

# EARLY HEAD START TIP SHEET

No. 29

Infant/Toddler Math & Science Development, July 2008

## **Does Early Head Start support math and science development with infants and toddlers?**

### **Response:**

Yes, the child development and education approach for all children requires that Early Head Start must provide for the development of each child's cognitive skills. This includes math and science.

With infants and toddlers, it is important to create trusting relationships that allow them to be ready and willing to explore. Adults join the children's curiosity by noticing children's interests, encouraging exploration, and creating play opportunities that highlight math and science concepts. However, supporting math and science development for infants and toddlers looks very different than for preschool-aged children. For example, talking with a baby about the similarities and differences of objects ('Your socks are red like the flowers') helps them explore the concept that objects have properties. This discovery is important for the later math and science skills of sorting or classifying.

For more examples of ways adults can support discovery opportunities for math and science concepts with infants and toddlers, please see the attached addendum: **Supporting Math and Science Discovery with Infants and Toddlers**.

### *Emerging math and science knowledge*

For healthy and optimal development to occur, infants and toddlers need strong, trusting relationships with caring adults with whom they feel safe to explore and discover. As very young children interact with supportive adults and explore the world around them, they are discovering who they are, how their bodies work, and how they fit in within their environment. They also begin to develop concepts that form the foundation for their emerging mathematical and scientific knowledge.

Infants and toddlers develop the foundations for scientific and mathematical knowledge through their:

- Natural curiosity (such as intently watching an adult's expressions and actions or turning over a rock to see what's underneath);
- Readiness to repeat actions that have an interesting effect (such as dropping a spoon from the high chair to see how many times a willing adult will retrieve it); and
- Need to explore and make sense of the world (such as trying various ways to fit a toy inside a container).

### *Role of the adult*

The adults' role is to create the trusting relationship that allows the child to be ready and willing to explore. Adults should be mindful to provide appropriate materials for exploration, share in the child's curiosity, and help the child make sense of the experience in an age-appropriate manner (by connecting new information to what they already know). More often than not, we are

already providing opportunities for exploring math and science concepts with infants and toddlers. However, it is certainly important to be aware of how and why we intentionally provide these experiences.

#### *Adult attitude counts*

Adults' attitude toward math and science can affect their ability to support young children's developing mathematical knowledge. Many adults do not think their math or science skills are strong, and so may lack confidence that they can support this learning in young children. It is important for staff and parents to be aware of their personal attitude towards math or science since these may impact their math- and science-related interactions with children.

Programs may want to consider providing opportunities for parents and staff to experience and 'play with' math and science materials before they are introduced to the children. This allows time for adults to gain comfort, confidence, and perhaps enjoyment in these experiences and concepts. Even adults who don't like math or science can demonstrate excitement through simple math or science experiences – such as including counting games with the baby ('1, 2, 3 – bounce') or exploring things in nature ('Look at the buds on the trees!').

#### **Questions to Consider for Planning and Programming:**

- How does the program support staff members and parents in understanding the process of cognitive development with infants and toddlers in general and, specifically how they develop early math and science concepts?
- How does the curriculum plan describe its approach for supporting and enhancing infants' and toddlers' cognitive development and learning?
- How do staff members and parents support curiosity and wonderment for math and science in infants' and toddlers' play and routines throughout the day? How do they relate math and science experiences to children's interests? How do they ensure that children have the time to explore math and science concepts in playful ways?
- How does the program support staff members and parents in developing or enhancing their own math and science knowledge so that they can better assist the child's process?

#### **Performance Standards, Title 45, Code of Federal Regulations:**

- 1304.21(4)(a)(i)-(iv) Grantee and delegate agencies must provide for the development of each child's cognitive and language skills by:
  - (i) Supporting each child's learning using various strategies including experimentation, inquiry, observation, play and exploration;
  - (ii) Ensuring opportunities for creative self-expression through activities such as art, music, movement, and dialogue;
  - (iii) Promoting interaction and language use among children and between children and adults; and
  - (iv) Supporting emerging literacy and numeracy development through materials and activities according to the developmental level of each child.

- 1304.21(b)(1)(ii)-(iii) Grantee and delegate agencies' program services for infants and toddlers must encourage:
  - (ii) Trust and emotional security so that each child can explore the environment according to his or her developmental level;
  - (iii) Opportunities for each child to explore a variety of sensory and motor experiences with support and stimulation from teachers and family members.
- 1304.21(b)(2)(i) Grantee and delegate agencies must support the social and emotional development of infants and toddlers by promoting an environment that encourages the development of self-awareness, autonomy, and self-expression.
- 1304.3(5)(i)-(iv) Curriculum means a written plan that includes:
  - (i) The goals for children's development and learning;
  - (ii) The experience through which they will achieve these goals;
  - (iii) What staff and parents will do to help children achieve these goals; and
  - (iv) The materials needed to support the implementation of the curriculum.
 The curriculum is consistent with Head Start Program Performance Standards and is based on sound child development principles about how children grow and learn.

## Resources:

**Domains of Child Development: Mathematics.** *The Early Childhood Learning and Knowledge Center.* DHHS/ACF/OHS.

<http://eclkc.ohs.acf.hhs.gov/hslc/ecdh/eecd/Domains%20of%20Child%20Development/Mathematics> (accessed August 14, 2010).

Early Head Start National Resource Center (EHS NRC). **Early Head Start Tip Sheets.** *The Early Childhood Learning and Knowledge Center.* DHHS/ACF/OHS.

- **10: How can an EHS Program have a Written Curriculum with Lesson Plans and Still Follow the Baby's Lead as He/She Creates His/Her own curriculum?** March 2003.
- **17: How do EHS Programs Divide an Infant/Toddler Classroom into Separate Learning Areas?** November 2003.
- **29 [Addendum]: Supporting Math and Science Discover with Infants and Toddlers.** July 2008.

EHS NRC. **Technical Assistance Paper, 6: The Foundations for School Readiness: Fostering Developmental Competence in the Earliest Years.** DHHS/ACF/ACYF/HSB. 2003.

Epstein, Ann S. **"Mathematics and Scientific Inquiry."** *The Intentional Teacher: Choosing the Best Strategies for Young Children's Learning.* National Association for the Education of Young Children (NAEYC). 2007.

Geist, Eugene. **"Children are Born Mathematicians: Encouraging and Promoting Early Mathematical Concepts in Children Under Five."** Presentation: 1<sup>o</sup> Congreso internacional lógico-matemática en educación infantil. 2006.

[http://www.waece.org/cdlogicomatematicas/ponencias/eugenegist\\_pon\\_ing.htm](http://www.waece.org/cdlogicomatematicas/ponencias/eugenegist_pon_ing.htm) (accessed August 14, 2010).

Kehl, Rita and Judy Ballweg. **Infants and Toddlers - Developmental Milestones in Mathematics.** *Launching into Literacy and Math.*

[http://oldweb.madison.k12.wi.us/tnl/lilm/early\\_math/infants&toddlers/milestones0-3-math.html](http://oldweb.madison.k12.wi.us/tnl/lilm/early_math/infants&toddlers/milestones0-3-math.html)

(accessed August 14, 2010).

Kehl, Rita and Judy Ballweg. **Infants and Toddlers – Math Thinking Skills.** *Launching into Literacy and Math.*

[http://oldweb.madison.k12.wi.us/tnl/lilm/early\\_math/infants&toddlers/math\\_thinking\\_skills.html](http://oldweb.madison.k12.wi.us/tnl/lilm/early_math/infants&toddlers/math_thinking_skills.html)

(accessed August 14, 2010).

**Young Children Journal: Mathematics in the Early Years.** NAEYC. (May 2009).

**Young Children Journal: Science.** NAEYC. (November 2009).

PBS Parents. **Early Math: Infants and Toddlers.**

<http://www.pbs.org/parents/earlymath/infant.html> (accessed August 14, 2010).

Simpson, Jean and William Ritz. **“A Head Start on Science.”** *Head Start Bulletin*, 67:

Curriculum in Head Start. DHHS/ACF/ACYF/HSB. (March 2000): 30.

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*This Tip Sheet is not a regulatory document. Its intent is to provide a basis for dialogue, clarification, and problem solving among Office of Head Start, Regional Offices, TA consultants, and grantees. If you need further clarification on Head Start Policies and regulations, please contact your Regional Program Specialist.*

## **Supporting Math and Science Discovery with Infants and Toddlers**

### **Addendum to Early Head Start Tip Sheet No. 29**

*Below are examples of ways adults can support discovery opportunities for math and science concepts with infants and toddlers:*

**Patterning** (exploring repeated cycles or similar relationships):

- Provide predictable yet flexible daily routines. Although the exact mealtime may vary slightly on a daily basis, always wash hands before meals and brush teeth afterwards so that children gain an understanding of daily patterns.
- Provide opportunity for children to notice patterns in songs or stories (For example, the song *Head, Shoulders, Knees, and Toes* and the book **Goodnight Moon** provide a repetitive sequence that young children enjoy. Eventually they begin to anticipate the pattern of motions in the song or of spotting the mouse in the book).
- Use language and point out logical sequences in daily routines ('First the sock goes on then your shoe.').
- Ask the children to predict what might happen next during familiar stories ('What do you think the bunny will do next?'), routines (What do you think we will do when you're done with snack?), and play experiences ('What do you think will happen if you add another block?').

**Classifying** (comparing similarities and differences, sorting by various attributes, putting objects into different categories, and arranging objects by various characteristics):

- Provide opportunities and sufficient time for children to explore materials and observe their environment – at their pace.
- Provide opportunities for toddlers to assemble and then explore collections (walk to the park to collect fallen leaves that will be used to fill the sensory table).
- Compare objects and point out differences in color, shape, and size.
- Provide an environment that includes a variety of age-appropriate manipulatives (blocks, interlocking blocks such as DUPLO®, links), collections (plastic animals, cars, leaves, rocks), dramatic play props (variety of clothing, dishes, dolls) and art materials (fabric samples, tongue depressors, sticks) in different colors, shapes, sizes to offer classifying and sorting experiences throughout the day.
- Use language and point out similarities and differences in, for example, toys and blocks, as toddlers put them on the shelf during cleanup time.
- Provide opportunities for toddlers to sort objects according to a characteristic ('Let's find all of the blue trucks?' 'Can we find a fatter stick?').
- Provide safe opportunities for children to observe, explore and investigate natural objects (indoors and outside) such as non-toxic leaves, flowers, and plants or time to observe ants on the sidewalk or fish in an aquarium.

**Measurement** (exploring concept of size and weight; and doing comparisons):

- Provide materials for toddlers to explore and compare sizes (various sized cups in water table to sort by size, to empty and fill, or to nest or stack; various sized like-figurines such as cats and kittens as props, or various dishware in the dramatic play area).
- Use language to compare dimensions such as overall size, height, weight, or loudness. Infants and toddlers tend to use terms such as big - too big, loud – too loud as comparisons. Expand the comparison and vocabulary with other qualifiers such as little, quiet, hard, soft, heavy, light, short, tall, high, or low.
- Ask prediction questions ('Do you think this ball will float?' or 'How many jumps do you think it will take to get to the sandbox?')

**Spatial relationships and shapes** (exploring the placement and properties of objects; and how they fit together):

- Provide opportunities for mobile infants and toddlers to explore spatial relations (set up spaces/materials for them to climb in [boxes], on [structures], or under [tables]).
- Use language to describe position relationships amongst materials using words such as ‘next to,’ ‘on,’ ‘under,’ ‘in,’ ‘out.’ (‘You’re sitting next to Amanda.’ ‘Can you put your cup on the table?’ ‘Oops, the ball rolled under the table.’ ‘You put the blocks in the basket!’ ‘Let’s get your bottle out of the refrigerator.’).
- Provide opportunities for children to build 2-dimensional and 3-dimensional shapes by putting simple shapes together (use various types/shapes of blocks [fabric, wooden, cardboard, paper towel tubes cut into proportionate sizes (e.g. full tube/ ½ tube / ¼ tube)], interlocking blocks such as DUPLO®, links, nesting/stacking materials, playdough).
- Identify objects by their properties (‘The ball is round.’ ‘The box top is flat.’ ‘The tile floor is smooth but the carpet is bumpy.’).
- Provide opportunities for children to experience how shapes can transform (provide cube- or ball-shaped clay pieces for the children to flatten; place ice cubes in water table so children can observe them melting).

**Number and quantity** (exploring how much there is of something that can be measured):

- Provide a variety of collections of objects for manipulating, organizing, comparing, and counting (plastic animals, cars, blocks, toy dishes, etc.)
- Identify small quantities of items (Child saying: ‘I got **two**!’ ‘**More** juice.’ Adult noting: ‘You found **one** of your shoes. Where’s the other one?’ ‘We have **two** dolls – one for each of you.’ ‘You have **so many** blocks!’).
- Provide different sizes of containers and scoops during water and sand play. Use proportionate sizes (e.g. ¼ cup; ½ cup; 1 cup) when possible.
- Provide opportunities for mobile infants and toddlers to experiment with full and empty.
- Count small numbers of items during play or meal times (when child seems receptive and counting doesn’t interfere with a goal that child is trying to achieve, such as carefully stacking blocks).

**One-to-one correspondence** (exploring how items work together in one-to-one relationships):

- Provide an environment that contains a variety of objects that match up with another item (cars and garages, containers with lids, etc.).
- Point out one-to-one relationships during meaningful experiences (‘There is one cup of juice for you, one cup for me, and one cup for Billy.’).

### References:

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<http://www.eric.ed.gov/PDFS/ED372952.pdf> (accessed August 14, 2010).
- Wittmer, Donna and Sandra Petersen. **Infant and Toddler Development and Responsive Program Planning: A Relationship-Based Approach**. New Jersey: Pearson Education, Inc., 2006.