

Meaningful Math for Young Children



Sharon M. Carver, Ph.D.
Carnegie Mellon University Children's School

Early Numeracy: Math and the Young Child
REL Southeast Bridge Event June 20, 2014

Practice Guide Emphases

- **Follow Developmental Progressions** (Recommendations 1-3)

- ➔ "Teach number and operations using a developmental progression."
- "Teach geometry, patterns, measurement, and data analysis using a developmental progression."
- "Use progress monitoring to ensure that math instruction builds on what each child knows."

- **Live Math Daily** (Recommendations 4&5)

- ➔ "Teach children to view and describe their world mathematically."
- "Dedicate time each day to teaching math, and integrate math instruction throughout the school day."

Practice Guide Emphases

- **Follow Developmental Progressions** (Recommendations 1)

- "Teach number and operations using a developmental progression."
 - Recognize small collections (**subitize**)
 - **Count** with one to one correspondence to determine the total number
 - Use number and counting to **compare** quantities
 - **Label** collections with number words and numerals
 - **Solve** basic math problems



Practice Guide Emphases

- **Follow Developmental Progressions** (Recommendations 1)
 - “Teach number and operations using a developmental progression.”
 - Recognize small collections (**subitize**)
 - **Count** with one to one correspondence to determine the total number
 - Use number and counting to **compare** quantities
 - **Label** collections with number words and numerals
 - **Solve** basic math problems

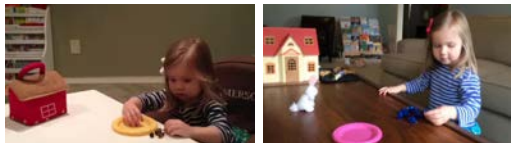


Developmental Progressions

- “Developmental progressions refer to sequences of skills and concepts that children acquire as they build math knowledge.”
- Understanding developmental progressions helps educators support children’s learning by first observing their current levels of understanding and then introducing opportunities to learn the skills and concepts that naturally develop next.
- Sample Learning Trajectories from the **Building Blocks** curriculum show developmental progressions for all 5 domains of Math. https://www.mheonline.com/assets/pdf/program/building_blocks_learning_trajectories.pdf
- Take a moment to review the trajectory headings to identify number and operations (6 headings), measurement (1), geometry (4), patterns (1), and data analysis (1).

Developmental Progressions

- Straightforward observation using natural and structured tasks can reveal a child’s level with respect to any particular learning trajectory.
- Example of Progression from Level 5 to Level 6 re: understanding “cardinality” (i.e., that the last number counted IS the number of objects in the set, or the answer to “how many?”).



Both Trajectories & Standards

- Standards set expectations for grade level benchmarks to help educators focus on clear goals for the year's learning.
- Trajectories emphasize the sequence of development to help educators focus support for each individual's progress relative to the goals, aiming for mastery as a foundation for the next step.
- Trajectories also help educators challenge children, like the one in the videos, who are already above the expected standard for the grade level.
- Note on the Trajectory Progress Charts that Standards are typically derived from the age range ROWS when the Trajectories in each COLUMN are aligned to highlight age level relationships.
- The **Building Blocks** sample is fairly congruent with the **South Carolina: Good Start, Grow Smart Early Learning Standards**.
http://childcare.sc.gov/main/docs/gsgs_finalbook_022608.pdf

Practice Guide Emphases

- **Follow Developmental Progressions** (Recommendations 1)
 - "Teach number and operations using a developmental progression."
 - Recognize small collections (**subitize**)
 - **Count** with one to one correspondence to determine the total number
 - Use number and counting to **compare** quantities
 - **Label** collections with number words and numerals
 - **Solve** basic math problems
- **Live Math Daily** (Recommendation 4)
 - "Teach children to view and describe their world mathematically."
 - Informal methods to **represent math**
 - Link with formal math **vocabulary, symbols & procedures**
 - Use **open-ended questions** to prompt applying math knowledge
 - Encourage **recognition and discussion** of everyday math

Live Math Across All Standards

- Following Practice Guide Recommendations #4 and #5 regarding HOW to teach early math means making math a way of life in the classroom and beyond.
- **Good Start, Grow Smart: Approaches to Learning Standards** emphasize learning through play to increase curiosity, initiative, and persistence in goal-directed reasoning & problem solving.
- **Good Start, Grow Smart** does not have Social Studies or Science Standards, but South Carolina's Kindergarten Standards provide a focus and potential topics for exploration.
 - K Social Studies: Children as Citizens in Families & Communities
 - K Science: Inquiry re: Seasons, Body, Organisms, and Matter

Focus Level & Context for Today

- Today's activities will give you an opportunity to apply developmental progressions to planning ways to live math daily in a particular classroom and grade level.
- First, using the sample trajectories for Number & Operations, identify the likely level for the majority of your incoming class in the fall, so we can use that for our activities. If you have time, identify the fall levels for the other four domains of math too.
- Next, list several possible content areas for exploration based on what you know of the social studies, science, or literature curriculum for that classroom and grade level.
- My examples will come from a class in which the children will be young 5's or older 4's at the beginning of the year, but all 5 by the end of December. They tend to be more advanced than the trajectory predicts for their age because of rich prior experience.

Live Math in School Every Day

- Introduce new topics to the whole group via circle time, story time, and again to small groups during teacher-led activities.



Live Math in School Every Day

- Reinforce concepts and skills via open-ended exploration indoors and outdoors.



Live Math in School Every Day

- Reinforce concepts and skills via open-ended exploration indoors and outdoors.



Live Math in School Every Day

- Build natural, spaced practice into the routines of the day, including circle time, as well as into the weekly schedule.



Live Math in School Every Day

- Engage children in focused practice through structured individual or small group activities and learning centers.



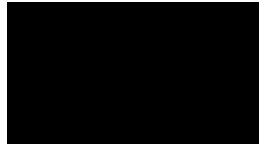
Live Math in School Every Day

- Engage children in focused practice through game play to automatize skills and refine strategies.



Live Math in School Every Day

- Engage children in focused practice through game play to automatize skills and refine strategies.
- Be sure to scaffold the play in ways that emphasize the particular skills and strategies you want the children to learn.



Live Math in School Every Day

- Make the most of all the experiences by including discussion and reflection, which provides additional support for the child's learning AND evidence for the educator's progress monitoring.



Live Math in School Every Day

- Now think about your age level and context. How can you strengthen the early math aspects of your ...
 - Circle Time / Story Time?
 - Teacher-Led Activities?
 - Indoor Exploration?
 - Outdoor Exploration?
 - Daily Routines (entry, cleanup, snack, etc.)?
 - Weekly Routines?
 - Structured Activities / Learning Centers?
 - Game Play?
 - Other Ideas?

The Math of Me & My Class

- Go deeper with applying and integrating math concepts and skills by engaging children in meaningful exploration related to topics of study in the classroom. One common example for the beginning of the year involves a study of Me and My Class, which fits with the social studies topics of family and community, as well as the science topic of my body.
- Natural context for emphasizing Number & Operations, plus Measurement and Data Analysis regarding **Names, Birthdays and Ages, Physical Characteristics, Families, Experiences, Preferences ...**
- For all aspects, Observe -> Identify -> Synthesize -> Compare.
- For advanced learners, extend comparison across classes or subgroups of classes.
- Some possibilities for Geometry and Patterns.

The Math of Me & My Class

- Example of Eye Color re: Observe -> Identify -> Synthesize -> Compare.



- More independent Activity with Graphing for Kindergarten



The Math of Me & My Class

- Example of Birthday re: Identify -> Synthesize -> Compare.



The Math of Me & My Class

- Now think about your age level and context. How might you engage your learners in an extended exploration regarding their ...
 - Names?
 - Physical Characteristics?
 - Families?
 - Experiences?
 - Preferences?
 - Other ideas?
- How might you incorporate Geometry and Patterns?

Practice Guide Emphases

- **Follow Developmental Progressions** (Recommendations 1-3)
 - ➔ "Teach number and operations using a developmental progression."
 - "Teach geometry, patterns, measurement, and data analysis using a developmental progression."
 - "Use progress monitoring to ensure that math instruction builds on what each child knows."
- **Live Math Daily** (Recommendations 4&5)
 - ➔ "Teach children to view and describe their world mathematically."
 - "Dedicate time each day to teaching math, and integrate math instruction throughout the school day."

Practice Guide Emphases

- **Follow Developmental Progressions** (Recommendations 1)
 - "Teach number and operations using a developmental progression."
 - Recognize small collections (**subitize**)
 - **Count** with one to one correspondence to determine the total number
 - Use number and counting to **compare** quantities
 - **Label** collections with number words and numerals
 - **Solve** basic math problems
- **Live Math Daily** (Recommendation 4)
 - "Teach children to view and describe their world mathematically."
 - Informal methods to **represent math**
 - Link with formal math **vocabulary, symbols & procedures**
 - Use **open-ended questions** to prompt applying math knowledge
 - Encourage **recognition and discussion** of everyday math

Live Math in the Real World

- Math abounds, any place, any time!



- Start with the classroom opportunities to explore How many? What shape? What patterns? How big? How frequent?

Live Math in the Real World

- Math abounds, any place, any time!



- Then consider where you live and learn. How many? What shape? What patterns? How big? How frequent?

Live Math in the Real World

- Math abounds, any place, any time!



- Be opportunistic and link with units of study. How many? What shape? What patterns? How big? How frequent?

Live Math in the Real World

The children were then given the hollow blocks and challenged to build a high, stable tower. The group discussed safety parameters, such as putting the heavy blocks on the bottom, using a chair (with an adult) to reach over your head, creating a stable base and taking the top blocks down first. We used a yard stick to measure the towers.



Jermaine, Henry and Shaylee's tower.

Once we practiced building stable towers, we took the Wrecking Ball Challenge. The children, working in small groups, were given 5 minutes to build a sturdy tower using the wooden blocks. When time was up Mrs. Blizman gave the structure three swings with the wrecking ball to test the strength of the building. We learned that buildings with a sturdy base and wider core survived!



David and Savannah's wreckage.

Live Math in the Real World

- Math abounds, any place, any time!
- Pick an Opportunity for Exploration (perhaps inspired by the South Carolina Brochures on your tables) or a Curriculum Topic that would afford rich math investigation.
- Then consult the developmental progressions to determine the starting level for the introductory activities.
- Remember to consider all five domains of math by asking yourself ... How many? What shape? What patterns? How big? How frequent?
- For each domain, specify how the activities you list could be used as part of your progress monitoring to alert you to the need for return to foundational levels or for advancement options.

The Math of Collections

- Young children love collections, so consider engaging them in both group collections based on your priorities and individual ones based on their interests.
- Collections emphasizing citizenship and community might focus on sharing what we have with others.



The Math of Collections

- Young children love collections, so consider engaging them in both group collections based on your priorities and individual ones based on their interests.
- Collections emphasizing natural objects (organisms) or cultural artifacts (matter) invite scientific inquiry.



The Math of Collections

- Pick a Collection Project that would fit the context you are using for today's activities.
- Then consult the developmental progressions to determine the starting level for the introductory activities.
- Finally, use the higher levels of each progression to envision challenges for children who have mastered the baseline concepts and are ready to progress or those whose reasoning is already at higher levels.



The Math of Collections

- **Leaf Collection in a Trees Unit for 3's & 4's**

- **Number & Operations**

- Sort the leaves by species & Count each set.
- Use larger collections with more types for 4's



- **Geometry**

- Identify the shapes of the leaves, particularly to draw the children's attention to coniferous vs. deciduous types.

- **Patterns**

- Arrange the leaves to make patterns that repeat or grow.

- **Measurement**

- Arrange the leaves in order of size, cluster #, # of points, etc.
- 4's Use informal and formal measuring tools and record data.

- **Data Analysis**

- Sort the leaves in many different ways (as above) and record which groups have more, fewer, or the same number.

Reflections

- Which aspects of today's sessions did you find most interesting, helpful, and encouraging. Why?

- What questions did the sessions raise for you?

- Which ideas are you most excited about trying this year?

REL-SE Research to Practice

This information is being provided as part of a Research to Practice Workshop administered by the Regional Educational Laboratory Southeast. Information and materials mentioned or shown during this presentation are provided as resources and examples for the viewer's convenience. Their inclusion is not intended as an endorsement by the Regional Educational Laboratory Southeast or its funding source, the Institute of Education Sciences (Contract ED-IES-12-C-0011).

In addition, the instructional practices and assessments discussed or shown in these presentations are not intended to mandate, direct, or control a State's, local educational agency's, or school's specific instructional content, academic achievement system and assessments, curriculum, or program of instruction. States and local programs are free to use any instructional content, achievement system and assessments, curriculum, or program instruction they wish, insofar as they support the goals and objectives of their state and local education agencies.
