All Hands On!  

SCIENCE INQUIRY WITH YOUNG TODDLERS

Science may not be a topic that families emphasize with their toddlers. Instead, families may focus on sharing story books, building structures with blocks, exploring crayons and paint, and simply playing with toddlers’ favorite toys. These are all excellent choices, but the world of inquiry-based science offers surprising opportunities for toddlers too. The following article describes how Montessori principles contribute to inquiry-based learning for young children. Examples of engaging, developmentally appropriate activities come from Rochester Montessori School’s toddler learning environment as well as a traditional toddler classroom. The latter is consistent with fundamental Montessori principles and is located on the campus of the University of Wisconsin in La Crosse, WI (UW-L). Activities can easily be adapted for exploration at home, with adult supervision. Both classrooms serve children between 24 and 36 months. Dawn Hayes teaches at Campus Child Care and Sarah Dennis is an assistant teacher at Rochester Montessori. Dawn’s toddler class includes teaching assistants and student teachers from UW-L.

INQUIRY BASED LEARNING APPLIED TO YOUNG SCIENCE LEARNERS

The Educational Broadcasting System, Thirteen Ed Online, and the Disney Learning Partnership collaborated ten years ago to create a series of research-based online professional development workshops that remain timely. Their Inquiry-based Learning workshop states that “the process of inquiring begins with gathering information and data through applying the human senses: seeing, hearing, touching, feeling tasting and smelling” (Exline & Costas, 2004). Inquiry based learning is the guiding premise for toddler exploration and learning.

Dr. Montessori advised teachers and families to design learning environments that foster concentration, order and independence as well as fine motor coordination (Montessori, 1967a). Of these four developmental aims, concentration typically captures the attention of classroom visitors. Both professional educators and prospective parents often express surprise at the degree of concentration displayed by children as young as 20 months. Lillard (2005) points out a possible connection between concentration and self-regulation.

“...concentration might be an engine of self-regulation, which is associated with many positive personality variables. Dr. Montessori saw concentration as the moment of self-development” (pp. 265 – 266).

Science activities, if designed appropriately, offer opportunities for toddlers to develop concentration. For example, a toddler may explore what is magnetic and what is not magnetic through repeated trials for as long as 15 minutes. He/she may explore pushing a tractor through a bin of dried beans, pausing to attach a wagon and load it with beans, and then resume investigating how to pull the tractor with the loaded wagon. Careful and amazingly patient concentration accompanies these scientific investigations.

The National Science Teachers Association emphasizes the importance of an inquiry-based approach for young children in the following statement.

Scientific inquiry reflects how scientists come to understand the natural world, and it is at the heart of how students learn. From a very early age, children interact with their environment, ask questions, and seek ways to answer those questions. (NSTA Position Statement, 2004).

Posing open-ended questions that ask why and how something happens is an essential aspect of inquiry-based learning. While toddlers are not quite ready to fully answer such questions, they listen attentively to follow-up responses. For example, a parent might encourage his or her toddler to make a prediction with the following question. “Will the piece of paper sink or float?” Once the toddler responds, provide a short explanation. “The paper gets heavy as it absorbs water. Then it sinks.” Developmentally appropriate statements and succinct questions nurture toddler inquiry as they explore their environment. The ultimate goal is to promote and extend curiosity and purposeful approaches to science learning.

AMAZING DEVELOPMENTAL COMPETENCIES OF TODDLERS

Toddlers ages 24 to 36 months are naturally curious. They wonder, “What will happen if...” as they explore their surroundings with keen focus and high energy (Honig, 2002). Will this car fit inside this box? Can I push this wagon over this hill? What’s going on in that room around the corner? Toddlers are driven to explore their surroundings (Copple & Bredekamp, 2009; Montessori, 1967b).

Skills within each developmental domain contribute to the success of these ongoing explorations. Most young toddlers are sturdy walkers, and many are competent runners. This mobility helps as they move from one object of interest to the next. Even more helpful, they are typically able to move from standing to kneeling, to squatting, to sitting, and then back to standing with ease.
The quality of interactions between adults and young toddlers is the heart of true learning. They are able to pick up and explore small items and generally can resist mouthing them. Young toddlers understand simple requests and are learning new words at an amazing rate. Eighteen month olds have a vocabulary of approximately 5 to 20 words. At 24 months they have increased their vocabulary to a range of 150 to 300 words (Child Development Institute, 2012). They can express their own feelings and are beginning to recognize how others feel as well.

Young toddlers work at making sense of their world by comparing and contrasting. As they explore similarities and differences, they are building perceptual foundations that eventually form the basis for understanding such abstract questions as, “What is the same?” and “What is different?” All understanding of inquiry-based learning, and respectful adult-child interactions. Descriptions are modified to provide families with ideas for carrying out these activities at home.

**SCIENCE ACTIVITIES FOR YOUNG TODDLERS**

The following descriptions offer examples of engaging inquiry-based learning activities for toddlers. Some were carried out at Rochester Montessori School and some at the Child Care Center on the campus of the University of Wisconsin at La Crosse. All required an in-depth appreciation of how toddlers learn, an understanding of inquiry-based learning, and respectful adult-child interactions. Descriptions are modified to provide families with ideas for carrying out these activities at home.

**PHYSICAL SCIENCE**

Investigating a variety of items is an inviting aspect of sink/float activities. Dependent variables include weight (heavy and light) as well as texture (absorbent and repellent). While young toddlers are not yet able to process these abstractions, they readily embrace guessing (a precursor to predicting) whether items will sink or float.

Midwestern winters bring frozen sidewalks. Rock salt is used to melt icy walkways in order to make them safe for young children. Toddlers are fascinated with this chemical reaction. Parents can create a safe and meaningful way to explore this phenomena by placing ice in a clear plastic tub, making colored salt water solutions in small containers, and then helping your toddler fill an eye dropper with this solution.

**ASK AND THEY WILL LEARN: THE ROLE OF QUESTIONS IN INQUIRY-BASED LEARNING**

A key to the success of learning activities for toddlers is the use of specific, developmentally appropriate questions. Opportunities to engage children through questions occur naturally as children investigate the world around them. Appropriate science activities provide a structure for closer investigations. Six inquiry processes provide a helpful framework for investigative questions (Martin, Jean-Sigur, & Schmidt, 2005; Padilla, 1990). Investigations be-
gin with observation, for example looking carefully at how the tempera ice melts on paper. Simple questions help young children focus their observations (What color is the paint now?). Classification occurs as children form groups of objects (Is the pumpkin a flower or a vegetable?). Young toddlers communicate new concepts as they respond to questions about their discoveries (Tell me how the pulp feels, how can you make the balls roll up the plane?). Investigations may involve measurement (How many droppers will it take to begin melting the ice? Will more beans fit in the tractor wagon?) or predictions (Will this ping-pong ball sink or float?). As young toddlers mature, they begin to make inferences (Does this tall sunflower remind you of your Dad?) as they draw on previous experiences with similar scientific phenomena. While most young toddlers are not able to process this level of thinking, exposing them to meaningful inferences lays the foundation for later abstractions.

The six components of the inquiry cycle are typically applied to science. However, they apply to the wider realm of the learning process. Toddlers learn about the world around them through each of these six processes. They observe, predict, infer and communicate as they explore picture books or make muffins or count ants on the playground. Montessori recognized this natural process as the heart of education.

We discovered that education is not something which the teacher does, but that it is a natural process which develops spontaneously in the human being. It is not acquired by (only) listening to words, but by virtue of experiences in which the child acts on his environment.

Have fun as you engage your toddler in the fascinating world of inquiry-based science. Your young explorer is certainly ready to embrace this rich learning opportunity!

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Ann holds a BS in Communicative Disorders from Northwestern University, a Masters in Early Childhood Education from Xavier University, and a Doctorate in Early Childhood Special Education from the University of Maryland. Ann was a Montessori teacher with 3 through 6 year-olds before completing her doctoral studies in Early Childhood Special Education. After thirty years as an early childhood professional, she still truly believes the best way to make the world a better place is to provide ALL young children and their families with the highest quality early learning experiences possible.

**REFERENCES**


