



New Jersey Department of Education



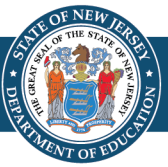
Flexible Small Group Instruction and in Early Learning Mathematics

Melanie Harding

Office of K–3 Grade Education

Division of Early Childhood Services

February 23, 2023



Purpose (1 of 4)



www.ecs.org/per

Written for ECS by Drs. Douglas H. Clements and Julie Sarama (<http://du.academia.edu/DouglasClements>)

Math in the Early Years

► A Strong Predictor for Later School Success

The earliest years of a child's education—from birth through 3rd grade—set the foundation upon which future learning is built. In recent years, state policymakers have emphasized the need to improve children's reading skills early on because a lack in this essential skill is a strong predictor of low student performance and increased high school dropout rates. By 2012, a total of 32 states plus the District of Columbia had policies in statute aimed at improving 3rd-grade literacy, with 14 of those states requiring retention of students on the basis of reading proficiency. While the emphasis on reading proficiency is critical, research shows that the development of mathematics skills early on may be an even greater predictor of later school success. Early knowledge of math not only predicts later success in math, but also predicts later reading achievement even better than early reading skills.

Young children have a surprising capacity to learn substantial mathematics, but most children in the U.S. have a discouraging lack of opportunities to do so. Too many children not only start behind, but they also begin a negative and immutable trajectory in mathematics, with insidious long-term effects. These negative effects are in one of the most important subjects of academic life and also affect children's overall life course.

The good news is that programs and curricula designed to facilitate mathematical learning from the earlier years, continued through elementary school, have a strong positive effect on these children's lives for many years thereafter. Starting early—in preschool—with high-quality mathematics education, creates an opportunity for substantial mathematical learning in the primary years that builds on these foundational competencies.

This issue of *The Progress of Education Reform* reveals five surprising findings about the importance of early math learning, and provides implications and recommendations for state policy.

What's Inside

- Surprise 1: Math's predictive power
- Surprise 2: Children's math potential
- Surprise 3: Educators underestimate children's potential
- Surprise 4: Math intervention for all
- Surprise 5: How children think about and learn math

2013 OCTOBER Vol. 1.6, No. 5

THE PROGRESS OF Education Reform

es

Education Commission OF THE STATE



Surprising Research Findings:

Surprise 1: There is predictive power in early mathematics.

Surprise 2: Given opportunities to learn, young children possess an informal knowledge of mathematics that is amazingly broad, complex, and sophisticated.

Surprise 3: Teachers vastly underestimate what their children know and can learn.

Surprise 4: All students need a math intervention.

Surprise 5: We know a lot!

[Math in the Early Years: A Strong Predictor for Later School Success \(PDF\)](#)



Purpose (2 of 4)



Why should a teacher incorporate small group mathematics in instruction?



“When a teacher tries to teach something to the entire class at the same time, chances are, one third of the kids already know it, one third will get it, and the remaining third won’t get it at all. So, two thirds of the children are wasting their time.”

-Lillian Katz



Purpose (3 of 4)



Differentiation:

How are you currently differentiating in your K–3 math classrooms?



Purpose (4 of 4)



Why Small Flexible Groups?

- Students are all at different developmental levels.
- Targeted instruction in students' zone of proximal development.
- Teachers can reach every student.
- Every student has access to the curriculum and grade level standards.
- Teachers can reinforce content as well as the Standards for Mathematical Practices.
- Mathematical disposition levels can increase.



Agenda



- Beliefs about Teaching Mathematics
- Getting Started
- Small Groups
 - Planning
 - Teaching
- Questions and Sharing





Beliefs



Flexible Small Group Instruction

Common Definition: What beliefs do we have about the Teaching and Learning of Mathematics?

Beliefs about Students Learning Math	Beliefs about Teachers and Teaching Math	Beliefs about Developing Mathematical Proficiency
<p>Children learn at their own pace.</p> <p>All children should be given the opportunity to learn grade level content.</p> <p>All students can learn math.</p>	<p>Teachers need to have solid content knowledge as well as a strong knowledge of student development and learning trajectories.</p>	<p>There is a balance between conceptual and procedural.</p> <p>Math should be taught at the concrete, pictorial, and then abstract levels.</p> <p>Math needs to be taught in small flexible learning groups to provide intentional mathematics instruction to build children's foundational understanding of mathematics.</p>



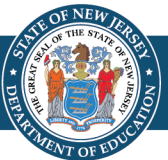
Getting Started (1 of 6)



Defining Flexible Small Group Instruction:

Teachers working with small groups of children to provide intentional mathematics instruction, while the other children are engaged in activities at other centers or with a co-teacher or aide. When teaching small groups, teachers can hear from all children multiple times. Teachers can engage children in multi-turn conversations and tailor instruction to meet children's needs.

[Small Guided Math Groups](#)



Getting Started (2 of 6)



Mathematically Rich Classroom

- Posters
- Anchor Charts (strategy, procedure, content) with QR codes
- Vocabulary/Word Walls
- Landmarked Clocks
- Schedules
- Number Grids, Walk on Number Lines, etc.
- Math Library
- Toolkits
- Math Workstation Storage
- Workstations/ Centers
- Small Group Instruction Area





Getting Started (3 of 6)



More about Tools

- Constructivist approach
- Concrete, pictorial, abstract

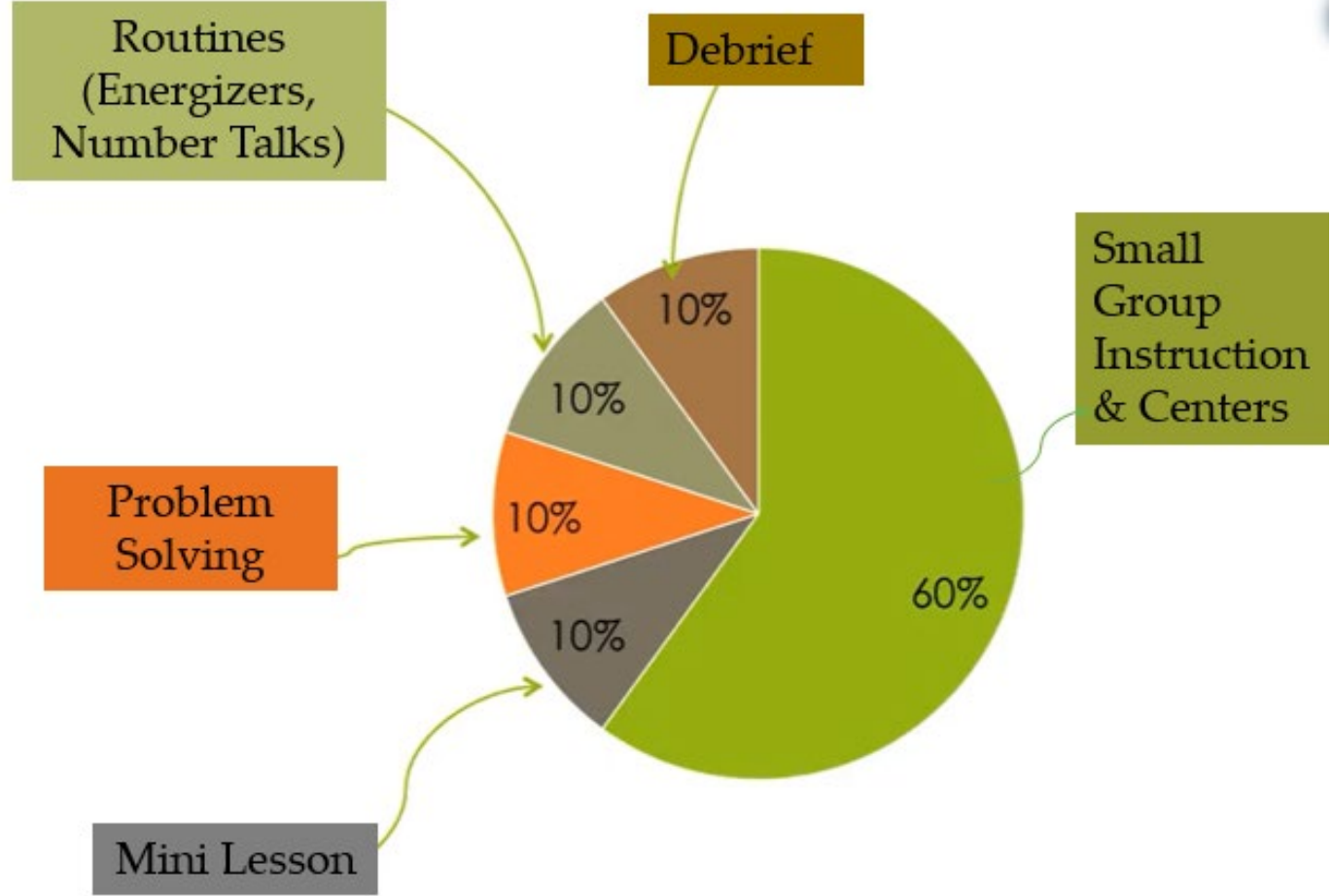
[Using concrete, pictorial, and abstract learning in a small group setting](#)



Getting Started (4 of 6)



Math Block Schedule (Sample)





Getting Started (5 of 6)



Small Group Framework

- Using a small group framework, teachers present engaging interactive, hands-on activities that have been chosen intentionally to help children apply a new idea or skill
- Demonstrate how to carry out the activity and allow children to do the activity several times to get plenty of practice with the new idea or skill.
- Students should talk the mathematics! Discuss and do the math!



Getting Started (6 of 6)



Sample Small Group Framework

Component	Length of time	Description
1. Focus & Learning Expectations	1–2 minutes	<ul style="list-style-type: none">•Teacher presents a focus for the meeting “We are learning to...”•Teacher may direct them to reflect on previous connected learning
2. Model	2–4 minutes	Teacher models or demonstrates the math concept, strategy, or skill.
3. Discuss & Do Math	5–7 minutes	Teacher gives the children opportunities to discuss and ‘practice the math’ (in a group, with a partner, or alone).
4. Monitors Student Work (formative assessment to guide responsive teaching)	throughout	Teacher listens to students’ conversations and watches their work to guide instruction.
5. Debrief & Future Plans	2 minutes	Teacher offers individualized feedback, summarizes major takeaways, highlights main points, and makes any necessary clarifications, and solicit further questions/comments.





Planning (1 of 5)



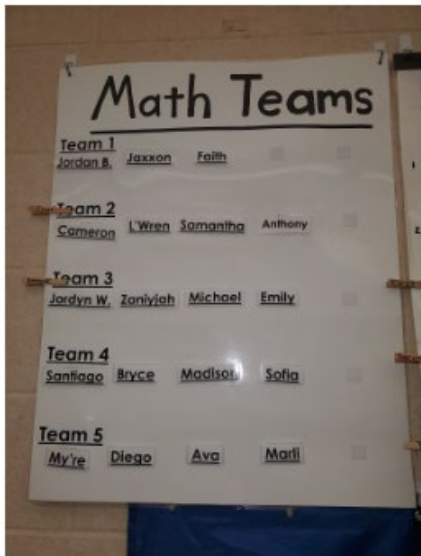
The goal of small group instruction is for students to become confident, competent and curious mathematicians. Planning this component is essential!

- Activities are based on students' needs, interests and choice.
- A variety of lessons pulled from core and additional resources with a focus on hands-on activities and making sense of math.
- Emphasis on doing, understanding, and explaining the math. Lots of math talk!
- Groups are specific, targeted, and flexible (often changing).

Planning (2 of 5)



- The core resource should not provide the plan for instruction. Remember, we don't work for the program...the program works for us!
- Teachers need a system of organization that works for them.





Planning (3 of 5)



Other Resources

- Children follow natural developmental progressions in learning. Curriculum research has revealed sequences of activities that are effective in guiding children through these levels of thinking. These developmental paths are the basis for the learning trajectories.
- Learning Trajectories have three parts - a learning goal, a developmental path along which children develop to reach that goal, and a set of activities matched to each of the levels of thinking in that path. Together, these help children develop to higher levels of mathematical thinking.

Planning (4 of 5)



The Consortium for Policy Research in Education (CPRE) recommends that mathematics educators should recognize research on learning trajectories in mathematics as a respected and important field of work.

learningtrajectories.org/

The screenshot shows the homepage of the Learning Trajectories website. At the top, there is a header with the logo "[LT]²" and the text "Learning and Teaching with Learning Trajectories" and "Early Math - Birth to Grade 3". There are links for "SIGN IN / SIGN UP" and "STUDENT SIGN IN". Below the header is a navigation bar with tabs: "EXPLORE LTS", "EXPLORE GAMES", "ABOUT US", "RESOURCES", and "HELP / HOW TO". The main content area features the title "Learning Trajectories" and a search bar. Below the search bar, there are several activity cards arranged in a grid. Each card has a title and a set of icons representing different mathematical concepts. The cards include: "Counting", "Subitizing", "Comparing Number", "2D Shapes", "Composing 2D Shapes", "Disembedding Shapes", "Measurement: Length", "Measurement: Area", and "Measurement: Volume".





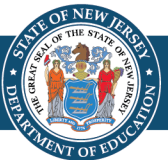
Teaching Small Groups (1 of 5)



While watching the following video consider...

- What is important about the size of the group?
- What is the teacher doing during the small guided math group?
- What are the students doing during the small guided math groups?

[Small Group Instruction](#)





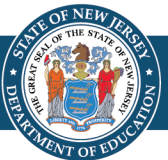
Teaching Small Groups (2 of 5)



Assessment

- Teacher listens to students' conversations and watch their work to guide instruction in the moment. They observe closely the work students are doing, listen closely to what they are saying, and probe deeper through questioning.
- Teacher takes anecdotal notes to plan for future instruction.

Through this formative assessment, teachers understand where students are on a developmental progression and truly personalize future instruction.





Teaching Small Groups (3 of 5)



Assessment

Small guided groups in mathematics gives teachers an opportunity to...

- have multiple close encounters with all of their students multiple times per week.
- observe closely the work students are doing , listen closely to what they are saying, and probe deeper through questioning.
- understand where students are on a developmental progression and truly personalize future instruction.

Use an anecdotal note catcher. Document it!

- Note what the children know well and what they are still working on.
- Record observations about children's knowledge to refer back to and guide decisions about which activities to use next

Teaching Small Groups (4 of 5)



Assessment in Small Group

Skill	Task	Date	Observation	Level of understanding
MATHEMATICS				
Number knowledge				
Using <u>cardinality</u> to show that the last number counted indicates "how many"	Have the child count a small set of items and ask the child to report "how many" items there are after counting.	Nov. 22	<i>I asked Miguel to count out a set of five beans I put in a cup. Then I asked Miguel, "How many beans are there?" and Miguel responded by saying "Five beans!"</i>	<input type="radio"/> Got it <input checked="" type="radio"/> Getting it <input type="radio"/> Not yet
Subitizing to five	Show the child a small set of items, then hide the items before the child can count them. Ask the child to recognize how many items there are without counting.	Feb. 10	<i>First, I showed 1 dot and then quickly covered it. I asked Daiyu to hold up how many fingers corresponded to the number of dots on the plate. Then I showed 2 dots, covered them quickly, and asked Daiyu the same question. I repeated the process with 3, 4, 5 dots. Daiyu could subitize up to 3 but had a hard time with 4 and 5 dots.</i>	<input type="radio"/> Got it <input checked="" type="radio"/> Getting it <input type="radio"/> Not yet
Understanding the concept of "one more"	Have the child count a small set of items. Then hide the items and ask the child to say how many "one more" will be without recounting a group of items.	March 8	<i>I showed 5 dots to Aamir and asked Aamir to count them. Then I covered the dots and asked Aamir to add one more without uncovering and recounting the dots. Aamir got it right after several attempts with different numbers.</i>	<input type="radio"/> Got it <input checked="" type="radio"/> Getting it <input type="radio"/> Not yet

Student's Name: _____

2nd Grade		
Student Learning Objectives	Skill and/or Standard: Must be logged into LT2 to see the learning trajectory	Notes
I can solve 'adding to' word problems within 20 and 100. I can find the unknown in all places. I can use objects, drawings and equations to represent the problem.	Problem Solver +/- (Adding/Subtracting) NJSL: 2.OA.A.1	
I can solve 'taking from' problems within 20 and 100. I can find the unknown in all places. I can use objects, drawings and equation to represent the problem. 5 – 2	Problem Solver +/- (Adding/Subtracting) NJSL: 2.OA.A.1	
I can solve 'putting together' problems within 20 and 100. I can find the unknown in all places. I can use objects, drawings and	Problem Solver +/- (Adding/Subtracting) NJSL: 2.OA.A.1	





Teaching Small Groups (5 of 5)



Closing the small group

- Teachers summarize major takeaways, highlight main points, and make any necessary clarification, and solicit further questions/comments.
- Teacher discusses homework and center work.

Debrief and Future Plans



Closing



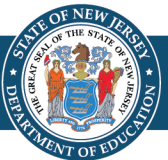
What you can do to better incorporate intentional, data driven small group instruction into K-3 mathematics in your district?



References and Resources (1 of 3)



- Baroody, A. J., Clements, D. H., & Sarama, J. (2022). Lessons Learned from 10 Experiments That Tested the Efficacy and Assumptions of Hypothetical Learning Trajectories. *Education Sciences*, 12(3), 195.
- Baroody, A. J., Yilmaz, N., Clements, D. H., & Sarama, J. (2021). Evaluating a Basic Assumption of Learning Trajectories: The Case of Early Patterning Learning. *Journal of Mathematics Education*, 13(2), 8–32.
- Bates, C. C., Schenck, S. M., & Hoover, H. J. (2019). *Quick and Easy Notes: Practical Strategies for Busy Teachers*. Teaching Young Children.
- Benders, D., & Craft, T. (2016). The effect of flexible small groups on math achievement in first grade. *Networks: An Online Journal for Teacher Research*, 18(1), 724–724.
- Bourassa, Mary. 2013. Which One Doesn't Belong? "Shapes." Retrieved on May 16, 2022, from <http://wodb.ca/shapes.html>
- Carpenter, T. P., Fennema, E., Franke, M. L., Levi, L., & Empson, S. B. (2015). *Children's mathematics. Cognitively Guided Instruction*. Portsmouth, NH: Heinemann.
- Clements, D. H. & Sarama, J. (2010). Learning trajectories in early mathematics – Sequences of acquisition and teaching. *Encyclopedia of Language and Literacy Development* (pp. 1–6). London, ON: Canadian Language and Literacy Research Network. Retrieved March 21, 2022 from <http://literacyencyclopedia.ca/pdfs/topic.php?topId=270>
- Clements, D., & Sarama, J. (2013). Math in the early years: A strong predictor for later school success. *ECS Research Brief, The Progress of Educational Reform*, 4(5), 1–7.

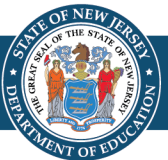




References and Resources (2 of 3)



- Clements, D. H., & Sarama, J. (2018). Myths of early math. *Education Sciences*, 8(2), 71.
- Clements, D. H., & Sarama, J. (2021). Learning and teaching with learning trajectories [LT]2. Retrieved from Marsico Institute, Morgridge College of Education, University of Denver. Website: [LearningTrajectories.org](https://www.learningtrajectories.org)
- Frye, D., Baroody, A. J., Burchinal, M., Carver, S. M., Jordan, N. C., McDowell, J. (2013). Teaching math to young children: A practice guide (Practice Guide No. NCEE 2014-4005). Washington, DC: National Center for Education and Regional Assistance. Retrieved from http://ies.ed.gov/ncee/wwc/Docs/PracticeGuide/early_math_pg_111313.pdf
- Katz, L. G. (1999). *Another Look at What Young Children Should Be Learning*. *ERIC Digest*.
- Newton, N. (2019). *Leveling Math Workstations in Grades K–2: Strategies for Differentiated Practice*. Routledge.
- Newton, N. (2021). *Guided math in action: Building each student's mathematical proficiency with small-group Instruction*. Routledge.
- National Research Council 2001. *Adding It Up: Helping Children Learn Mathematics*. Washington, DC: The National Academies Press.
- Pellegrini, M., Lake, C., Neitzel, A., & Slavin, R. E. (2021). Effective programs in elementary mathematics: A meta-analysis. *AERA Open*, 7, 2332858420986211.

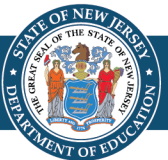




References and Resources (3 of 3)



- Preparing Young Children for School. Practice Guide Introduction. WWC 2022009. (2022). In *What Works Clearinghouse*. What Works Clearinghouse.
- Tal, C. (2018). The Challenge of Implementing Small Group Work in Early Childhood Education. *Global Education Review*, 5(2), 123–144.
- Taylor, S. (2020). From Circle Time to Small Groups: Meeting Children’s Needs. *Teaching Young Children*. April/May 2020 Vol. 13, No. 4
- Tomlinson, C. A. (2000). Differentiation of Instruction in the Elementary Grades. ERIC Digest.
- Van de Walle, J., Lovin, L. A. H., Karp, K. S., & Bay-Williams, J. M. (2018). *Teaching Student-Centered Mathematics: Developmentally Appropriate Instruction for Grades Prek–2: Volume I*. Pearson Education Limited.
- Vgotsky, L. S. (1978) *Mind in Society; The Development of Higher Psychological Processes*. Cambridge, MA: Harvard University Press.
- Wright, J., & Hoonan, B. (2019). *What Are You Grouping For?* Corwin. Thousand Oaks, California





Thank You!



New Jersey Department of Education: nj.gov/education

Melanie Harding

Office of K–3 Grade Education

Division of Early Childhood Services

melanie.harding@doe.nj.gov

Follow Us!



[Facebook:](#)
[@njdeptofed](#)



[Twitter:](#)
[@NewJerseyDOE](#)



[Instagram:](#)
[@NewJerseyDoe](#)

