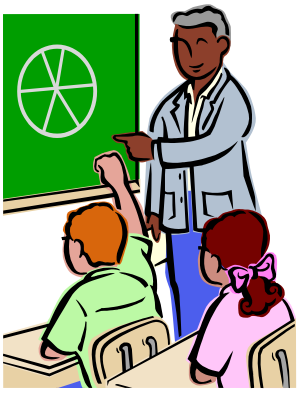
Santee Unified School District

MATHEMATICS PROFESSIONAL DEVELOPMENT

KINDERGARTEN



November 12, 2013

MENTAL MATH

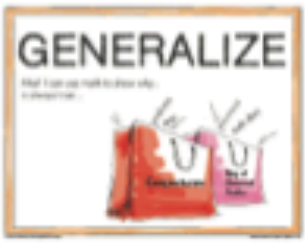
During recess there are 98 students on the playground. 87 students join them. How many students are now on the playground?

Record how you mentally solved this problem.

MATHEMATICAL HABITS OF MIND

To **make sense** of math ideas and problems, I look for *regularity, patterns, structure, representations, connections, and other math I know.* I reflect about my own and others' thinking and mistakes and I persevere to be sure that ideas and problems make sense.

Math ideas and solutions make sense when I can use *regularity, patterns, structure, representations, connections, and other math I know* to **justify** why the ideas and solutions are always, sometimes, or never true.



I use *regularity, patterns, structure, representations, connections, and other math I know* to make **conjectures** about math ideas I think are always, sometimes, or never true. I create **mathematical generalizations** by justifying why conjectures are valid.

To make **S**ense of math ideas and problems, and to support **C**onjectures, **J**ustifications, and **G**eneralizations:	**S, C, J, G**	**Evidence**
I notice and reason about mathematical REGULARITY in repeated reasoning, PATTERNS, and STRUCTURE (meanings, properties, definitions). 		
I create and reason from MATHEMATICAL REPRESENTATIONS – visual models, graphs, numbers, symbols and equations, and situations. 		
I notice and reason about CONNECTIONS within and across mathematical representations, other math ideas, and everyday life. 		
I explore MISTAKES and STUCK POINTS to start new lines of reasoning and new math learning. 		
I use METACOGNITION and REFLECTION. I think about my math reasoning and disequilibrium – how my thinking is changing and how my ideas compare to other mathematicians' ideas. 		
I PERSEVERE and SEEK MORE. I welcome challenging math problems and ideas, and after I figure something out, I explore new possibilities. 		

MATHEMATICAL HABITS OF INTERACTION

When I do math with other mathematicians, we:		Rating (1,2,3,4)	Evidence
Honor each other's right to PRIVATE REASONING TIME before talking about our ideas.			
EXPLAIN how we think and reason mathematically.			
LISTEN TO UNDERSTAND each other's math reasoning about problems, conjectures, justifications, and generalizations.			
Use GENUINE QUESTIONS to inquire about each other's math reasoning about problems, conjectures, justifications, and generalizations.			
Explore MULTIPLE PATHWAYS by applying each other's lines of reasoning.			
COMPARE our math LOGIC and IDEAS to figure out how they are mathematically the same and different.			
CRITIQUE and DEBATE the math logic and truth in each other's reasoning.			
Use MATH REASONING as the AUTHORITY for deciding what is correct and makes sense.			

Mathematically Productive Teaching Routine
Structuring Student Math-Talk

Purposes

- Support the development of student-to-student interaction that is consistently equitable, status-free, and mathematically productive
- Provide formative assessment information that drives instructional decisions

Student Outcomes

- Equitable, status-free, and mathematically productive student-to-student interaction
- Increased metacognitive skills
- Increased capacity to articulate and clarify their math thinking
- Increased math content knowledge
- Improved Mathematical Habits-of-Mind
- Increased accountability and engagement
- Increased self-efficacy as mathematicians

Structures

When students work in a Mathematicians Dyad, Triad, or Quad, the math-talk:

- **Always** begins with "Mathematicians Think Time" (i.e., time to think privately) about the task
- **Always** focuses on each group member's mathematical reasoning, sense making, representations, justifications, and/or generalizations
- **Always** ends with a discussion of ways their ideas are mathematically the same and/or different
- **Always** follows a prescribed structure that provides students "practice" with status-free, and mathematically productive student-to-student interaction

LISTEN & COMPARE 	A. Partner #1 explains her/his ideas while the other partner(s) silently listen to understand Partner #1's thinking. B. When the teacher announces, "*Finish your thought and switch roles*," repeat step A for question/task and student backgrounds. C. (for triads and quads) Repeat until all partners have reported.
REVOICE & COMPARE 	A. Partner #1 speaks while the other partner(s) silently listen to understand Partner #1's mathematical thinking. B. When the teacher announces, "*Finish your thought and Partner #X revoice,"* Partner #X carefully revoices Partner #1's ideas without judging, adapting, or commenting about the correctness or sensibility of the ideas. C. Partner #1 clarifies as needed. D. When the teacher announces, "*Rotate Partners*," Partner #2 speaks while the other partner(s) silently listen to understand. E. When the teacher announces, "*Finish your thought and Partner #Y revoice*," Partner #Y carefully revoices Partner #2's ideas. F. Partner #2 clarifies as needed. G. (for triads and quads) Repeat until all partners have revoiced and reported.
INTERPRET & COMPARE 	A. Two partners exchange their written work for a task. During Private Think Time, the partners study each other's work and, without any discussion, try to understand each other's reasoning. B. Partner #1 reports her interpretation of Partner #2's reasoning. C. Partner #2 clarifies. D. Partner #2 reports his interpretation of Partner #1's reasoning. E. Partner #1 clarifies.

Student Mathematical Discourse Types

Discourse Types	Examples from Case Study
PROCEDURES/FACTS *No evidence of reasoning.* • Short answer to a direct question • Restating facts/statements/rules • Showing or asking for procedures *Uses meanings, definitions, properties, known math ideas to describe reasoning when:* • Explaining ideas and methods • Questioning to clarify • Noticing relationships/connections • **But *doesn't show why* the ideas/methods work**	
JUSTIFICATION *Reasons with meanings of ideas, definitions, math properties, established generalizations to:* • Show why an idea/solution is true • Refute the validity of an idea • Give mathematical defense for an idea that was challenged	
GENERALIZATION *Reasons with math properties, definitions, meanings of ideas, established generalizations, and mathematical relationships as the basis for:* • Making conjectures about what might happen in the general or special cases Or • Justifying a conjecture about what will happen in the general or special cases	

Number of Days in School

Dawn

Kindergarten, December

Each morning, as my kindergarten class gathers on the meeting rug, we run through a routine that helps set our day in motion. This set of rituals includes taking attendance, working with our classroom calendar and weather graph, and recording how many days we have been in school. It is amazing how much mathematics is involved in these activities, and often I am astounded by the thoughtful responses of five- and six-year olds give to such questions as, "What number should we record on our days-in-school chart today?" This morning, our sixtieth day of school, we turned to our days-in-school chart.

Over the years, I have spent a lot of time thinking about the optimal way to record this data with kindergarten students. Many years ago I used a number line that spanned the top of the chalkboard, but found that this was too physically removed from the children, not to mention extremely cumbersome for me. Having seen in the past the merits of using hundreds boards when working with older students, I wondered if this type of grid might have a place in the kindergarten classroom as well. About ten years ago I made a switch to this type of recording system for tracking how many days we have been in school each year. Every day I record the number on our 10-by-18 grid, and the child who is the calendar-helper adds one seashell to a cup that we keep nearby. This provides a set of concrete objects that corresponds to the number being logged on the chart. From time to time, the children count this set of shells, and we then compare our two types of recording systems to connect the quantity of shells with the number we count, read, and write. If necessary, we then adjust our data.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	

To begin our discussion this morning, I asked, “What number should I write on our chart today?” Hands shot up and I began writing responses on the chalkboard next to our chart, hoping to allow as many children as possible to respond before recording the “right answer” on the grid. Often this type of discussion yields some interesting discoveries. Today was no exception.

ANDREW: I think it’s fifty-ten. [*I wrote 510 on the board.*]

JOSEF: Sixty. [Î wrote 60.]

More hands shot up, and Bianca, Jared, Rhea, Terry, Toshi, Pat, John, Sione Susan, and Brady all responded “*Sixty.”* Some children added other comments, too.

TOSHI: I know it’s 60. I just know it is.

Jared, John, and Sione were equally emphatic. Susan seemed a little less sure, but apparently wanted to go along with the general consensus. Still more responses kept coming as more hands were up.

TAMIKA: Forty. [*I wrote 40*]

JERREL: Eight [*I wrote 8*]

NINA: Seventy. [*I wrote 70*]

“How can we find out which number we should write today?” I asked, to continue our discussion.

BIANCA: Counting we could know what comes next.

JOSEF: All the numbers are in front of it, ‘cause 6 comes after 5 you know.

As Josef spoke, he moved up to the chart and pointed to the column of numbers on the right hand side, stopping at the empty box under the 50.

JARED: Yeah, see, zero all the way down.

ANDREW: Don’t forget the 10

Once again, physical involvement seemed a necessity as Andrew moved up to the chart and dragged his finger across the row with the numbers 51, 52, 53, 54, 55, 56, 57, 58, and 59. Andrew seemed to be making use of the number (counting) sequence; thus his response of “fifty-ten” (510) made perfect sense.

BRADY: But it’s a 6 [*Again, moving up point at the chart, Brady’s finger slid down the right hand column just as Toshi’s and Jared’s had as they spoke*.] See, 1, 2, 3, 4, 5, and 6 goes here ‘cause you’re counting down.

TOSHI: See, it’s 60. I know it is.

Sitting toward the back of the group was Norman. Though he didn't speak out in front of the group, my aid was taking notes and later related to me that he was making comments under his breath.

NORMAN: It can't be 8. We already had that one. . . . Five and ten looks like five hundred and ten. That is too big to go there.

Because we needed to move on, I ended this discussion by reminding the children that another way to check was to use Bianca's suggested strategy of counting. Together, as I pointed to each number on our chart, we counted from 1 to 60 and agreed that 60 was the number to be written in the box for today. As we finished there were two final comments:

JOSEF: Are we going to get to 100?

BRADY: Yes, 'cause look, we can count by tens: 10, 20, 30, 40, 50, 60. I think we will get to more than 100.

As I reflect on these events, I am particularly taken by the ease with which some children are able to connect to the systematic way we use numbers. At the same time, I know for sure that not all children in my class are making sense of this experience at this time. Trying to provide opportunities where young children can investigate numbers in a meaningful way is a challenge.

Going Up and Down with Numbers

Wendy

Kindergarten, March

As we start each day in kindergarten, we assemble at the rug area for our opening meeting. One of the things we discuss is the number of children in school. This morning, as usual, we counted the number of boys, which today totaled 9 and then the number of girls, which totaled 8. I wrote on the chalkboard:

9 boys
8 girls

I then asked, “How many boys are out today?”

Natalie raised her hand and answered, “When all the boys are here, we have 10 boys, so today we have 9 boys, so 1 boy is out.”

“How many girls are out today?”

Peter raised his hand and said, “It’s 2.” He knew that there we 10 girls in the class when all were present.

I asked, “How did you figure it out?”

Peter replied, “8 and 1 and …” He seemed to be stuck in his thinking. I feel he did figure it out correctly but then had trouble explaining.

I then asked, “Can someone else tell me how many girls are out today?”

Denisha’s hand went up. She said, “It’s 2, because 8 is 2 numbers down from 10.”

“What does that mean?” I asked Denisha.

“When all the girls are here, it’s 10,” she told us. “You go down from 10 by 1, that’s 9, and down 1 more, that’s 8, so that’s 2”

We usually count around the circle to find the total number in class for the day. I decided instead to see if the children could come up with the total just by looking at the numbers.

9 boys
8 girls.

“How many kids here today?” I asked.

Daniel answer, “17.”

I said, “Daniel, if you look at the numbers of boys and girls, can you tell me how you got 17?” He didn’t replay. I think that Daniel counted around the circle and didn’t want to tell me that.

Rachelle offered, “8 and 9 makes a 1 and 7.” When I asked Rachelle how she knew that, she answered, “I counted in my mind.”

“How did you count in your mind? Say it out loud.”

So she began, “1, 2, 3, 4, 5, 6, 7, 8, 9 . . .” But she didn’t go on. She wasn’t using her fingers, so I’m not sure how she was going to explain the answer.

“Did anyone else figure it out in a different way?” I wondered.

Tamara’s hand went up and she said, “It’s 17, 8 and 9. If you took 1 away from the 9 it comes an 8, and 8 and 8 makes 16, so you put the 9 back. You go up one more from 8, you make a 9 and you have the 8, you get 17. You’re going one more higher than 16.”

I was amazed at how several of the children could see the relationship that numbers have to each other. They used the phrase “going up or down” to describe this. Tamara “went down” one from the 9 to make 8. It seemed easier for her to add 8 and 8, yet she knew that 9 was 1 more than 8 so the 16 had to “go up” by one. I feel that Peter was thinking about “going up” when he said 8 and 1, but couldn’t say the 1 more to make 10. Denisha described “going down” from 10 by 1, and by 1 again to get 8. She then knew 2 girls were absent. Being able to go up and down with numbers seems to be a key to understanding number differences.

Name:_____

Lee has 1 dog and 1 bird.
How many legs in all?

Name:_____

Lee has 1 dog and 2 birds.
How many legs in all?

Student Discourse Observation Tool

Scripting of Student Discourse	Discourse Type P/F, J, or G

Classroom Observation - Reflection

1.
What mathematical ideas did students seem to understand? What is your evidence?

2.
With what mathematical ideas were students struggling? What is your evidence?

3.
How would you characterize the students' mathematical discourse?

Commitments

1. Read the article “3 Ways that Promote Student Reasoning.”

2. Work problems 1b and 2b in the article. Mathematically justify your thinking.

3. Conduct a Structured Math Talk with your students a minimum of one time per week.

4. Bring successes and challenges to our next session.

REFLECTION – Kindergarten – Session One

1. What are key elements of your professional learning from today's session?

2. In what specific way(s) do you intend to refine your practice as a consequence of today's learning?

3. How do you rate the impact of today's work in terms of your learning?

1	2	3	4	5
Unproductive				Highly Productive

Rationale/Comments/Suggestions (continue on back if needed):

Name: _____