
FEATURE

Children's brain development: A primer

Overheard at the start of a session on children's brain development at a recent ECE conference: "Why do I need to know that? I'm a preschool teacher, for goodness sake, not a doctor!"



The answer to the question is complex. Yes, best practices are established and, if heeded, probably support children's brain development. However, competent professionals want to know the underpinnings—where those best practices come from and why they matter. In fact, best practices reflect current scientific research balanced by the anecdotal reports of competent, responsive educators. Best practices give teachers accurate and proven guidance on what works in most classrooms, for most children, most of the time. Best practices don't harm children or impede their optimal development.

It's useful, then, to review and consider the current research on how children learn and how teachers can make a difference in children's outcomes.

Ages and stages

When teachers talk about what is *developmentally appropriate* for children, they have in mind both children's ages and the range of skills (stages) a typically developing child of that age has mastered. It's important, then, to use commonly accepted definitions of children's chronological ages. Here, infants are children from birth to 12 months; toddlers are children from 12 to 36 months; preschoolers are children from 36 to 60 months (3-5 years). These wide age ranges suggest a vast array of skill development in any particular child based on the environment, experiences, personality and temperament, culture, and heredity.

Across these age ranges, children develop in identified domains: cognitive, social, emotional, and

physical. While practitioners have identified characteristics of each domain, researchers point out that development is fluid and crosses domains. Writing a letter, for example, requires physical skill (muscles that hold and manipulate a pen), cognition (communication skills that employ vocabulary and word meaning), social interaction (desire to engage with another person), and emotional awareness (the writer's intention and purpose). Developmental stages are shaped by the dynamic, ever-changing, and continuous interaction between biology **and** experience. Think about the ways in which children build and use skills within the developmental domains.

Social development reflects the ways in which a child relates to others. It impacts play, cooperation, conflict resolution, handling anger, and common interpersonal interactions.

Emotional development reflects how a child perceives himself or herself. It's an indicator of a child's self-confidence and sense of self-worth; it impacts



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how a child feels and expresses those feelings.

Cognitive development refers to a child's increasing ability to explore, perceive, evaluate, learn, and communicate about the world and the people in it.

Physical development reflects the changes that occur over time including size, weight, coordination, and small and large muscle control.

Research and experience indicate that diet, environmental factors, adult-child interactions, disease, heredity, culture, and geography have impact on all developmental domains. If a child has limited access to nutritious food, for example, that child is likely to be underdeveloped physically with poor social, cognitive, and emotional reserves: "If I'm hungry, I'm cranky, I don't want to read a book, and I don't want to play."

Why brain science matters

Over the past 20 years, technology has offered unprecedented opportunities to study the brain and the process of brain development. Practitioners no longer rely simply on observations and anecdotal records to describe development. Magnetic Resonance Imaging (MRI) and functional Magnetic Imaging (fMRI) are noninvasive tools that provide real-time images of the brain and brain function. Positron Emission Tomography (PET) scans allow researchers to observe and measure brain structure and activity.

Using these and other research tools, scientists have given early care and education practitioners

new ways to think about children's brains and the impacts of early experiences. One key finding is that there are critical windows—prime opportunities for specific kinds of skill and learning development.

Early care and education professionals want to be attentive to these windows in order to support optimal skill mastery and long-term developmental outcomes for children.

RECOGNIZE THAT EVERY CHILD IS UNIQUE.

We are born with about 100 billion neurons or brain cells. Children's brains develop, building skills across domains, by strengthening the connections or *synapses* between these cells. The quality and type of interactions between adults and children have life-long impact. Brain science tells us that satisfying children's basic needs (food, shelter, clothing) isn't enough. It's clear that early experiences and responsive, attentive care impact both the physical structure of the brain (neurological connections) and the child's long-term outcome and success across all domains.

During infancy (birth to 12 months), the critical task is to support the development of neurological connections, to offer opportunities and interactions that strengthen the neural pathways that result in smooth, strong, and tightly linked connections among brain cells. Connections that are used are strengthened; those that are ignored are *pruned* or discarded as unessential. Infant brains must make connections to the environment—the people and things in that infant's life. The quality of adult-infant interactions impacts brain development. Children with responsive, attentive caregivers fare best.

Toddlers (12 to 36 months) further strengthen connections through interactions with both people and things in the environment. By the age 2, a child's brain is as active as that of an adult **and** the rate of activity continues to rise through the first decade of life.

Play materials should offer challenges while being enjoyable. Conversations should be meaningful. The



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environment should allow safe and satisfying exploration and discovery. Critical in this period is the development of language and communication skill. Hearing new words and sounds strengthens neurological connections enabling toddlers to explore and interact in their environments more expansively. Between 12 and 24 months, toddlers typically develop a vocabulary of more than 250 words, understanding the meaning of many more. By middle toddlerhood, children learn to use new words every day, connecting those words into simple sentences. Strong neural connections enable a toddler to remember where a favorite toy is stored, to point to the storage spot, and to ask for the toy by name. Strong neural connections enable a toddler to move from concrete (what I can see now) to symbolic thought.

MAINTAIN ROUTINES THAT OFFER SECURITY AND TRUST.

Preschoolers (36 to 60 months) continue to build and reinforce brain connections through interactions with other children, adults, and objects in the environment. Play offers the immediate tools for brain growth; symbolic thought enriches activities and broadens all skill sets. Play scenarios give preschoolers opportunities to process information, make sense of interactions, and build a storehouse of information for future use. Opportunities for repetition (repeating and remembering an activity, interaction, or task) and rehearsal (building on what is familiar with new ideas or materials to reinforce, elaborate, or integrate information) are critical.

Risks to optimal development

Just as there are critical periods for specific kinds of brain growth, there are also times when negative experience (or the absence of responsive relationships) can have serious and sustained impact on children. Trauma (including exposure to environmental toxins like nicotine, alcohol, and lead), neglect, and violence can interfere with brain development and impair skill development across domains.

Research has also shown that many risk factors are

exacerbated by or associated with poverty. Economic deprivation impacts nutrition, access to medical care and intervention services, safety, and continuity of care, both at home and in early care and education programs.

It is promising, however, that the research is consistent in recognizing the positive impact of prevention and early intervention services. While some disorders and environmental impacts are difficult to reverse, timely intervention can minimize risks and improve outcomes across all domains.

Improving practice through responsive care

Research, and brain imagery, show us that warm, responsive care of children is not only comforting but also critical to healthy development. Without consistent, knowledgeable, and practiced care, children find chaotic environments that thwart development.

Use the following guidelines as a starting place for providing the care and experiences that help ensure children's optimal development—across all domains.

Infants

- Provide lots of face-to-face time—talking, smiling, singing, and describing. Take every opportunity to build communication pathways; your face and hands are critical to an infant's security and evolving trust in others.
- Give special attention to sensory learning—seeing, hearing, smelling, touching, and tasting.



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- Ensure the environment is appropriately stimulating, ordered, and ready for exploration.
 - Supervise groups of infants vigilantly, and build trust by immediately responding to children in need.

Toddlers

- Recognize that toddlers need lots of one-on-one time with adults but are beginning to recognize their peers as separate and unique.
- Prepare the environment for stimulating, repetitive activities including early pretend play.
- Offer support—personal and environmental—for both large and small muscle development.
- Maintain routines that offer security and trust.

Preschoolers

- Support developing social play and children's attempts at self-regulation.
- Provide consistency—in routine, schedule, and guidance techniques.
- Ensure environmental features that appropriately reflect children's interests and skill development.

All children—at all ages

- Recognize that every child is unique.
- Develop secure, attentive relationships.
- Be attentive to health, safety, and nutrition needs.
- Respond to cues. Ask questions, make observations, and help children see you as an ally in their development and happiness.
- Encourage exploration and discovery through play.
- Master the techniques of positive, supportive guidance.
- Ensure routines and establish rituals that help children build self-regulation skills.
- Communicate—non-verbally; in meaningful conversations; and with books, songs, and finger plays.

Resources

Center on the Developing Child. <https://developingchild.harvard.edu>.

National Association for the Education of Young Children. www.naeyc.org.

Urban Child Institute. www.urbanchildinstitute.org/why-0-3/baby-and-brain.

Zero to Three. www.zerotothree.org. ■