The Thinking Brain

by Pam Schiller

The human brain is the most fascinatingly organized three pounds of matter on this planet, maybe even in the universe. Although often compared to a computer, it is far more complex and far more capable. In fact, the human brain takes in and organizes more information in one day than a computer is capable of processing in years.

The human brain is responsible for imagining and creating the spaceship that took us to the moon, the Alaskan pipeline, laser surgery, baseball, the automobile, the computer, the "Blue Danube," the Mona Lisa, electricity, spaghetti, and play dough. All of this from an organ that is about the size of a grapefruit and that, even then, utilizes only a fraction of its capacity.

Our understanding of the capabilities of the human brain has undergone several modifications. With advancements of technology, we have come to a whole new understanding of how the brain is constructed and how it functions. We have moved from an unsophisticated model that suggested the head (brain) was responsible for our thinking and the body was responsible for everything else to the knowledge that our brain is responsible for our actions and emotions as well as our thoughts.

Long before birth, the brain is building neural pathways (connections) that will be responsible for everything from our breathing and sight to our abilities to speak, think, and reason. Although genetically the structure is in place, it will be up to the environment to strengthen and grow the pathways. Our brain is made up of tens of millions of basic neural networks that function simultaneously and in interconnected combinations. Despite the debates about left and right hemispheres and special areas of the brain related to multiple intelligences, the brain functions as an integrated whole.

This article will focus on the cognitive aspects of the key findings on brain research. We will explore how and when we can strengthen the neural networks (pathways) associated with our cognitive abilities. We will also explore brain functions: attention, processing, memory, and retention. Environmental influences and suggestions for the classroom are located in the sidebar on page 52.

Neural Networks

Brain research suggests that we have from birth to the age of ten to help children develop the wiring of the

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brain. After that time, a pruning process begins, leaving the child, for better or worse, with a brain that is uniquely his or hers for a lifetime. The more one reads about brain research, the more it becomes evident that the key to our intelligence is the recognition of patterns and relationships in all that we experience. Strengthening a child's neural network then becomes a job of helping the child develop an awareness of patterns and relationships and helping him or her make connections between those patterns and relationships and all new information.

Brain Functions

Our brain is constantly collecting information from the environment . . . an average of about 40,000 stimuli a second. About 95% of this information comes to us through our vision, hearing, and touch. All of this information enters our short-term memory but at an unconscious level. Since it is impossible for the brain to attend to this many pieces of information at once, it begins a screening process, seeking out what is relevant and registering only the information that matches an individual's experiences.

The filtered information is passed on to our working memory (still short term). It is here that we consciously attend to the information and attempt to make sense and meaning of it. It is here that we focus and give our conscious attention to the information for the first time. If we are able to connect the new information with existing information (if it makes sense and has meaning), it will be stored in our long-term memory.

There are two kinds of long-term memory: procedural (how to do something) and declarative (remembering names and objects). Declarative memory can be further classified as episodic (memory of details pertaining to personal history) or semantic (memory of facts independent of one's personal history). If the information stored in long-term memory is preserved in such a way that it can be located, identified, and retrieved accurately in the future, then we say retention has occurred.

There are a number of strategies that enhance attention, processing, memory, and retention. Here are a few strategies along with suggested activities for early childhood classrooms:

- **Emotions enhance memory.** Events that are accompanied by intense emotion are more easily recalled. Think of a year. Then think of an event that occurred in your life that year. Was an emotion attached to that memory?

  Use laughter, stories, and music when introducing new information. For example, if you are teaching a lesson on farm animals, start by singing "Old MacDonald's Farm."

- **Diet activates memory.** Proteins are necessary for converting outside stimuli to electrical signals within the brain. We all need 20 to 30 grams of protein each day.

  Offer snacks like peanut butter, cheese, deviled eggs, nuts, and yogurt.

- **The more connections made between new information and existing patterns in the brain, the greater the chances of moving information from working memory to long-term memory**.

  Offer many different opportunities for gathering and processing information. For example, when studying zoo animals, you might want to take a field trip, read a book, shape animals from clay, classify the animals, make up zoo stories, and so on. You get the picture.

- **Learning about something within meaningful context increases memory.** Meaningful context requires that the material being presented is relevant and that the learner can make connections between the material and information he or she already understands or sees a need to understand. One of the best ways to create meaningful context is to start with the whole and work to the parts.

  When introducing a new skill or concept, read or tell a story that illustrates how it is useful. For example, before practicing patterning, tell a story about a child who used patterns to create something or to solve a problem.

- **Novelty can boost memory. Our bodies release chemicals when under stress.** Positive stress increases adrenaline, negative stress increases cortisol. Both chemicals act as memory fixatives. Novelty creates positive stress because when a situation is different from existing patterns the learner is challenged.

  Teach a lesson outside. Switch places with another teacher one day. Work puzzles upside down. Change your room arrangement. A typical preschool classroom is a good example of novelty because we change activities frequently.

- **We remember the first and last of a lesson better than we do the middle.** Psychologists call this the BEM principal — beginning, end, middle — the order in which we are most likely to remember something.

Offer short episodes of learning with more beginnings and endings and less middles. If you are studying dinosaurs, give one or two points of information each day instead of stating all the facts at once.

■ **Memory is kept more accurate by revisiting the information frequently.** Each time we review information, variables change (i.e., the context, the learner, the age of the learner, etc.).

Revisit information two or three times a week.

■ **Practice makes permanent.** When we practice what we've learned over a period of time, retention is increased. For example, remembering a dance is easier when we practice it over a period of time as opposed to practicing it several times in one day.

It's the old concept of elaboration being preferable to acceleration. Provide many opportunities for children to practice new skills. For example, make patterns outside using shadows, in the art center with paints, in the block center with blocks, during the day with transitions and routines.

Brain research information has provided concrete evidence of how important the early years are to healthy development and of how critical early experiences and interactions are to providing an opportunity for all children to reach their full intellectual potential. Each week there are between 75,000 and 80,000 babies born in this country alone. That gives us an average of 77,500 opportunities to do it right.

As a profession committed to the well being of all children, it is our responsibility to help brain research information make its way into every home, every early childhood classroom, and every piece of legislation affecting children. The information provides a clear road map for achieving a brighter future for all children. If everyone who reads this edition of *Child Care Information Exchange* will pass information on to just two people . . . think of the reach we can have. Who will you tell?

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Environmental Influences on Cognitive Functions

1 The brain functions better on several small meals each day as opposed to three big meals each day. Too much time in between eating can cause loss of concentration and decreased alertness. Offering several nutritious snacks a day optimizes brain function.

2 Water enhances brain alertness. All humans need eight to ten glasses of water a day. Drinks that contain caffeine act as a diuretic and further deplete the brain of hydration. Fruit juice, because of the sugar content, is received by the body as a food. When food is digested, it requires water, and so instead of more hydration reaching the brain the opposite occurs. Offer children ample opportunities to have water. Keep it readily available in the classroom. Plan activities that use water, such as experimenting with using straws of varied sizes.

3 Aromas can stimulate mental alertness and memory. Peppermint, basil, cinnamon, rosemary, and lemon are believed to enhance alertness. Lavender, orange, and chamomile regulate stress. In the classroom, you might want to make potpourri, and use scented play dough or scented paints.

4 Colors enhance brain functions. Yellow, beige, and off-white are optimal for learning. Brighter colors, such as red, orange, and yellow, spark energy and creativity. Think about colors when planning an activity. If you are asking children to brainstorm a list of names for a class pet, you might want to use a red marker to write their ideas on a chart.

5 Plants increase productivity. A plant in the classroom raises the oxygen level and reduces the pollutants in the air. Keep several plants low in toxicity in your classroom, such as ficus benjamina, philodendrons, yellow chrysanthemums, and gerbera daisies. For information on plant toxicity, contact your local poison control center.

6 Lighting affects our alertness and responsiveness. During the winter months in areas of the country where the length and brightness of the day is shortened, it is important to provide alternative lighting.

7 Activities strengthen brain wiring:

- Sequencing — Offer activities that encourage children to establish order.
- Patterning — Provide repeated experiences with visual and auditory patterns. Call attention to patterns in stories, classroom events, math activities, nature, social relationships, personal routines, art, music, motor activities.
- Fine and gross motor — Offer several activities each day that encourage the development of hand-eye coordination and muscle development. Be sure to include some cross lateral activities. Cross lateral activities encourage children to integrate the use of the left and right hemispheres of the brain.
- Making choices and decisions — Encourage children to make choices and decisions and then help them understand the thinking behind their actions. Providing children an opportunity to verbalize their thoughts allows them to refine their logic.
- Sensory experience — Ninety-five percent of the information we receive comes to us through seeing, touching, and hearing. Our sensory channels are our primary sources of learning.
- Asking *why* questions — Help children make connections between patterns and relationships by asking them to explain their thinking.
- Reading aloud — Read to children several times a day. Hearing stories helps them see patterns and relationships between events, life experiences, words and print, and language.
- Cause and effect — Enhance children's understanding of patterns and relationships by providing opportunities to see cause and effect relationships. For example, sanding wood makes the wood get hot and also creates sawdust. How is this similar to rubbing our hands together when we are cold?