Supporting Numeracy Development for Children with Autism

Mary Jimerson, MA, Doctoral Student, UNM-Autism Programs – Sr. Program Therapist/Autism Consultant
Linda Stam, Autism-Specific Teacher
Fatima Mendoza, General Education Teacher

Overview: Supporting Numeracy Development for Children with Autism

In this presentation participants will be provided with strategies on:
- how to prepare for numeracy.
- using ongoing assessment.
- accommodations and modifications to support numeracy activities.
- Inclusive practices for Numeracy development

Preparing for Numeracy

- How to support successful numeracy experiences
  - Setting Up Environment
  - Organizing and Planning Schedule
  - Organizing Numeracy Materials
Preparing for Numeracy

- Setting up an environment conducive for learning numeracy skills.
  - Learning centers with embedded numeracy materials: counting games, manipulatives, measurement materials, etc.
  - Math rotations with facilitated numeracy activities: counting strips, linking cubes, number lines, etc.
  - Using labels, defined spaces, visual schedules, choice boards

Preparing for Numeracy

- Organizing and Planning Schedule
  - Look for opportunities to teach numeracy
  - Large group: Circle time, snack time, calendar
  - Small group: priming opportunities for students with ASD, board games, interactive numeracy embedded within literacy activities.
  - Independent tasks: setting table for snack, task folders, work stations, structured teaching activities

Preparing for Numeracy

- Organizing Numeracy Materials
  - Preparing differentiated task folders
  - Hands on manipulatives for concrete learning
  - Rotating high interest games
  - Math center specific to standard
Ongoing Formative Assessment

- Definition of Assessment
- Critical first step in identifying where instruction begins
- Guiding Instruction with Assessment
- Toolbox of Formative Assessments
- Accommodations for Formative Assessment

Ongoing Formative Assessment

- Definition of Assessment according to Williams (2011)

  “An assessment functions formatively to the extent that evidence about student achievement is elicited, interpreted, and used by teachers, learner or their peers to make decisions about the next steps in instruction that are likely to be better, or better founded, than the decisions they would have made in the absence of that evidence.” (Larson et al. 2012)

Ongoing Assessment Humor

"You have to solve this problem by yourself. You can't call tech support."
Ongoing Formative Assessment

- Critical First Steps in Ongoing Formative Assessment
  - Get to know students
  - Identify the curriculum
  - Collaborate with team
  - Familiarize with standards and goals/objectives
  - Review past and present IEPs
  - Review working folders

Ongoing Formative Assessment

- Guiding Instruction
  - At beginning of lesson provide a clear and understandable version of standard (child friendly language, pre-rubrics)
  - Determine the building blocks (sub skills needed)
  - Provide meaningful, timely feedback to students
  - Use a variety of assessments (Larson et al. 2012)

Applying to Real Life Humor

“Are there enough problems in the world already?”
Ongoing Formative Assessment

Formative Assessment Toolbox

- Key questioning during whole class
- Mini white board responses
- Traffic Lights: check for understanding
- All student response systems: clickers
- Diagnostic interview questions: engage in evaluative questioning during small group/center work
- Checklists
- Goal Attainments Scale
- Rubrics
- Portfolio documentation: work samples, data, observations

Ongoing Formative Assessment

Accommodations for Formative Assessment

- Untimed assessment
- Complete fewer number of problems
- Chunking assessment over period of time
- Frequent breaks
- Accept varied end product
- Minimized distractions
- Lower Verbal instruction
- Visual aids
- Use of manipulatives/concrete materials

Ongoing Assessment

Accommodations/Modifications for Ongoing Formative Assessments

- Have mindset that all students can learn
- Use authentic assessment over period of time (chunking an assessment)
- Use fewer problems to assess math skills
- Check for understanding
Ongoing Assessment

- Collaborative teams use ongoing assessment feedback to improve instruction
  - How much of lesson/materials were student centered, cognitively demanding tasks, student questioning versus teacher directed?
  - Is there mathematical discussion?
  - What ongoing formative assessments were used throughout the lessons?
  - Did the teacher seek evidence of understanding?
  - What evidence was there of a learning community, mathematical practices, student understanding?

Accommodations for Learning Numeracy

- Pacing
- Environment
- Presentation of subject materials
- Types of Instruction
- Materials
- Assignments
- Assessments
- Motivation and Positive Climate
- Social Interaction Support

Accommodations for Learning Numeracy (Horstmeier, 2004)

- Pacing
  - Vary activities
  - Allow more breaks
  - Work on vocabulary prior to lesson
- Environment
  - Reduce/minimize distractions
  - Visually structure environments
Accommodations for Learning Numeracy

- Presentation of Subject Material
  - Visual
  - Auditory
  - Tactile-kinesthetic
  - Experiential (naturalistic experiences)

- Type of instruction
  - Functional application of academic skills
  - Varied group instruction
  - Errorless learning

Accommodations for Learning Numeracy

- Materials
  - Hands on learning materials
  - Presented in multiple modalities
  - Duplication of materials

- Assignments
  - Visual Organizers
  - Reduce paper and pencil tasks
  - Reduced number of assignments
  - Chunking

Accommodations for Learning Numeracy

- Assessments
  - Breaking into chunks
  - Various types of assessment

- Motivation and positive climate
  - Offer choice
  - Planned motivating sequence of activities
  - High number of positive reinforcement
  - Verbal praise
  - Concrete reinforcement
  - Token economy
  - Use strengths and interests
  - Cultivate a general positive attitude
Accommodations for Learning Numeracy

- Social interaction supports
  - Shared experiences in school
  - Structured activities to foster social interactions
  - Train, reinforce, and rotate peer tutors

Instructional Strategies for Inclusive Practice

- Environment
  - Clearly Articulated Learning Targets
  - Activities
  - Student Engagement
  - Defining Teacher Roles

Instructional Strategies for Inclusive Practice

- Environment
  - Inclusion classrooms should have settings that mirror each other as much as possible.
  - Visual schedules
  - Quiet spaces
  - Independent Work Stations
  - Communication Tools
  - Temptation Shelves
  - Defined learning spaces
Instructional Strategies for Inclusive Practice

- Clearly Articulated Learning Targets
  - Clipboards with individualized goals
  - Goal Attainment Scales
  - Posted Standards
  - Verbal articulation of targets

- Learning Activities
  - Language of Numeracy: Make sure to emphasize language rather than just math
  - Provide variety of settings: small group, large group, independent tasks, learning centers
  - Naturalistic Activities: setting table, lining up, counting steps, flying a kite, cooking
  - Extensions of Learning: Newsletter Home connections, Family Field Trips, Family Nights

- Student Engagement
  - Peer models
  - Teacher facilitated activities
  - Heterogeneous small groups
  - Strategic preferred seating near peers
  - Building time on task in group settings
  - Preferred peer choice
  - Token economy
Instructional Strategies for Inclusive Practice

- Defined Teaching Roles
  - Build on Strengths
  - One teacher leads, another teacher takes data
  - Engage with children
  - Communication with all families GE/SE
  - Consistency with behavioral strategies
  - Assign specific tasks/children
  - Full participation at Professional Learning Communities

New Mexico 3 and 4 Year Old Early Learning Outcomes and Indicators

Numeracy #9 The child understands numbers, ways of representing numbers and relationships between quantities and numerals.

- 9.1 Uses one-to-one correspondence in counting increasingly higher groups of objects
- 9.2 Uses numbers and counting as a means for solving problems and determining quantity.
- 9.3 Recognizes some numerals.

1:1 Correspondence: Match My Dots

From Teaching Math to People With Down Syndrome and Other Hands-on Learners (Horstemeier 2004)

Objectives: Students will match correct number of sticks with dots on cup. Students will count which is the predecessor for counting.

Procedure: Label one can with 1 dot, another with 2 dots, etc. Challenge students to put one stick in for each dot on the can. Have students check their answers by counting sticks and dots.

Generalization in classroom: Put lined in muffin pans, pass out construction paper, playing duck-duck-goose, setting dinner table, putting produce in a bag at grocery store.

Differentiating: Number of cans used. Color code the cans, clothespins for fine motor, make addition problems using multiple cans.
Numeral Track Activity

From Teaching Numbers in the Classroom with 4-8 Year Olds (Wright 2006)

- Students identify missing number on number track.
- Procedure: Place any series of numbers on a number track. Cover a number. Have students match correct number from 3 cards. Flip cover to see if it is correct.
- Differentiating: For younger children use dots. For more advanced students use higher series of numbers.
- Generalization: Counting buttons on elevator, Hopscotch, Measuring tape
- Assessment: observational data collection

Dot Concentration

From Teaching Numbers in the Classroom with 4-8 Year Olds (Wright 2006)

- Objective: Students will match corresponding dot cards to develop number sense.
- Procedure: Set out two sets of cards on table with dots 1-5. Student looks at cards and matches pairs. Student counts dots on cards to check their work.
- Generalization: matching games, dice, dominos.
- Differentiating: Dots 1-10, Color code 2 sets, have 1 set of numerals and 1 set of dots.

Using a Number Line

From Teaching Math to People With Down Syndrome and Other Hands-on Learners (Horstmeier 2004)

- Objective: The students will be able to represent the numbers on a number line with concrete materials.
- Procedure: Show the number line to the student, point out the numbers and have him identify them. See if he can put the right number of chips or blocks on the numbers.
- Differentiating: Vary the numbers on the number line, use a blank chart to draw the circles instead of concrete chips, Use candy pieces, ask what number comes before or next on the number line.
- Accommodation: Set up as a paired activity with a buddy.
Visual Spotting

From *Teaching Math to People with Down Syndrome*, Horstmeier 2004

- **Objective:** Student quickly identifies number of spots on a dice without counting.
- **Procedure:** Roll dice at the table or small carpet. Have students take turns identifying how many dots are on the dice as quickly as possible.
- **Generalization:** Board games with dice, dominoes, etc.
- **Differentiating:** Allow more time for students that need to count, time students that have conservation of numbers.

Five Frame Flash

*Teaching Numbers in the Classroom with 4-8 Year Olds* (Wright 2006)

- **Objective:** Students will develop ease with making five.
- **Procedure:** Display a flash frame for half a second. Have students take turns guessing how many dots were shown. Or hand out five frames with different quantities to students and the matching student to the frame flashed stands up.
- **Differentiating:** Have students count when it is their turn, think-pair-share what number they saw, slow down or speed up amount of time of the flash.

Five Little Speckled Frogs

- **Objective:** Students develop number sense making five.
- **Procedure:** Students sit at carpet and sing a long to story with hand gestures. Five students selected to act out frogs jumping into pool. Students keep track on fingers how many frogs are on log.
- **Generalization:** Five Little Monkeys, Five Little Ducks, etc.
- **Differentiating:** Preteach song in small group so all can participate, allow students with special needs to participate first and for shorter periods of time, use manipulatives when it isn't their turn, give them copy of book while activity is going on.
Bunny Ears
Teaching Numbers in the Classroom with 4-8 Year Olds (Wright 2006)

- Objective: Students will think figuratively about numbers and practice making 5.
- Procedure: Teacher models how to make five using two fists (5/0, 4/1, 3/2, 2/3, 1/4, 0/5). Then children make two fists above their heads. Teacher practices making 5 with the children using two fists. Then she calls out: Show me five. Show me five a different way. Show me five a different way.
- Differentiating: Teacher shows one hand of numbers and have students show what the other hand would be. Buddy children up and have one student hold up one fist and the other child hold up the other fist. Preteach in small group.

M & M’s © Counting Book activities

- Objective: Students will develop 1:1 correspondence.
- Procedure: Students dump M & M’s © on a plate. They sort into color groups and count how many they have in each group.
- Differentiating: Have some students graph in small group, put colors on different plates to help students sort, put dots on plates to help students with 1:1.

Additional Read Alouds

It is important to have a variety of books to include multi-cultural and diverse interests to help reach all children in the classroom. Here are some of our favorite counting books:

- The Big Storm: A Very Soggy Counting Book
- Chicka Chicka 1,2,3
- Counting Crocodiles
- Counting on Snow
- Five Green and Speckled Frogs
- Five Little Monkeys
- Mouse Count
- Pete the Cat and His Four Groovy Buttons
- Ten Little Fingers and Ten Little Toes
- Ten Black Dots
- 12 Ways to Get to 11
- M & M’s Counting Book
- Cheerios Counting Book 1,2,3
References


Common Core State Standards

Common Core State Standards Domains

- Counting and Cardinality (K)
- Operations and Algebraic Thinking (K-3)
- Number and Operations in Base 10 (K-3)
- Number and Operations Fractions (3)
- Measurement and Data (K-3)
- Geometry (K-3)

(Larson et al. 2012)

Common Core State Standards Mathematical Practices

- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.
- 5. Use appropriate tools strategically.
- 6. Attend to precision.
- 7. Look for and make use of structure.
- 8. Look for and express regularity in repeated reasoning.