
Teacher-child interaction

How are you at brain building?

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More than 10 years ago, breakthroughs in neuroscience started to reshape early childhood education. New research tools—including Magnetic Resonance Imaging (MRI) and Positron Emission Tomography (PET) scans, for example—offered scientists and researchers noninvasive tools for observing brain structure and function. Physicians now have tools that help diagnose and treat neurological disorders. And teachers have new tools—and real scientific research—to direct and support practices that impact children’s development.

The new science, coupled with alarming statistics on children’s physical and psychological health, has fueled an evaluation of practices in child development, education, and social policy. For the last decade, regulatory forces and policy makers have underscored the key findings of current brain research:

- An individual’s ability to grow and learn depends on the interplay between nature (genetic factors) and nurture (the environment—interactions with people and things).
- The human brain is hard wired to benefit from rich experiences and interactions, particularly during the early years.
- Learning is lifelong.

A brain primer

The *brain* orchestrates the way people see, think, feel, hear, communicate, taste, smell, speak, move, analyze, evaluate, balance, create, and respond. The brain controls how a person receives information, analyzes it, and encodes, stores, and recalls it in memory.

The average brain weighs about 3 pounds and has developed to full size by the time a child is about 6 years old. As it develops, the brain responds to waves of chemical signals that stimulate different areas at different times. These responses allow researchers to describe a typical developmental sequence and prime times for particular kinds of learning and skill development.

The *cerebrum*, the largest and most complex portion of the brain, has two *hemispheres* or sides. The right hemisphere controls the left side of the body; the left hemisphere controls the right side. Each hemisphere is divided into four large sections called lobes.

The *frontal lobe* governs reasoning, judgment, and voluntary movement.

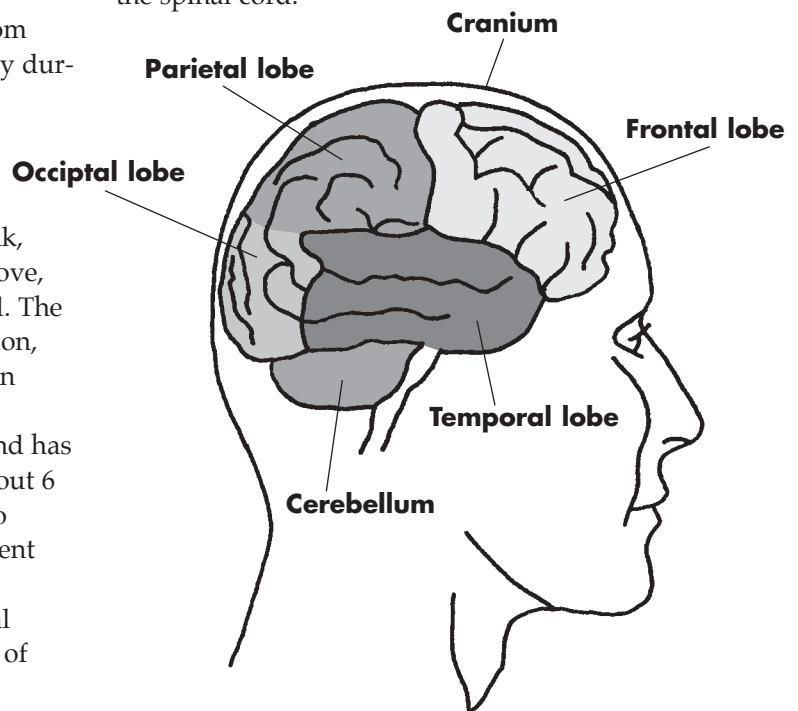
The *parietal lobe* controls spoken language ability and governs the sense of touch.

The *occipital lobe* is responsible for vision and reading ability.

The *temporal lobe* contains the centers for hearing, smell, and memory.

The *cerebellum*, located below the cerebrum, controls posture and muscle reflexes.

The *central nervous system* (CNS) connects the brain and spinal cord to carry nerve messages between the brain and the body. The *cranium* (top of the skull) and facial bones protect the brain. *Vertebrae* (hollow spinal bones) protect and support the spinal cord.





The *peripheral nervous system* (PNS) is a network of nerves that connect the CNS with the rest of the body—skin, muscles, and organs. It is not protected by bone and is more subject to trauma and toxins. The PNS includes two subsystems. The *somatic nervous system* (SNS) coordinates body movement and outside stimuli. The *autonomic nervous system* (ANS) controls unconscious functions like breathing, digestion, blood circulation, and blinking.

The *limbic system* connects the areas of the brain that control emotion. Part of this limbic system, the *hypothalamus*, controls body temperature, sleep cycles, mood, hormonal processes, hunger, and thirst. It works with the *pituitary* gland to produce and regulate hormones. The hypothalamus and pituitary gland are tiny structures at the base of the brain.

From this overview, it's clear that the brain is a complex organ. It's also clear that various parts and functions are connected, and have an enormous impact on perception, feeling, thinking, and learning.

What makes brains powerful?

Each part of the brain is made up of cells, or *neurons*. Here is where the real work of the brain goes on. Each cell has branches, or *dendrites*, that take in electrochemical information, and an *axon*, a long fiber that sends out information. The information flowing between cells occurs as electrochemical sparks or *synapses*.

At birth, a child's brain has about 100 billion neurons, but almost half are unconnected. It's like a new house with a breaker box but no wiring inside the rooms. New experiences—talking, touching,

eating—stimulate neurons and cause synapses to occur. Repeated experiences strengthen these electrical pathways. Connections that are not reinforced are pruned and fall away.

By age 3, a child's brain has about 1,000 trillion synapses—twice as many as in the brain of the child's parent. That number holds steady for about 10 years. By late adolescence, half the synapses will have been pruned. The remaining 500 trillion will remain relatively constant throughout the rest of the child's life.

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The first three years of life offer a remarkable window of opportunity for learning, especially for language. For example, an infant's brain is able to detect all the sounds of all spoken languages. If a caregiver speaks only Spanish, the connections for Spanish will be strengthened and the potential for Cantonese or Swahili will be pruned. As pruning accelerates, the synapses that have been reinforced become permanent. That's why learning languages

is easier in early childhood and harder—but not impossible—in adolescence and adulthood.

The more experiences and interactions a child has with people and the environment, the more synapses develop in the child's brain. The richer the interactions, the stronger the synapses. Neural networks formed during early childhood build the brain power that enables information processing throughout life.

Research shows that children's development and capacity for learning depend on both genetic traits and the environmental factors—nutrition, surroundings, and interactions—that are provided or withheld. Genetic factors are in place at birth. Environmental factors begin to have impact during the prenatal period and continue through the lifespan.

The early years of infancy and preschool offer an enormous opportunity for parents, teachers, and other caregivers to help build neural networks in children's brains. Every positive interaction with people and materials builds a stronger brain. Every negative interaction or forgotten opportunity weakens potential.

How do you rate in brain building?

Use the following characteristics and behaviors to evaluate your interactions with infants and young children.

You read and respond to children's cues.

- You know each child's skills, needs, and interests.
- You use gentle touch to respond, guide, and redirect.

- You pay attention to children's communication tactics—crying, smiling, signing, or speaking.
- You provide an environment that is safe, clean, and inviting.
- You build and expand children's interests with questions, props, and materials.
- You respond with flexibility to unforeseen events, accidents, and needs.

You respond to children's developmental needs.

- You create learning spaces for exploration and investigation.
- You scaffold children's learning by connecting concepts, questions, opinions, and ideas.
- You foster creativity and initiative.
- You are attentive to children's emotions and routinely give explanations, offer choices, and acknowledge feelings.
- You work to form a solid base of child development theory to provide learning opportunities across developmental levels from sensory to symbolic.
- You respond to children's unique interests and skills with both interpersonal support and environmental materials and equipment.

You use positive guidance and respond to behaviors and events consistently and fairly.

- You apply behavioral consequences without shaming or blaming.
- You anticipate needs and interactions and are prepared to respond quickly and calmly.
- You foster independence.
- You offer predictable responses to behaviors, avoiding inconsistency and abruptness.



- You apply simple rules appropriate to children's ages and developmental levels.
- You maintain reasonable expectations that are appropriate to children's ages and developmental levels.
- You demonstrate confidence and optimism in children's skills and behaviors.
- You model and foster problem-solving skills.

You ensure a healthy environment.

- You are attentive to children's nutritional needs and foster good eating habits.
- You maintain a pleasant meal-time environment.
- You arrange classroom and outdoor spaces to safely build developmental skills.
- You encourage daily physical exercise according to the children's ages and developmental levels.
- You demand a smoke-free environment and minimize the use of toxic cleaning agents.
- You offer options for active and quiet independent play that is respectful of children's emotional and social needs.

You delight in literacy, language, and learning.

- You speak directly and frequently to children, using their names regularly.
- Your conversations with children support and construct appropriate language patterns and conventions.
- You support curiosity about literacy by providing books and other print materials appropriate to the children's ages and developmental levels.
- You introduce language and build fluency skills with songs, finger plays, rhymes, and signs.

You value children's play.

- You play games with children appropriate to their ages and developmental levels.
- You provide materials and equipment that allow children to create and observe interactions between people and things.
- You support play that helps children integrate new ideas while gently challenging and broadening existing skills and notions.
- You model and foster wonder.

You model empathy and compassion.

- Your interactions with children reflect your belief in the value of all children.

- You create situations in which children can observe and learn from each other without competition.
- You actively teach about feelings, kindness, and compassion with specific observations and comments.
- You model cultural and ethnic sensitivity and build your curriculum using anti-bias practices and techniques.

You strive for balance in interactions.

- You recognize the impact of temperament and personality in children's growth and development.
- You tailor your interactions with children to maximize positive, constructive results.
- You work in partnership with children's parents.

You express delight in children's development.

- Your body language—and often your voice—reflect joy and interest in children's growth and development.
- You strive to make your teaching authentic and attentive to particular children with specific interests at a given time.
- You share and encourage curiosity.
- You communicate your interest in the real value of every person in every circumstance.

You reflect on your role in children's lives.

- You take time for regular self-examination and evaluation of your teaching practices.
- You seek collaboration and peer support.
- Your treasure your professional affiliations and demonstrate loyalty to the highest standards of practice.

Your impact lasts a lifetime

Learning occurs throughout one's life. But it's during the early years that the learning pathways are laid down and connected in the brain. Early sensory and physical experiences—touching, talking, reading, singing, crawling, running, jumping, playing—wire the brain for learning and growth.

The care and nurturing you provide will have a lifelong impact on a child's development and cognitive success.