

Homework:
Take subtraction problems home with a stick bundle to use as manipulatives

current unit of study. Based on the assessments, specific teaching points are selected and the lessons focus on these.

Beliefs About Teaching and Learning Mathematics That Frame Guided Math

Meeting Students Where They Are

Guided math allows you to meet students where they are so you can take them where they need to go (see Figure 1.2, page 10). Guided math allows you to scaffold learning so that even if you are on page 72 of the math book, you can teach all the students what they need to be ready for the current concept. Let's say page 72 is teaching double plus one facts. You already know that some students aren't quite ready for this. Some students don't know their doubles. Some students don't even know their facts through ten. Some students don't even know their numbers!

A guided math structure allows you to pull students in small groups and teach them in their zone of proximal development (Vygotsky, 1978). We already know that everyone is not on the same page at the same time. Although all the students are working on the big idea within a particular math strand, they are working at their instructional level. For example, double plus one is a math strategy that comes up in a particular lineup of teaching math strategies. As a knowledgeable teacher, you would recognize the appropriate place in the sequence for each group of children and then group them accordingly. Thus, eventually everyone will learn doubles plus one facts, but you'll do first things first.

It might look like this in your classroom. If the class is working on addition, there might be four groups. Group 1 (novice learners) might be working on facts through ten with concrete scaffolds such as ten-frames. Group 2 (apprentice learners) might be working on fluency with doubles using double ten-frames. Group 3 (practitioner learners) might be working on facts through 20 using double ten-frames. Group 4 (expert learners) might be working on adding a double-digit number with a single-digit number.

Tapping into Multiple Learning Styles and Intelligences

Children's learning styles and intelligences are considered in the planning and implementation of guided math lessons. Diverse instructional strategies, integrating linguistic, musical, visual, logical-mathematical, digital, bodily-kinesthetic, interpersonal, and intrapersonal approaches are used (Gardner, 1983). Teachers should have a toolkit of songs, poems, chants, manipulatives, charts, diagrams, and various activities. You might teach the students a concept through a song one day and the next you might play

Figure 1.2 Beliefs About Teaching and Learning Mathematics

Beliefs About Students and Learning Math	Beliefs About Teachers and Teaching Math	Beliefs About Developing Mathematical Proficiency
Children learn at their own pace	Teachers need to have solid content knowledge	Math should be taught at the concrete, pictorial, and then abstract level
Children have different learning styles (visual, auditory, kinesthetic) that need to be addressed	Teachers need to make connections with real life by contextualizing all the math they teach	Math should be taught with an emphasis on conceptual understanding, procedural fluency, and problem-solving skills
According to Gardner's theory, children have dominant learning intelligences (logical-mathematical, musical, spatial, linguistic, naturalist, interpersonal, intrapersonal, bodily-kinesthetic)	Teachers need to find new ways to teach children, if the children are not learning the way the teachers are teaching	Math should be contextualized so it makes sense
All children can learn math	Teachers should provide some small-group guided math instruction	
Smart is learned (Resnick, 1999)	Teachers should differentiate learning (process, product, content) (Tomlinson, 2001, 2003; Tomlinson & Eidson, 2003)	
Affect must be acknowledged in the math learning process—because learning math can be very emotional	Teachers need to work with children to set specific learning goals	
Students should reflect on their knowledge bases and skill sets and should set personal math goals		
Fundamental belief: Every child has the right to become a flexible, competent, confident mathematician!		

with the base-ten blocks or represent problems by drawing pictures with different colored pencils.

Building Mathematical Confidence

Children's disposition toward math is considered and valued during the design of lessons. Children are taught to acknowledge and work through frustrating moments while learning to become confident mathematicians. You talk about how sometimes they have to "wrestle with the math problem." You talk about what it means to "stick with it." You talk about "stepping away for a minute" and then being sure to come back to the problem. In guided math groups, the children and the teacher discuss "what's tough" and "what's easy." Students talk about themselves as learners, what they "get" and what they are still in the "process of getting." Students become reflective learners who set goals for themselves.

Stretching Your Own Pedagogy

Running guided math groups effectively requires teachers to "stretch their own pedagogy" (Mulgrave, personal communication, 2011) so they can reach and teach all students. This really means that teachers reflect on their usual practice, take notes about what is working and what is not working, and then stretch out of their own zones of comfort in order to devise new and engaging ways to help everyone learn. It means that if Johnny doesn't get it after you've tried to teach him three different ways, then you try a fourth. You teach from your own dominant intelligences, and that works for some students and it doesn't for others. You have to make sure you are using a variety of strategies, not just the ones you like and know best.

Summary

Guided math provides a powerful opportunity for students to learn math. In small groups, you can meet learners where they are and take them to where they need to go. You get everyone talking to each other. You coach learning. You facilitate thinking. You orchestrate masterful conversations. Everyone is invited to engage as thinking mathematicians. Students get to hear how others are doing it, and they also hear themselves make sense of the math they are doing. They get immediate feedback so that they can stay on track. Guided math provides time for students to make more and more sense of math in its growing complexity at a pace that is appropriate for them. Guided math is good for all students. It allows them all to reach their next level.

Reflection Questions

1. Currently, do all the students in your class feel that they can learn math?
2. What do you do with the students who are frustrated?
3. Does everyone participate in mathematical conversations? Who does, how, and under what terms?
4. How do you promote perseverance in your classroom?