



# Promoting the inclusion of infants and young children with disabilities in child care

## Participant Module

## Brain Development: Implications for Caregivers



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# Session: Brain Development, Implications for Caregivers

## OVERVIEW

Participants will learn about the “Prime times” of infant/toddler brain development. It is critical for a care giver to recognize “prime times” and provide opportunities to enhance learning and brain growth. It is the outside world that shapes the development of a child’s brain. Both the physical outside world and the social outside world provide opportunities for the senses to take in new and brain forming information.

Enriched physical environments have recently been shown in research to have a direct impact on the number of neurons in the brains of infants and young toddlers. Social environments allow for attachment and the development of trust and comfort. Children learn through the context of relationships. Relationships that provide warm, consistent care help infants and young toddlers grow into curious, confident, able learners. Relationships and interactions are a part of responsive care and have shown to do far more to enhance later learning rather than flash cards or work sheets for example.

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## From this session, participants should gain understanding about:

- i Describe the basic neurology of brain growth and development.
- i Identify the long-lasting effects of the social and physical environments on brain development.
- i Describe the impact of brain development on social relationships, speech and language, and cognition..

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## BACKGROUND

Helen picks up the crying 8 month old. Tamarra reads a book to a toddler. Anthony holds little Carlos on his lap while Carlos sucks from a bottle. During these interactions thousands of the very young brain cells are making millions of neural connections. Some brain cells are turned on, others are being strengthened, and new connections are being formed. Early care of infants and toddlers has a profound impact on the development of brain function, a child's ability to learn, and their ability to regulate their own emotions. We cannot see what is going on inside an infant's or toddler's brain and perhaps the greatest misunderstanding about a newborn's brain is that it is simply a small version of an adult brain. New thinking in brain research tells us that the prenatal and newborn brain is not a fully developed brain. Rather it is a brain waiting to "get hard wired", in other words it is in the process of developing and maturing. Actually, by the age of three, the brain of a child is two and a half times more active than the brain of an adult. Recent research also reveals that early experiences have a determining impact on the developing brain and on the nature and extent of adult capabilities. Additionally, brain development is not linear, growth depends on providing life experiences at "prime times" of development (prime times are also referred to as "critical windows" or "windows of opportunity"). Early development of the brain is not only shaped by physical conditions or experiences, but also by social conditions and

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interactions. Learning, and hence brain maturation, is acquired through the context of important relationships. As suggested in brain development literature the best way to promote the development of curious, confident, able learners is to provide the very young child with warmth, consistent care, and opportunities for attachment. Research supports nurturing brain growth and maturation, less about drilling for facts (i.e. ABC's and 123's). Brain research underscores that early emotional experiences are the foundation and seeds of human intelligence.

### **Basic Brain Anatomy**

In order to gain a comprehensive understanding of brain development it is important to review it's anatomy in brief. As a part of the central nervous system the brain plays a vital role in bodily functions, cognition, emotional regulation, memory, motor actions and processing of sensory information. Both voluntary (such as walking and reading) and involuntary functions (for example, breathing and blinking) are controlled by the brain.

The brain has two hemispheres together called the cerebral cortex. The cortex is arranged so that specific areas, called lobes, that can be thought of as having a “specialty division of labor”. The frontal lobe is often referred to as the CEO of the brain where higher cognitive functioning such as reasoning and intentional behavior take place. Hearing, language, and smell are associated functions of the temporal lobe. Processing of touch and sense of position and information about perception and

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spacial orientation are housed in the parietal lobe. Finally the occipital lobe is more or less specifically concerned with visual functions. What about memory and new learning? These functions are spread out among various structures of the cortex mainly the limbic lobe and a structure called the thalamus which are deep inside the cortex. These structures communicate with all other parts of the cortex to formulate long-term and short-term memories and the ability for new learning.

In addition to the division of labor of the lobes of the cortex research has also determined that each hemisphere (half) of the cerebral cortex has different functional specializations. The left hemisphere in most people appears to be dominant for language, mathematical ability and ability to solve problems in a sequential, logical fashion. The right hemisphere seems to be superior in musical skills, recognition of faces, and in tasks requiring spacial relationships.

The cerebellum, which sits tucked under the cerebral cortex, is a primitive brain structure and plays a vital role in balance and coordination of movement. Deep within the cerebral cortex is the thalamus and other related structures responsible for transmitting information about wakefulness, arousal, and emotional regulation. All necessary body functions, such as breathing, circulation, heartbeat and reflexes are a function of a structure called the brain stem. Of all the regions of the brain the brain stem is the only

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functional area that is completely "hard wired" at birth.

Rate of development of different functional areas of the brain impact the "prime times" for various learning opportunities.

## Basic Neurological Development

Neurons, the building blocks of the brain, are brain cells that are waiting to connect, or synapse, and create a functional architecture that lets our brains grow and make us who we are as adults. Infants are born with over 100 billion neurons with the potential to synapse with other neurons. It is through the development of these neuronal synapses that the brain develops habits, thoughts, consciousness, memories, feelings, and the ability to learn.

During the first year of life there is a remarkable increase in the number of neuronal synapses. By puberty research shows that there is a marked reduction in the number of synapses that continue to form via a process called pruning. Therefore, it is important to remember the "prime times" of brain development to provide multiple and varied opportunities/experiences to facilitate neuronal synapses to form.

## Importance for Caregivers

"Prime times" do not occur for brain development overall rather for each "division of labor" in the brain's system. Therefore it is critical for a care giver to recognize "prime times" and provide

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opportunities to enhance learning and brain growth. Between birth and age of four in order of succession an infant is able to learn motor development, emotional control, vision, social attachment, vocabulary, second language, math/logic, music.

The outside world shapes the development of an infants brain. The outside world comes in through the senses - vision, hearing, touch, taste, smell - allowing continued neuronal synapsing and brain development. Both the physical outside world and the social outside world provide opportunities for the senses to take in new and brain forming information.

Enriched physical environments have recently been shown in research to have a direct impact on the number of neurons in the brains of infants and young toddlers. Social environments allow for attachment and the development of trust and comfort. Research shows that secure attachments to a consistent child care provider have been associated with better cognitive and social development, greater language proficiency and fewer behavior problems. Children learn through the context of relationships. Relationships that provide warm, consistent care help infants and young toddlers grow into curious, confident, able learners. Relationships and interactions are a part of responsive care and have shown to do far more to enhance later learning rather than flash cards or work sheets for example.



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# SESSION OUTLINE

## **I Welcome**

Promoting the inclusion of infants and toddlers with disabilities in child care settings has been a primary purpose of PIN. PIN is designed to address the priorities, needs, and concerns of child care providers who are working with infants and toddlers.

## **II 10 Things Every Child Needs - Video**

## **III Overview of Baby Brain Anatomy**

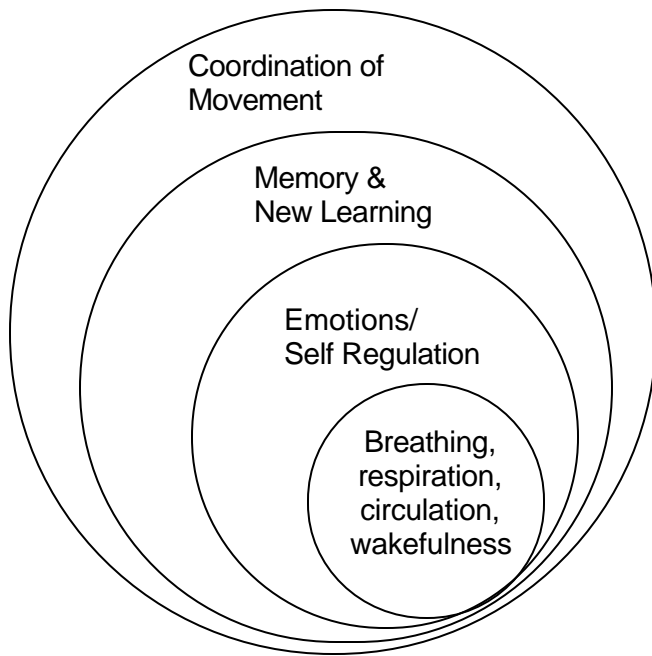
## **IV Complexity of Brain Function**

## **V The First Years of Life - Video**

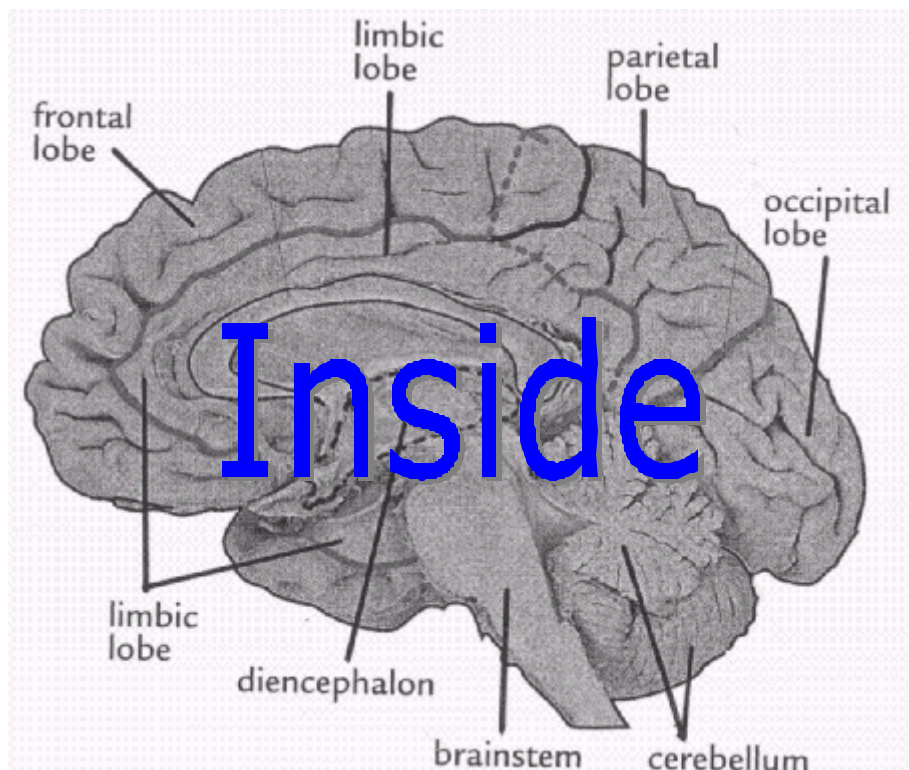
## **VI Implications for Caregivers**

## **VII Summing Up**

# Brain Development from Inside to Outside

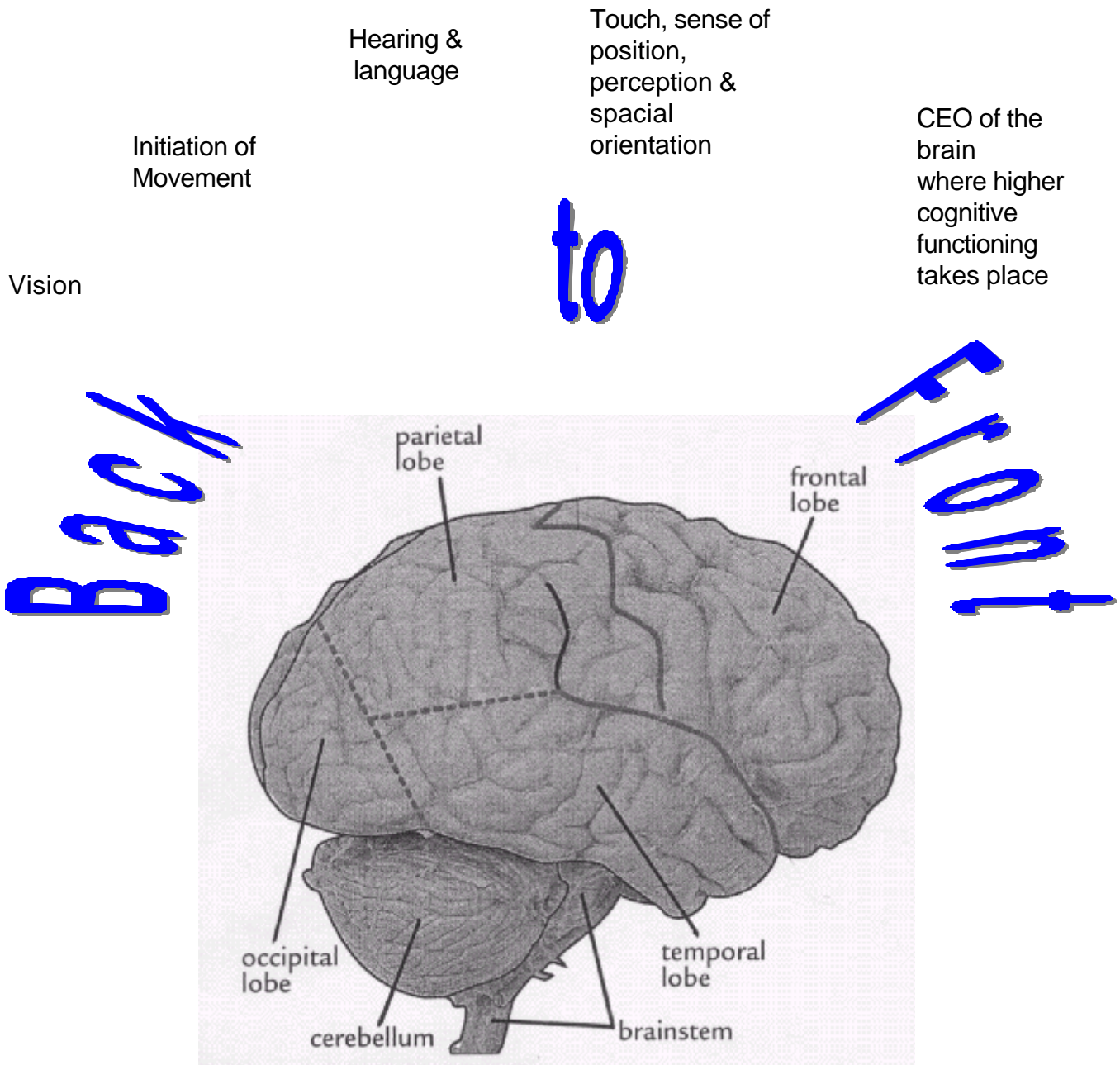


**OUT**



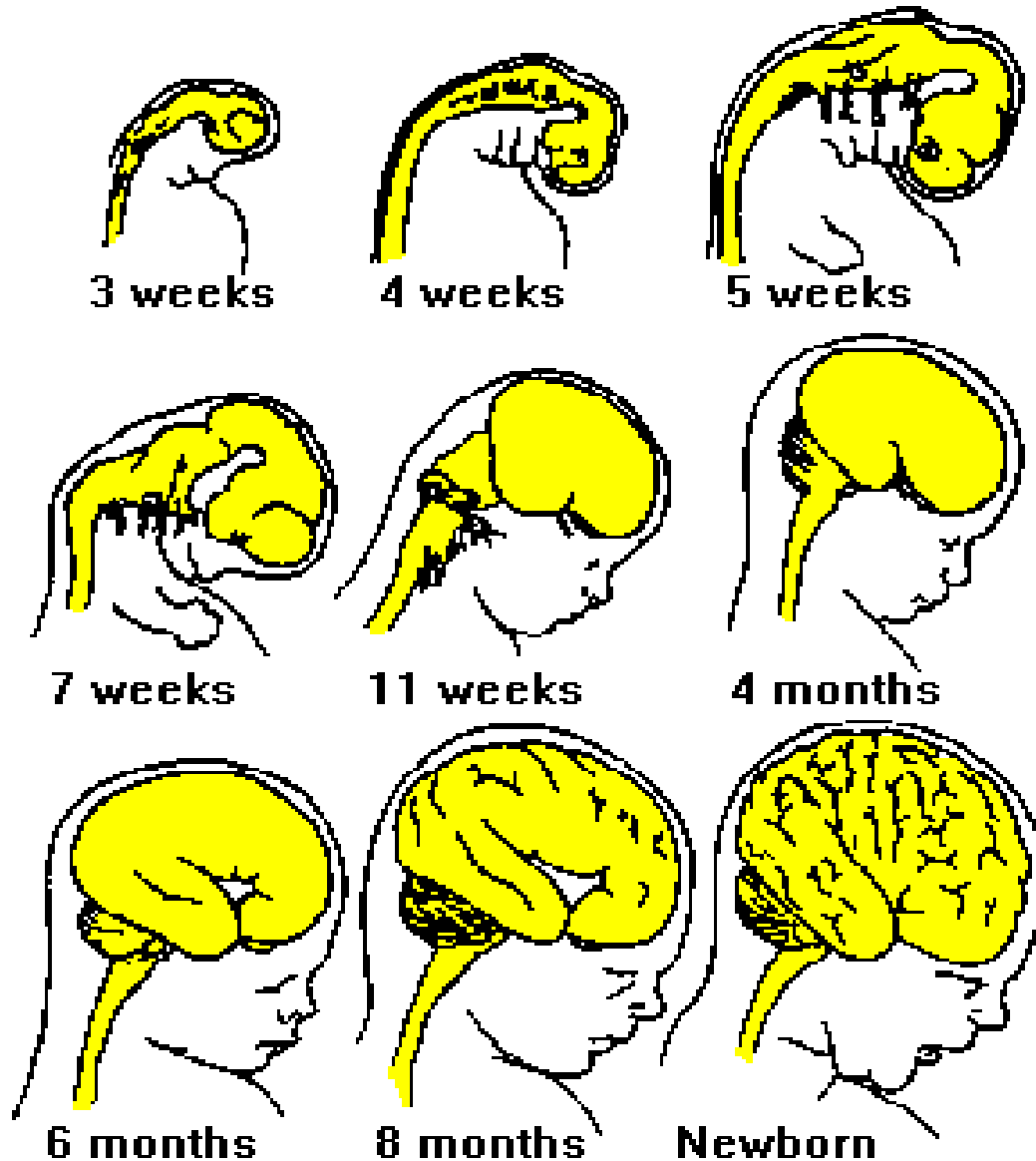
**SIDE**

# Brain Development from Back to Front



# Process of Prenatal Development

New thinking in brain research tells us that the prenatal and newborn brain is **not** a fully developed brain. Rather it is a brain waiting to "get hard wired", in other words it is in the process of developing and maturing.



# Building Blocks of the Brain: Neurons

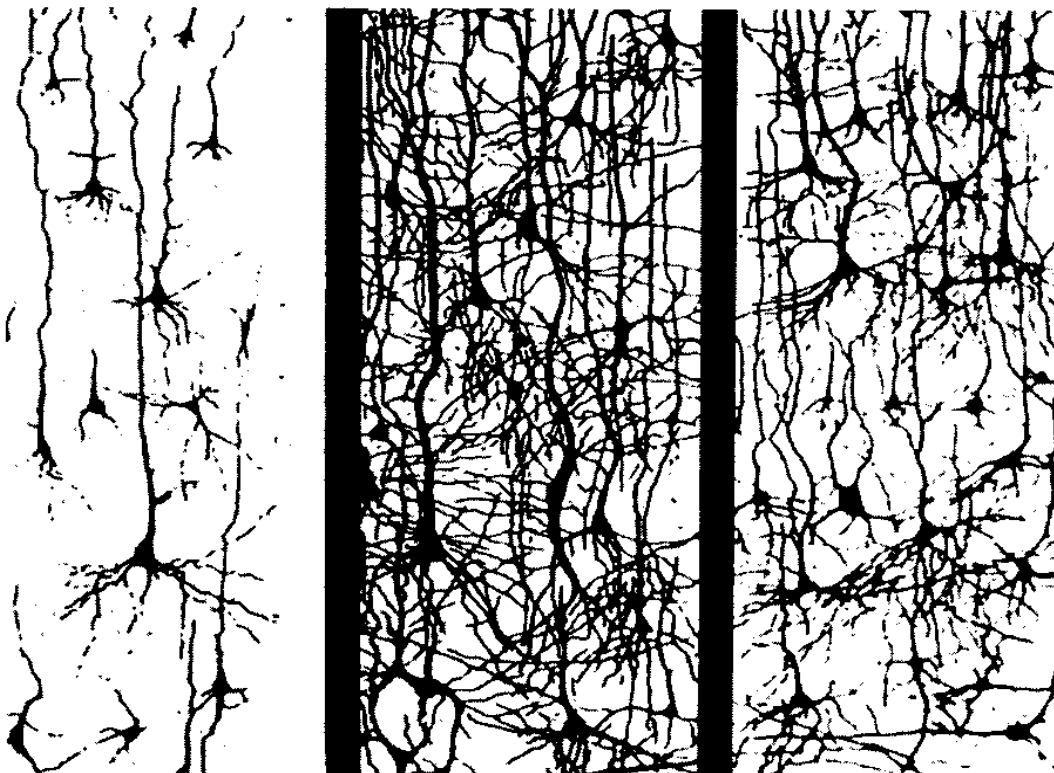
born with 100 billion waiting to connect pruning process

development of habits, thoughts,  
consciousness, memories, feelings,  
and the ability to learn

At Birth

6 Years Old

14 Years Old



***SYNAPTIC DENSITY: Synapses are created with astonishing speed in the first three years of life. For the rest of the first decade, children's brains have twice as many synapses as adults' brains.***

# Prime Times of Brain Development

## i Vision Birth - 6 months

What you can do: you can help the developing connections in the brain by holding infants so she can look around. Give infants opportunities to use their eyes; give them something interesting to look at when they are in their crib, on the floor, or in an infant seat.

## i Emotions Birth - 18 months

What you can do: pick up infants and children when they are in distress/crying; respond quickly and warmly. Avoid repeatedly responding with frustration or hostility. Stick to the same caregiver as much as possible.

## i Talking Birth - Age 3

What you can do: speak to the infant/child in full sentences; talk and read to the children often because children are learning the components of speech. Explain what you are doing, like washing hands, wiping nose, setting up lunch... Talk with the children about things you see by describing them "I see a red fire truck outside the window". General conversation is important even when a child cannot respond with words.

## i Social Attachment Birth - Age 3

What you can do: allow children to move freely or take them from their cribs so natural groupings and interactions can occur. Model positive social interaction by smiling, talking, and showing affection. Reinforce positive social interactions, for example, praise a child for finding a duplicate toy instead of taking from another child. Assign responsibility of a small number of children to one primary caregiver.

## i Movement Birth - Age 4

What you can do: Provide opportunities for children to explore different types of movement; climbing, running, crawling, walking, swinging, spinning, rolling... Explore the movement of other things such as rolling a ball down a hill vs. up a hill, throwing a balloon vs. a playground ball. Movement over smooth, un-even, slanted, skinny surfaces will challenge children to learn coordinated movements.

## i Math - Logic Age 1 - 4

What you can do: look for opportunities to explain simple concepts like the different sizes of blocks, concepts of a few blocks, many blocks... Find opportunities to sort - all red objects or all purple paints. Establish correspondence - the fork goes next to the plate on the left side; street lights are red on top, then yellow, then green on the bottom.

## i Music Age 3 - 10

What you can do: sing simple songs and play songs that have simple melody structure. Repetition is key to building strong neural pathways, so let the children sing or hear the same songs over if they wish. Provide opportunities to hear and sing a variety of types of music and to listen to/play various types of musical instruments.

## REFERENCES & RESOURCES

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Kotulak, Ronald. (1996). Inside the brain. Kansas City: Andrews and McMeel.

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Ramey, C. and S. Ramey. (1992). At-risk does not mean doomed. Occasional Paper #4. Washington, DC: National Health/Education Consortium.

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Viadero, D. (1996). Brain trust. Education Week, Sept. 18, 1996.

Willis, C. (1997). Your child's brain: Food for thought. Little Rock, AR: Southern Early Childhood Association.

Zero to Three: The National Center for Clinical Infant Programs. (1992). Heart start: The emotional foundations of school readiness. Arlington, VA: Author.



### Web sites

I Am Your Child Campaign  
335 North Maple Drive, Suite 135  
Beverly Hills, CA 90210  
(310) 285-2385  
<http://iamyourchild.org>

Families and Work Institute (Rethinking the Brain)  
330 Seventh Avenue, 14th Floor  
New York, NY 10001  
(212) 465-2044  
(212) 465-8637 (fax)  
<http://www.familiesandwork.org>

The Ounce of Prevention Fund  
(Resource paper: Starting Smart)  
122 S Michigan Avenue  
Chicago, IL 60607  
(312) 922-3863  
<http://www.bcm.tmc.edu/civitas/links/ounce.html>

Boston Child Health and Development Connection  
This web resource developed by the Department of Pediatrics at Boston Medical Center helps parents, service providers and children access information and services that promote healthy child development.  
<http://www.bostonchildhealth.org>

Raleigh News and Observer  
An in-depth series of feature articles on brain development that appeared in the Raleigh News and Observer.  
<http://www.news-observer.com/2little2late/stories/day1-main.html>

### Time Magazine

Visit this site to view the Time Magazine special report entitled, "Fertile Minds":  
<http://cgi.pathfinder.com/time/magazine/1997/dom/970203/cover0.html>

### University of Georgia

Building Baby's Brain, a series of articles on brain development, was developed by the University of Georgia:  
<http://www.fcs.uga.edu/pubs/current/FACS01-CS.php3>

### University of Washington

Designed to teach children about neuroscience, this site is appropriate for both adults and children:  
<http://faculty.washington.edu/chudler/dev.html>

### ZERO TO THREE

If you are concerned about your child's development and/or are looking for resources on particular issues  
<http://www.zerotothree.org/brainworks/caregivers.html>



# What Did You Learn Today?

1. Did you make any changes in your child space since the last session? Explain
2. List 2- 3 main points you learned from this session.
3. I am leaving this session with a better idea about how to:
4. What is one thing you plan to do differently in your child space before the next session?