Emotions, Cognition, and Becoming a Reader: A Message to Teachers of Struggling Learners

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Abstract

This paper considers the emotional nature of learning and the critical role emotions play in the making of the mind. It reflects an effort to connect recent theoretical perspectives with the teaching of struggling learners. Perspectives explored include: the recent neurological research on the interaction between cognition (reason) and emotion (feelings) in the development of plans of action and decision making, the role of language in the development of the mind, and the development of higher-order functions arising from social interaction. Implications of these theories for practice are also examined.

Historically, a dichotomy has existed between cognition or intellectual behavior and emotion or affective behavior. This dichotomy is apparent in our schools, classrooms, and curricula. For example, it is not uncommon for school counselors to offer emotional support for children who have experienced a traumatic event such as a fire or death of a classmate. In most schools, when children are experiencing a personal crisis, there is an attempt to meet individual emotional needs. However, school personnel generally hold an impersonal, cognitive view when it comes to addressing children's individual learning needs. This view holds that one approach to instruction will fit all children. Thus, making it the child's responsibility for learning the material as it is presented. For children who do not effectively engage in these types of learning activities, medication often becomes the answer.

Generally speaking, schools operate on the principle that cognitive growth will result in academic achievement. If educators can identify the one best way to teach reading, deliver that program to all children, test scores will improve. Although school mission statements may include concern for improving self-esteem and cultural awareness, the graded course of study and curriculum is nearly always based on learning specific content, developing specific skills, demonstrating specific competencies, and testing to determine if children have acquired a specific body of knowledge.

It is time for educators to erase the dichotomy by considering the wealth of

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information that has become available substantiating the role that both intellectual and affective behavior play in learning. It is as Dr. Stanley Greenspan (1997) suggests in his book, The Growth of the Mind, our educational system's failure to educate the masses of children who are cognitively capable of learning is due to reliance on a model that ignores the emotional nature of learning and the critical role emotions play in the making of mind.

Processes That Build the Mind

Clinical studies of infants and children conducted by neurologists, pediatricians, and psychiatrists have revealed that cognition (i.e., reason) and emotion (i.e., feelings) begin to interact from birth and continue for a lifetime. Emotions were found to be an integral and inseparable part of the learning process (Damasio, 1994; Konner, 1991). After two decades of clinical research and experience in infant and child development Greenspan (1997) concluded that "emotions, not cognitive stimulation, serve as the mind's primary architect" (p. 1) and "babies' emotional exchanges with their caregivers, rather than their ability to fit pegs into holes or find beads under cups, should become the primary measuring rod of developmental and intellectual competence" (p. 9).

Over a period of about twenty-six years, thirteen of which have been spent working as a Reading Recovery teacher and university trainer, I have found support for the position that emotions play a primary and critical role in learning through four kinds of personal experiences. These experiences include: (a) interactions and conversations with my son, Ken, from birth through college, medical school, and pediatric residency; (b) the teaching of Reading Recovery (RR) children, many of whom were identified as learning disabled or developmentally handicapped; (c) twelve years of research examining teacher/child interactions of effective Reading Recovery teachers; and (d) clinical studies of learning disabled and RR children using the electroencephalogram (EEG) and brain electrical activity mapping (BEAM) tools to track brain activity during problem solving while reading.

These first hand experiences have lead me to believe there are certain kinds of nurturing that propel children's intellectual and emotional development and that affective experience facilitates children's ability to engage successfully in the variety of problem-solving tasks needed to become a proficient reader and writer.

In my view, research conducted by Greenspan (1997) has much to say to researchers and educators interested in how individuals become literate. His work describes and explains how new capacities emerge at different stages of a child's development. These include a "progression of abilities, such as attention and self-regulation, engagement, intentionality, and complex pattern making, that underlie the sense of self, consciousness, and moral awareness" (p. 125). Two personal experiences involving my son Ken provide insight into the development of reason and its inseparable dependence on emotion: The Button Jar and the Calendar Trick.

The Button Jar

My Grandma Mueller loved to sew. As the first born and only grandchild for five years, I received many of Grandma's homemade creations. I would go to the

store to help Grandma select the "perfect buttons" for each of my homemade outfits. I generally chose unusual buttons in a variety of colors, shapes, sizes, and what I called "fancy buttons" which were animals, flowers, clowns, and holiday figures. When she died in 1970, Grandma willed me her sewing machine, a sewing box, and a large glass pickle jar filled with buttons. The sewing machine was placed in our spare bedroom and on top of the sewing machine I placed the large glass button jar.

When Kenny was five months old, he started to crawl. Once on the floor, the first place he always went was to the spare bedroom where he would immediately point to the button jar. I think he was fascinated with the many colors, sizes, and shapes of the hundreds of buttons that filled the jar.

I would put the button jar on the floor so that he could take a closer look at it. But looking was not enough; he wanted to touch the buttons. I would open the jar and dump a few buttons on the hardwood floor. I showed him how to push the buttons one-by-one into a pile. Then the two of us would pick up each button and return it to the button jar. I watched him very closely so that he would not put the buttons in his mouth, which of course is what he usually tried to do. After repeatedly telling him not to put the buttons in his mouth because he might swallow them and get sick, I had to tell him that the next time he tried to put the buttons in his mouth, I would put the button jar away. The day after that warning, he learned that I meant what I said. The button jar was put away for several days until he promised that he would not put any buttons in his mouth again.

After about three weeks of pushing the buttons into piles, I showed him how to sort the buttons by color. While demonstrating the process, I would say, "Let's put all the white buttons in this pile." With my help, Ken learned how to make a pile of red, white, and black buttons. We would have a conversation about the color of each group, with my doing all the talking, and Ken making babbling sounds. He would look at me with that proud look mothers come to understand when a child feels good about what he has accomplished. We both had fun and I believe he knew he was pleasing me.

When Ken was eight months old, he started to associate a color word to each pile of different colored buttons. When I asked him to show me the red pile of buttons, he could point to the red pile. He could group the buttons according to a specific color, but could not yet produce the word to associate with each color. Once he could sort by color, I showed him how to count the buttons in each pile. He started to learn the number concepts of one, two, and three and say a word to represent each button he counted.

One day he pointed out that some of the buttons had holes and others had no holes. So we sorted buttons into piles of "holes" and "no holes." Ken, not I, had discovered another classification system. From that activity, we sorted buttons by the number of holes; that is, two holes, four holes, six holes, etc. He also noticed that some buttons were smooth, others were rough, some were square, and others were round. He had not acquired a word to label the concepts, but he noticed differences and similarities among buttons, thus completing the task visually. By the time he was one, Ken had developed a classification system and specific words (e.g., color, shapes, number of holes) to describe this classification system.

Every day we played the button game. I would push all the white buttons together and ask him to tell me how I grouped the buttons. He would look at the piles and say "white pile, no holes, two holes," etc. Then our roles reversed. Ken would sort the buttons into specific groups and I would tell him how he had classified them. We took great delight in this activity, talking and laughing trying to trick each other. Sometimes I would put a red button into the white pile and he would squeal and tell me, "No!" and push it into the correct pile. Then I would watch him place a button in the wrong pile and he would watch me to see if I discovered his error. In his baby book I wrote that at 12 months of age, Ken's favorite pastime was playing with the button jar.

What did Ken learn playing with the buttons? What may have been going on inside his brain? Distinguished Soviet psychologist Alexander Luria's description of the functional organization of the brain (1973) provides a plausible explanation.

The Neuropsychology of Learning

Luria (1973) believed that human mental processes involve complex functional systems that work together and make their own particular contribution to the organization of the overall system. He proposed three principal functional units of the brain whose participation is necessary for any type of cognitive activity (see Figure 1).

Unit I, located in the brain stem, is responsible for regulating tone or waking. The most important part of the first functional unit is the reticular activating system (RAS), a small structure located near the top of the brain stem. The RAS serves as a trap door or gatekeeper, allowing stimuli to enter the brain and be relayed through the limbic system to the appropriate cortical areas. This interaction

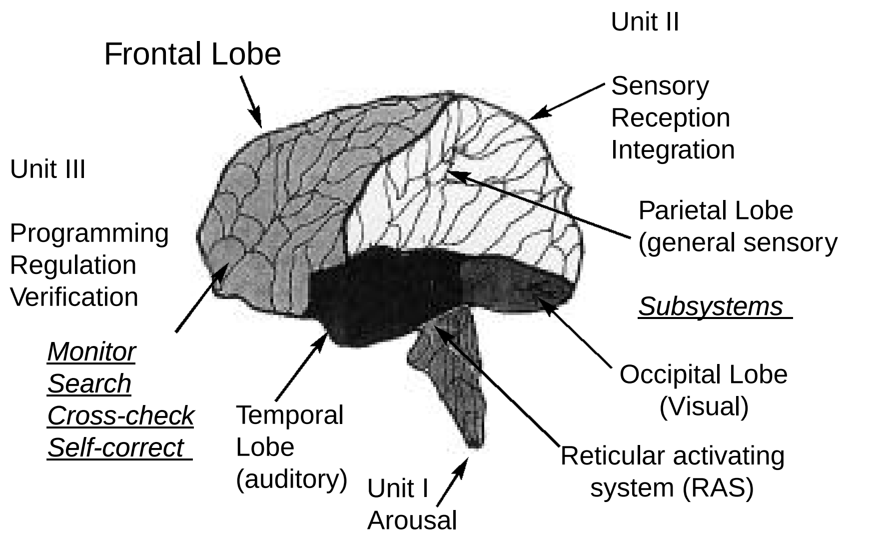

Figure 1. The Functional Organization of the Brain

Note. Adapted from *The Working Brain* by A. Luria, 1973, New York: Basic Books.

helps with attention, thinking, balance, and coordinated movement. As children grow, they learn to send messages from the cortex to focus their attention. In this way, the RAS plays an integral role in directing consciousness and attention. On the other hand, without the reticular formation's alerting signals, the brain grows sleepy and disengages.

The RAS was responsible for focusing and sustaining Ken's attention while we played the button jar game. From the first moment the button jar was placed on the floor, he was focused, interested, and engaged in what I was doing and saying. He was able to sustain and focus his attention, even as the activities became more challenging.

The second functional unit (Unit II) is primarily responsible for the reception, analysis, integration, and storage of information. This unit occupies the posterior region of the cerebral hemispheres and incorporates the visual (occipital), auditory (temporal), and general sensory (parietal) regions. The temporal lobe located near our ears is an area believed to be responsible for hearing, listening, language, and memory storage. The occipital lobe processes our vision. The parietal lobe deals with the reception of sensory information that involves movement.

Each of these lobes processes the same information in different ways and in different parts of the brain. There is much overlap in the functions of each of these lobes. These three areas of the brain appear to be involved with types of memory. The parietal, upper temporal and occipital lobes seem to serve as short-term memory banks for auditory, visual, and kinesthetic (motion, perception) impulses (Luria, 1973). Discussion of actions described as subsystems in Bruner's (1973) and Clay's (1991) work are similar to behaviors associated with Unit II.

The sensing, receiving, and integrating unit is involved in specific interactions that involve cortical processing in the temporal, occipital and parietal lobes of the brain. Through the button jar game, Ken learned how to integrate and coordinate actions while involving these three lobes of the brain. He learned to:

- Coordinate and control arm, hand, and eye movements while placing buttons into discrete groups.
- Integrate and connect gesture, touch, sounds, and words with feelings.

The third functional unit is the frontal lobe, which is located in the area around the forehead. It is involved in purposeful acts, which Luria termed programming, regulation, and verification. The frontal lobe plays an essential role in regulating the state of the activity, organizing and changing it in accordance with complex intentions and plans formulated with the aid of speech (Luria, 1973). As the frontal lobes mature, they team up with the RAS, which directs arousal and alertness, and with the limbic system, which regulates hormones and emotions, forming a loop that works to select and direct attention. An important function of this loop is regulation of the child's ability to use "feedback" as an ongoing check on behavior. This feedback system helps the child monitor and catch errors and remember what he or she is supposed to do to resolve problems. Problem solving actions such as monitoring, searching, cross-checking, and self-correcting involve the frontal lobes. Varied experiences with the button jar provided opportunities for Ken to program, regulate, and verify his actions. He learned how to:

- Associate a specific word (number or color word) with an object.

- Categorize objects into discrete groups according to a plan of action.
- Develop a flexible classification system.
- Recognize similar and different patterns.
- Develop a feedback system to monitor his behavior.
- Reorganize or reclassify individual buttons in a variety of ways.
- Find solutions or rationale for Mom's plan for organizing and developing a category.
- Use language to regulate his behavior to develop his own plan for organizing information.
- Correct his behavior when necessary.

Understanding the role of the three functional units of the brain and the important ways in which each unit participates in the organization of human behavior may contribute to an explanation of the nature of Ken's reasoning as we played with the buttons.

The Relationship Between Cognitive and Emotional Development

Recent neurological research (Damasio, 1994) may help us better understand how cognition (reason) and emotion (feelings) interact to support problem-solving and our ability to make decisions and generate plans of action. Three major principles that support the links between infants'emotional and cognitive development are discussed by Greenspan (1997).

First, the foundations of learning are the infant's own natural intentions. This principle suggests that it is the child not the parent or caretaker who determines and controls where attention will be focused and subsequently what is learned. The child's reticular activating system (RAS) located in Unit I arouses and focuses the brain's processing. It is responsible for arousal and consciousness and is critical to focusing our attentional system. So attempting to develop Ken's ability to learn color words or number concepts by manipulating buttons would probably not have worked if it had been my idea.

Greenspan's (1997) research indicates that when an infant is confused, senses disapproval, or feels anxious, there is a psychological and physiological reaction in the brain that inhibits processing. The child's RAS shuts down and he will look away. However, if the parent follows the child's interest, many learning opportunities will arise because the infant has voluntarily attended and engaged.

Secondly, each sensation, as it is registered by a child, gives rise to an affect or emotion. This process is called "dual coding" of experience and is the key to understanding how emotions organize intellectual capacities and create the sense of self and well-being. According to Greenspan (1997):

> Emotions and intellect are NOT two separate parts of a person. Emotions are the organizer or the "supersense," helping to organize all the sensory information coming our way. Experience is stored and organized in the brain with a dual code. The dual code consists of the sensory experience and the emotional or affective reaction to the experience, both of which will be coded together in the brain. This double coding allows the child to cross-ref-

> erence each memory or experience in a mental catalog and feeling and to reconstruct it when needed. (p. 21)

The dual coding phenomenon may help to explain the relationship between Ken's cognitive and emotional development. I believe that his capacity to reason (e.g., sort buttons in discrete categories) was followed by mechanisms of emotions, which occurred as he began experiencing feelings of affirmation and support from me. Once this occurred, systematic connections between categories of objects and situations, on the one hand, and emotions, on the other were formed in his mind. He labeled and coded the buttons as bright, smooth, red, etc. and also by emotional qualities connected with feelings he exhibited while playing with the buttons. This double coding allowed him to cross-reference the category system with a positive memory.

Third, parts of the brain and nervous system that deal with emotional regulation play a crucial role in planning, discriminating and choosing between alternatives, monitoring, self-correcting, and regulating one's behavior. Recent neurological research (Damasio, 1994) demonstrates that neuronal development in the prefrontal cortex (Unit III) regulates emotions. Furthermore, damage to the prefrontal cortex seriously impairs a child's judgment and regulation of behavior. When the regulatory system is working well, infants between three and eight months can register the appropriate sense perceptions when presented with sights and sounds, attend and discriminate among them, and comprehend sensations that they see, touch, and hear (Greenspan, 1997).

Each sensation that Ken registered gave rise to an affect or emotion. He squealed with delight while touching and pushing the buttons on the floor. He also came to understand that if he tried to put a button in his mouth, the button jar would disappear and the game would end. He responded to the button jar game in terms of the emotional as well as the physical effect on him. From an emotional perspective, he learned how to regulate his behavior by not doing what he wanted to do, which was to eat the buttons.

In one study, Greenspan (1997) found that measurements of emotional regulatory function, taken at eight months of age, correlated with children's mental capabilities indicated on standardized IQ tests at age four.

> In developing the mind, intellectual learning shared common origins with emotional learning. Both stem from early affective interactions. Both are influenced by individuals, and both must proceed in a step-wise fashion, from one developmental level to another. The sort of learning a child acquires in kindergarten and primary grades is not the true foundation of his or her education. In fact, early school work cannot proceed without previous mastery of various mental tasks. The three R's and all that follows, symbolic and increasing abstract academic knowledge, cannot be understood by a person who has not grasped the skills that make learning possible. (p. 210)

Greenspan's view of the developing mind provides a plausible explanation for how Ken created the calendar trick.

The Calendar Trick

Every year I buy a linen calendar towel that depicts the days of the week for each month over the course of that year. I have a collection of towels that spans over forty years. When Ken was two, one of his favorite pastimes was going to the kitchen drawer and throwing the calendar towels out on the floor. Instead of sleeping during naptime, he would take five to ten towels to his room, and carefully line them up according to years on the floor. I never understood why he did this, but as long as he was quiet, I did not care.

When he was two and one-half years old, Ken would ask my husband and me to give him a date and he would tell us on which day of the week the date fell. For example, we would say, “August 7,” and he would reply, “Thursday.” He was invariably right. We could ask him random dates in different months and years and he always would tell us the correct day of the week. What was particularly amazing was how fast he could do this trick. When asked how he did it, he said he did not know. What we did learn, however, was that he recognized similarities and differences among dates for each month depicted on the towel and he recognized recurring patterns of numbers among the days of the week and months of the year.

The neighbors and relatives soon learned about Ken’s calendar trick. He could tell people on which day of the week their birthday would fall two or three years later, or on which day Christmas fell four years ago. He could tell us the day of the week for specific dates in the past, present, and future years, even accounting for a leap year. We did receive an invitation to take Ken to appear on the Tonight Show with Johnny Carson, which we turned down. (However, my husband did consider taking Ken to the local bar to make some money.)

When he was three and one-half years old, he finally told us how he did the calendar trick. He said that if you know on which day of the week the first of the month falls, you can figure out the rest of days for every month in the year. Because the same day of the week has the same numbers all the time. If the first day of January falls on a Thursday, then the other Thursdays in January will be on 8, 15, 22, and 29. If the first day of March falls on Sunday, then the remaining Sundays in March will be 8, 15, 22, and 29. What Ken had discovered was patterns among and across the dates of each day of the week and in each month of a specific year. He had developed a more complex and intricate skill beyond what he had learned while playing with buttons. He had generalized properties and skills learned in one context and applied them to a new context.

Recent neurological research (Damasio, 1994; Greenspan, 1997) provides some explanation for how he acquired the ability to go from concrete thinking and categorizing developed through various activities involving the button jar, to abstract thought developed independently and evident in the calendar trick. The research shows that our minds can instantly retrieve similarly coded information relevant in one situation and use it in a similar way for a new situation. Such neurobiological clinical research has indicated that the brain is a natural pattern seeker and synthesizer that actively searches for patterns to categorize, organize, synthesize, code information into memory, and then retrieve it.

Ken was able to retrieve this stored information rapidly and reliably because his affective capacity organized information in an especially functional and meaningful manner. Because the information was dual coded according to its affective, sensory, and cognitive qualities, he had the structure and circuitry established in

his brain to enable him to retrieve it easily. He probably was also intrinsically motivated to share the calendar trick with us because he had received such positive reinforcement in the button jar game. The pleasure he experienced was not simply one of mastery, but one of feeling good and seeing the pleasure of others. But the important question is how did he teach himself to do this? An examination of the neuronal development systems of the brain, electrical and chemical, provides some insights.

Neuronal Development of the Electrical Brain

Babies are born with over 100 billion neurons or nerve cells designed to communicate electrochemically with one another. Each neuron has three main parts: cell body, axon, and dendrites. The cell body is the nucleus of the neuron. An axon is a long, slim, “tree-trunk” fiber that transmits signals from the cell body to other cells via junctions called synapses. Dendrites are networks of short fibers that branch out from an axon, receive signals from the ends of axons from other neurons, and bring the signals to their neuron’s own cell body (Lambert, Bramwell, & Lawther, 1982).This complex electrical and chemical processing system regulates communication and action (see Figure 2).

Each neuron communicates to other neurons by firing an electrical impulse or message along the input axon. The input axon sends impulses or messages to the cell body. The cell body receives the electrical impulses and sends them to the output axon. The output axon carries the electrical impulses to other neurons over a gap called a synapse.

Each neuron has many dendrites, each of which picks up electrical impulses and sends chemical messages to another neuron cell, starting the process over again. Dendritic spines develop and shift in response to the need to connect assemblies of neurons into memories. They can deteriorate or lose strength from lack of use and gain strength from frequent use. The dendrite spines allow for short periods of continuous attention to develop a permanent record or memory. Cells which become stimulated by picking up and relaying messages develop new dendrite spines and more complex neural networks (Healy, 1994).

As electrical messages are processed over and over again the axons develop a fatty, white/light gray cellular insulation called myelin. Myelin facilitates rapid conduction of the electrical impulses. It makes the axons more efficient, enabling electrical impulses to travel up to 12 times faster. The more myelin there is coating the axons, the more automatic the processing (Lambert et al, 1982).

For years, scientists have had tools that allowed them to observe and study the electrical communication system of the brain. Only recently, however, have tools been developed that allow researchers to understand better the chemical communication system of the brain.

The Chemical Brain

The axon of one neuron releases a chemical agent called a neurotransmitter to stimulate the dendrites of another cell. This reaction occurs at a synapse. The neurotransmitters bind to receptors on other neurons, causing an electrical charge that redirects the neural pathways. The effect on an individual is a change in physical

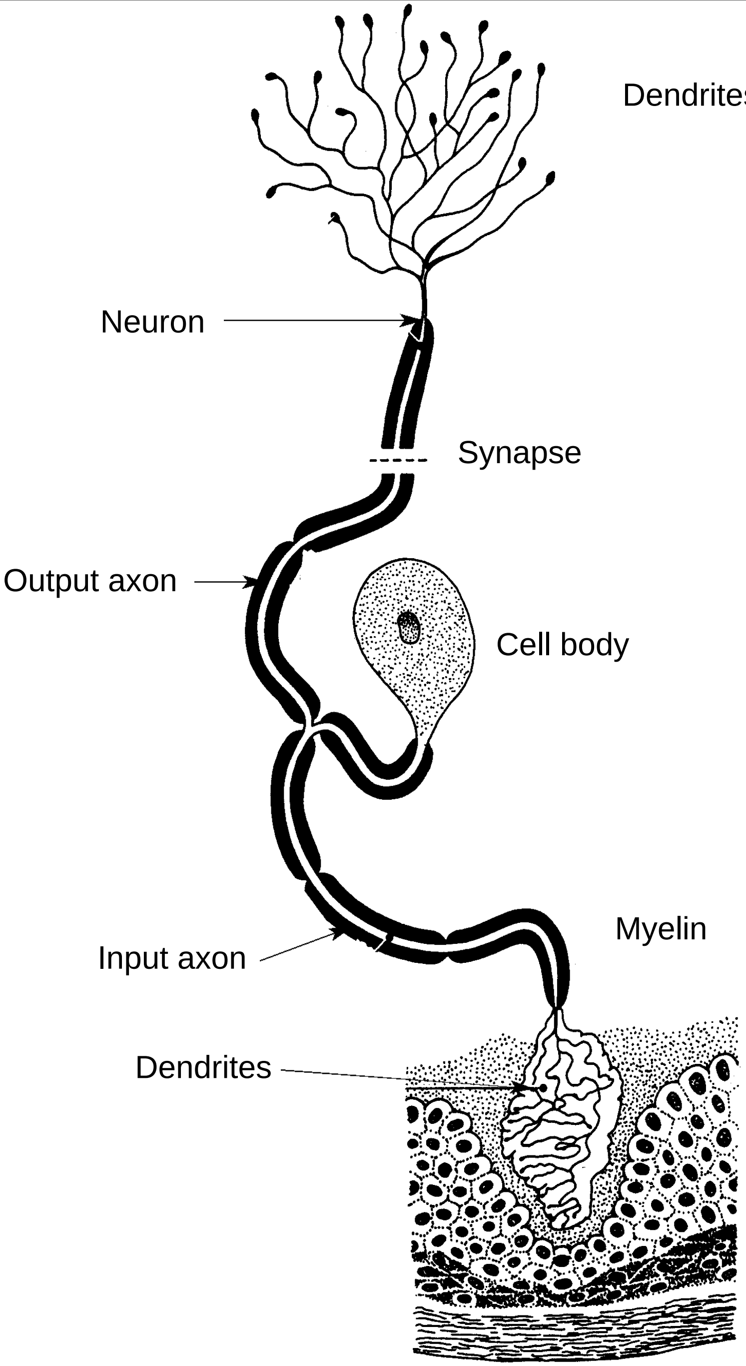

Figure 2. One Neuron Consisting of a Cell Body, Tail-Like Axon, and Dendrites
Note. Adapted from *The Brain: A User's Manual* by D. Lambert, M. Bramwell, and G.Lawther, 1982, New York: G. P. Putnam.

activity, including behavior, mood, and emotion. The adult human has trillions of synapses that connect to the network of our brains. If they are not connected, they disappear (Pert, 1997).

Neuroscientists believe that there are 70 to 80 different kinds of neurotransmitters. Seratonin, for example, is a mood-controlling neurotransmitter. When released in an individual, it is associated with feeling good about oneself and having a positive attitude. High seratonin levels are associated with attention and memory. When individuals feel successful, happy, and proud that they have overcome a difficult task, seratonin levels increase. When they experience failure and feel dejected about not being able to learn, seratonin levels decrease. Neurotransmitters either enhance or inhibit further transmission of impulse to dendrites (Damasio, 1994).

From the first hour of birth, our brains are getting wired, developing tracks that will last us for a lifetime. Early brain stimulation is critical to learning and emotions play a major role in developing cognitive abilities. The critical time to build neural networks is during the first three years of life. By the time a child is three years old, his or her brain has already reached two-thirds to three-quarters of its adult size. By age five, when a child enters kindergarten, so much of the brain is developed that a child who has not acquired the necessary skills of attention, communication, and the ability to participate actively in relationships (give and take with others) is at a disadvantage. The earlier the child is provided opportunities to build this complex electrical and chemical neural network that becomes the mind, the easier it will be for the child to learn (Greenspan, 1997).

Thus, emotions (feelings) are part and parcel of what we call cognition (reasoning); they play a critical role in forming ideas and generalizing information (i.e., seeing the forest through the trees). They orchestrate many of the mind's most important functions, such as classifying and organizing information, problem solving and evaluating the consequence of our actions (Greenspan, 1997).

Neurologists believe that when a child reaches puberty the brain has stopped growing. This does not mean that one cannot continue to learn; certainly our experiences after adolescence demonstrate this. However, it is the case that the most opportune time for building the neural network that is the foundation for learning how to learn has come to an end. It stands to reason then, that the more opportunities or experiences a child has had during the first three years of life, preschool, and early elementary school, the more neural pathways he or she has developed. The process is self-perpetuating. That is, the more neural pathways developed, the more dendritic branches appear. The more dendritic branches appearing, the more connections can be made among neurons. The more connections among neurons being made, the more complex reasoning and myelin building can occur. The more myelin is accumulating, the faster and more automatic the child can process information.

I believe the button jar game was the foundation for the calendar trick. Ken had rich and varied opportunities to develop a complex electrical and chemical neural network that mylinated during those early years. But what about those children who enter school having had limited early childhood opportunities to set the circuitry of their brains? What can be done today to overcome their inadequate beginnings and to help them learn how to learn to read and write?

Emotions, Cognitive Development, and Reading Recovery

Three bodies of research provide insights regarding instructional contexts that may help primary level teachers become more efficient and effective. They include the role of emotions, the role of language, and the role of social interaction in the making of the mind. To illustrate these points, following is an example of how Reading Recovery (RR) teachers support children in ways that are based on these theoretical principles. (Reading Recovery is an early intervention literacy program that serves first-grade children who are at risk of failure in learning to read and write. Children receive individual tutoring daily from a specially trained teacher.)

The Role of Emotions

The first body of research discusses the critical role emotions play in developing the brain structure required for attending, organizing, categorizing, storing, and retrieving information. Research (Damasio, 1994; Greenspan, 1997) has demonstrated that feeling successful is critical to keeping the RAS open. The RAS must be opened and aroused in order for the child to attend; without attention, the child will not learn. Having a positive, non-threatening, non-stressful experience while learning enhances the child's opportunities for success.

Effective RR teachers create an instructional environment that includes two major features to help the child feel positive and successful, both of which support and sustain attention. First, they teach the child the task. Second, they keep the task easy so that the child will feel successful and will attend to the process. An example to describe how this is accomplished follows.

Reading Recovery teachers must teach children "how words work" so they can use what they know about a word to problem solve words in reading or writing. The teacher begins by having the child make a familiar word that has a few letters that he or she is sure the child knows. The teacher may use the known word 'cat,'for example. The teacher gives the child the exact number of magnetic letters and either demonstrates how to put the three letters together to make the word 'cat'or asks the child to make the word by himself. The teacher and/or child make and break apart the known word several times. Starting with a known word frees the child to focus on how individual letters make up words, and how words can be taken apart letter by letter.

The child begins to understand how words are constructed and a process for constructing them. The teacher has organized the experience so that the child is successful, assuring he or she will voluntarily and easily engage in the activity. In teaching the task and the process of constructing a word by using a word the child knows, the teacher has made it easy for a child to learn how words work. But this activity teaches the child much more. It teaches him or her how to:

- Focus and sustain attention.
- Associate letters to a sound and sounds to letters.
- Discriminate between and among features of letters.
- Categorize letters into groups that are similar and different to make a word.

- Reorganize and reclassify letters into different words.

The list of processing behaviors should sound familiar because those are the skills Ken developed while playing with the buttons. He learned to discriminate features of objects (buttons) which he then used to discriminate among features of letters. Perhaps that is why he was reading at age three and one-half without formalized schooling. Children who engage in the process of making and breaking words apart and constructing new words from known ones develop the capacity to plan, guide, and monitor behavior. These are the problem solving skills that are used every time they read and write.

The Role of Language

The second body of research that has implications for RR teachers involves the role of language in the development of the mind. Four principles regarding the role of language are critical to teachers'work in Reading Recovery.

First, in order to learn language, children must come to understand that language has a purpose and function and that they must learn how to use it to communicate their needs and desires. Neurological research has demonstrated that every child is born with billions of neurons and thus has the potential to learn language. But as Greenspan's research (1997) indicates, unless the child masters the ability for reciprocal emotional and social signaling, his or her ability to use language functionally develops poorly, often in a fragmented manner. Words lack meaning, pronouns are confused, scraps of rote learning, such as repeating illogical phrases that are not connected to what he is doing in a meaningful way, will dominate speech. Marie Clay (1993) writes:

> Some children have particular difficulty in calling up an association or label for a word, or a name for a letter. This low recall means that the earliest, easiest, and most basic links of oral language with print are very difficult for the child to establish. (p. 25)

While sorting buttons during infancy, Ken learned to associate a word (red) to a specific color and a number word (three) to a specific number of buttons. He was developing strategies for remembering color and number words. Just think of how many opportunities his neural network had to mylinate prior to former schooling. He could see similarities and differences among features of letter (e.g., noticing where to put the stick to make a lower case <u>b</u> or <u>d</u>), just as he saw similarities and differences among buttons and number patterns on calendar towels.

Secondly, the origins of language are found in the parent's verbal commands and directives and this language or speech usually plays a regulatory function in everyday life. Luria (1982) contends that the real birth of regulatory speech is when the child responds to a parent's directive. When I asked Ken to group all the white buttons with two holes together in a pile, he complied with my verbal request and regulated his behavior to accomplish the task.

The same process occurs many times throughout a RR lesson. Reading Recovery teachers organize and regulate a child's behavior through language. For example, in Reading Recovery: A Guidebook for Teachers in Training (Clay, 1993), there is a section devoted to helping a child who enters RR with very low letter knowledge (i.e., Learning to Look at Print, pp. 24-28). Clay suggests the following procedure to help the child orchestrate three ways of remembering:

1. Movement – The teacher holds the child's hand and guides him, eventually calling for the child to do so independently.
2. Words – The teacher verbally describes the movement while she is making the letter or word and asks the child to do so independently.
3. Visual Form – The teacher writes the letter, providing a visual model and asks the child to do so independently.

The child's behavior is regulated through the teacher's verbal directives. The teacher must be careful to use language specific enough to match the action the child must perform. For example, while writing a lower case b, the teacher must guide the child's hand to form the letter while saying the words, "Down, up, and around." Words and movement must be coordinated.

Third, when young children learn to use language effectively to make sense of their experiences, they begin to plan and regulate their actions. Infant research (Luria, 1982) demonstrates that regulation of behavior by speech is attained slowly over time. It appears first in interaction with others, and later, children can be heard directing their own behavior or problem solving out loud.

While playing the button jar game, Ken would talk to himself and give his plan away. While listening carefully to what he said to himself, I knew when he was going to put one red button into the white pile. He made his thoughts explicit. Sometimes RR children do the same thing. They will say, "That didn't make sense." or "That didn't match." The words provide an oral feedback system that acts as a call for action.

Finally, language guides the behavior according to a verbalized plan and modulates arousal of the brain through motor activity to meet the demands of the task (Luria, 1982). This principle is supported often in Reading Recovery, especially in early lessons. RR teachers'oral language in the form of prompts guides the children to think about something to do. For example, when children notice that what they read did not match the words on the page, they might say, "That didn't match;" "There were too many words;" "There were not enough words;" or "I better try that again and read it with my finger to make it match." They learned those words to regulate their actions by listening and reacting to the teacher's prompts. Eventually teachers will not have to use prompts because the children's internal verbalized plan will be functionally successfully.

The Role of Social Interaction

The third body of research that contributes to our understanding of the making of mind, the making of a reader and writer is Vygotsky's theory that higher-order functions (such as problem solving, reasoning, planning, remembering, and communicating) develop out of social interaction. Vygotsky (1978) argued that:

> Every function in the child's cultural development appears twice; first, on the social level, and later, on the individual level; first, between people (interpsychologically), and then inside the child (intrapsychologically). This applies equally to voluntary attention, to local memory, and to the formation of concepts. All the higher functions originate as actual relations between human individuals. (p. 57)

This growth occurs in the zone of proximal development, which is the "distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978. p. 86).

Following are examples of two children, my son Ken and Trevor, a Reading Recovery child, which illustrate shifts that occur in learning as children progress through the zone of proximal development (ZPD) as illustrated in Figure 3.

Zone of actual development. The zone of actual development refers to what the child can do independently. Through close observation, RR teachers determine concepts the child has already acquired. For example, Trevor could write the first letter of his name independently, which meant that he had full, mature control of the functions for forming that letter. The RR program is built upon a firm foundation rooted in what the child knows and can do independently. The information gained from both An Observation Survey of Early Literacy Achievement (Clay, 1993) and from the first 10 sessions of the Reading Recovery program, called "Roaming Around the Known", serves to uncover what the child knows and can do without assistance. The teacher can determine the aspects of the child's problem solving that have already matured, that is, those that are the end products of development.

The zone of proximal development (ZPD). The ZPD defines those functions that are in the process of maturation, functions that will mature tomorrow or next week. The ZPD has three overlapping phases: (a) assistance provided by a more capable other; (b) transition from other-assistance to self-assistance; and (c) assistance provided by the self.

The stage of assistance provided by a more capable other refers to a situation where parents, caregivers, teachers, etc., may organize activities and facilitate learning by regulating the difficulty of the tasks and modeling mature performance through joint participation of the adult and child in those activities. For example, when Ken and I had our first interactions with the button jar, I spilled the buttons on the floor, took his hand, and showed him how to push each button into a pile according to specific color. I was deliberate in my actions, but did not intentionally create a "lesson;" that is, I did not explicitly and intentionally focus on instruction or set out to teach him color words, etc. However, in our joint interactions a tacit lesson was learned.

This is not the case in a Reading Recovery lesson. The teacher consciously and intentionally creates an activity that engages children in such a way that they have opportunities to use what they know and can do to solve a problem. The teacher structures children's participation so they handle manageable, but comfortably challenging, portions of the activity that increase in complexity with their developing understanding and skill. For example, teachers explicitly teach children how to visually scan a line of text from the left to the right by holding the "pointing finger" to demonstrate how to match what they say to what they see as the teacher reads the text with them on an individual basis. Through routine and often tacit guided participation, children gain control of directionality and learn how to match words seen on the printed page with words spoken (i.e., achieve a one-to-one match).

Vygotsky (1978) emphasized language as the most powerful tool for thinking and communicating between individuals. Two types of social speech were evident during the interactions described above. Initially the adult uses language to model the process. For example, through conversation while sorting buttons by color, I believe Ken developed an understanding of how to classify objects by color and the concept of “word” to correspond to each pile of buttons. While engaged in the “sorting buttons by color” activity, my language was very specific. I would say,

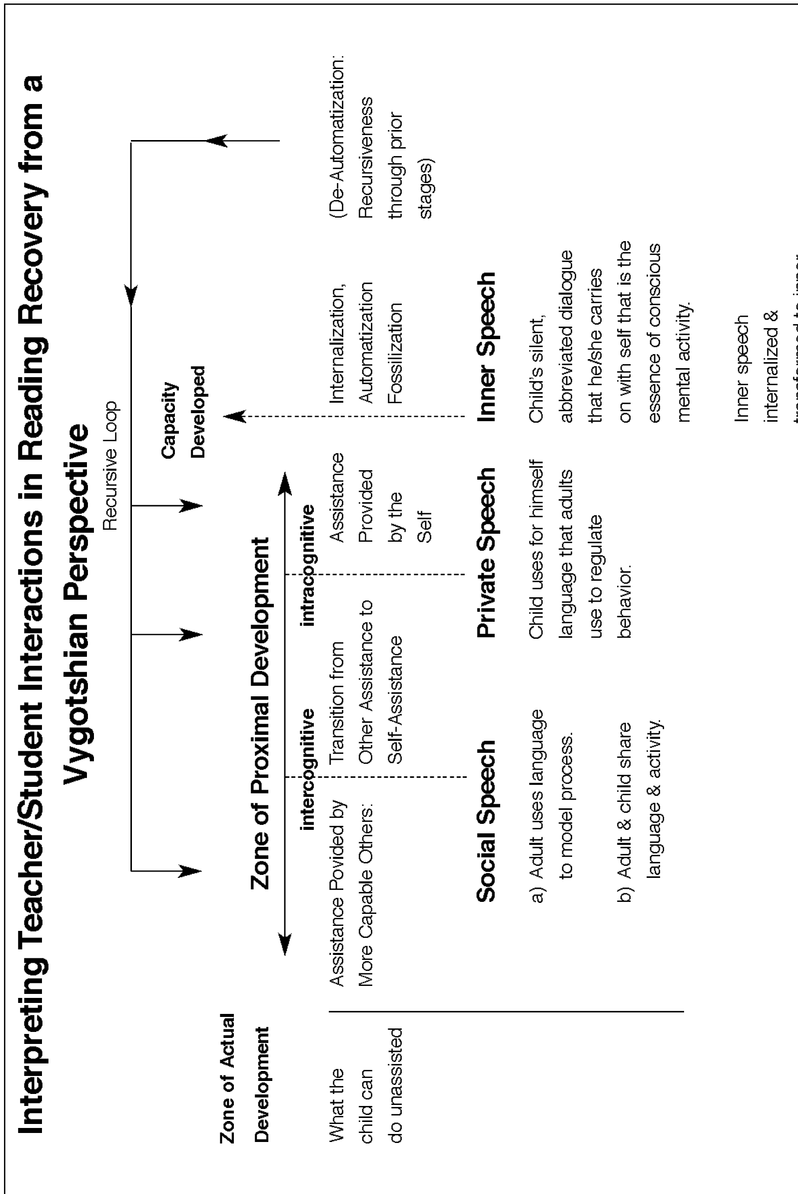

Figure 3. The Zone of Proximal Development (Vygotsky, 1978)
Note. Adapted from *Rousing Minds to Life*, by R. Tharp and R. Gallimore, 1988, New York: Cambridge University Press.

“Push all the red buttons here.” As he became more involved in the activity, he assumed my role and started using my words to regulate what he was doing. For example, he would say, “Push all the red buttons over here” as he found red buttons scattered on the floor and pushed them into the “red” pile.

During RR lessons, the teacher assumes a role similar to the one I had while playing with Ken. However, RR teachers explicitly teach children using specific language to model a process. They routinely adjust their interactions and structure lessons, tasks, and social speech in ways consistent with providing increasingly more challenging activities as children develop additional competencies.

In Figure 3, the dotted line separating assistance provided by more capable others and transition from other-assistance to self-assistance is designed to show the fluid and flexible adjusting of teacher and child roles and responsibilities as they progress through the program. This transition involves the teacher in a process of assisting children in posing and solving problems through the creation and arrangement of children’s activities and responsibilities. For example, in the button jar game, as Ken become more capable of sorting the buttons by color, shape, holes, etc., my role become less directive and our social speech shifted to meet this adjustment. In Reading Recovery, when the child’s eyes routinely complete a left to right visual scan of words in a sentence, the RR teacher might ask the child to “Read it with your finger,” to support his or her processing.

The dotted line separating transition from other-assistance to self-assistance and eventually to assistance provided by the self completes the zone of proximal development. The dotted line represents teachers’ challenging and supporting children in a process of posing and solving increasingly complex problems that the teacher, and eventually the child, have created as activities. As this process occurs the child’s thinking and problem solving are his or hers alone; that is, they occur within the child’s mind (intracognitive). During this process the child uses private speech, which is likely the language the teacher used to regulate his or her behavior.

Private speech is self-directing and self-guiding (Vygotsky, 1978). As an example, Ken revealed his plan for sorting buttons out loud through private speech. Once this stage occurs, the child has developed the capacity to initiate and successfully complete a task.

Internalization, automatization, and fossilization occur when the child has emerged from the ZPD into the developmental stage for the activity or process learned. For example, in the case where a RR child has developed the ability to read fluently and flexibly in a left to right direction, executing this directional reading in a smooth and integrated way, the process (left-to-right serial order) would be considered as internalized and automatized. Vygotsky (1978) described it as the “fruits” of the development, but he also discussed it as “fossilized” which suggests the fixity of the process.

During this period of development there is a transition from private speech to inner speech. Inner speech is the child’s silent, abbreviated self-dialogue that is the essence of conscious mental activity. Vygotsky (1978) postulated that “language arises initially as a means of communication between the child and period in his environment. Only subsequently, upon conversion to internal speech, does it come to organize the child's thought, that is, become an internal mental function" (p. 89). When this occurs, assistance from the adult is no longer needed. The following example illustrates a child who, by evidence of his inner speech, has reached this phase of development. He has emerged from the zone of proximal development.

Trevor had been in the Reading Recovery program for seven weeks and this was his first attempt to read the level 6 book Willy the Helper.

The text: On Monday, Willy helped me fold the clothes.

Student talk: On Monday, Willy helped me <u>fix</u>, there's no 'x'(hesitates), <u>find</u>, f-i-n-d, there's no 'o', <u>fold</u>, yea, that looks right. On Monday, Willy helped me fold the clothes.

It is obvious that Trevor had developed a plan to guide and monitor his behavior independently. Fortunately, he revealed his thinking through verbalized inner speech. Eventually Trevor's inner speech would be internalized and transformed to inner verbal thought. His overt behaviors did, however, suggest shifts in problem solving. For example, Trevor's first plan was to think of a word that began with 'f' that would make sense in the sentence – 'fix'was a meaningful prediction. However, when he said the word aloud, he did not hear or see an 'x'. His next move was to think of a word that made sense, started with an 'f' and ended with a 'd'. He tried 'find'. Once again, 'find'was a good choice because it began with an 'f' and ended with a 'd'and made sense, but after saying the word slowly he did not hear an 'o', the second letter he saw of the unknown word. He had to think of a word that started with an 'f' and was followed by an 'o'. He tried 'fold' and listened to the sounds of each letter in the word, checked them against what he saw in print, and he then pronounced that "The word looked right." He was now ready to read the entire sentence accurately and fluently.

Trevor's behaviors suggested a smooth integration of several task components, each of which was taught several times three to four weeks prior to this lesson. He had developed a flexible strategy system for problem solving that enabled him to predict and confirm words that would make sense, look right, and sound right in a particular sentence. Trevor had developed the ability to regulate his own behavior.

According to Diez, Neal, and Amaya-Williams (1990), self-regulation is "the child's capacity to plan, guide, and monitor his or her behavior from within and flexibly according to changing circumstances" (p. 130). The word "capacity" combines two separate but interrelated concepts, that of will and skill. If the child does not have the will to learn, there is no interest, no motivation, no focused attention, and few opportunities for the child to develop higher order reasoning. The research of Damasio (1994) and Greenspan (1997) supports the links between feelings and reason; that is, emotion and cognition.

Developing specific skills is equally important. The child must have learned and developed some fundamental cognitive skills in order to make continuous progress. For example, the child must develop the skill to distinguish the features of specific letters (lines, circles, squiggles), to recognize similarities and differences among letters, to determine features of a letter that other letters have in common, and to provide a label (letter name) for specific letters in order to organize

them into a specific sequence to make up a word.

For some children, these skills are not going to emerge as easily as they did for Ken. Not because they do not have enough neurons, but because connections between neurons and dendrites have not been established or routinely used enough to become mylinated. This is true because some children have had fewer opportunities to engage in reading and writing activities prior to formal schooling. But time has not run out for such children. Reading Recovery teachers know that it is possible, with expert teaching, to provide learning opportunities that enable children who enter school with a low repertoire of literacy skills to become proficient readers and writers in a relatively short period of time.

Neurological studies (Greenspan, 1997) have also demonstrated how experience, organized and directed through specific speech and language patterns, develops the growth of brain structures and minds in such a way that one can see connections among neurons and dendrites. Through repetition and mylination, these neurons and dendrites can become stronger, speedier, and more flexible.

De-automatization of performance represents the final stage of the described process. Life-long learning by all individuals involves the same regulated ZPD sequences—from other assistance to self-assistance—recurring over and over again for the development of new capacities. However, for every individual there is a point in time when he or she needs assistance while learning a new skill. When this occurs, recursiveness through prior stages takes place. In some cases the individual can provide assistance for himself. Other times, however, he or she may need expert help from another individual.

Prior to reading Willy the Helper, Trevor's lessons were a mix of other-regulation and self-regulation sometimes occurring in one sentence in the text. Each strategy used (check first letter, last letter, middle of the word) to analyze and read the word 'find'was taught many times while reading and writing texts and sorting letters within words using magnetic letters. A fundamental principle that underpins Vygotsky's (1978) theory of learning is that the instructional activity of teaching and learning is effective only when it proceeds ahead of development. This theoretical principle becomes evident in an analysis of multiple interactions between Trevor and his RR teacher as they progressed through the RR program.

My experiences in the examination of teacher/child interactions while observing and analyzing hundreds of Reading Recovery lessons and interviewing many teachers have led me to discern five characteristics of effective RR teachers (Lyons, Pinnell, & DeFord, 1993). First, they know how to create opportunities for children to learn how to learn as they progress from other-assistance to self-assistance within the ZPD. Second, they understand and are able to discuss the learning and teaching processes at both theoretical and practical levels. Third, they can recognize specific behaviors that indicate shifts in children's learning and conceptual development.

Fourth, they know how to create opportunities (through arrangement of materials and conversations) to accommodate specific child needs and to shift instruction when behaviors suggest a task is too easy or too difficult. Finally, they listen carefully to the child's language as he or she transitions from stage to stage through to self-regulation: (a) from social speech between the teacher and child,

(b) to private speech, where the child uses the language of the teacher to control reading and writing behaviors, (c) to inner speech where the child's abbreviated self-dialogue controls his actions, and finally, (d) to inner verbal thought.

Implications for Teachers

The theories discussed in this article serve to present a challenge to teachers of struggling learners. The practical implications of these theories that explain the making of the mind suggest three important things teachers may do to facilitate joyful and accelerative learning:

- Provide emotional support and encouragement for children's imperfect attempts and partially right responses.
- Expect all children to make accelerated progress such that they can benefit from classroom instruction.
- Remember it is the quality of experience and instruction, not the child's cognition, that determines success or failure.

Melvin Konner (1991), a physician and anthropologist who has studied the emotional and cognitive development of children, writes:

> Consistently losing does not promote self-esteem, no matter how impervious to reality you may be. So every educational program needs to make a choice. You can get short-term gains in self-esteem and continue to lose ground; or you try this theory: that self-esteem can come from making great effort, from facing uncertainty and overcoming obstacles that we are not sure we can meet, from doing our level best. (p. 231)

I believe effective teachers function in such a way as to support this point of view.

Teachers of at-risk learners may have to struggle with children from time to time to get them to overcome doubts about themselves, to dig in, and to make strong attempts. It is a challenge, but only by accepting it will teachers get to see the excitement in a child's face when he or she closes the cover on a new book just read and says in a thrilled, surprised voice, "I did it!"

True self-esteem grows from mastery of genuine challenges. Recent neurological research (Damasio, 1994; Greenspan, 1997) suggests that no human being can learn material presented in a form that his or her nervous system cannot handle. Children given tasks beyond their capacity lose confidence, the will to learn, and self-respect. They become defeated. As educators, we should take seriously Greenspan's (1997) challenge set forth in the opening of this article, that is, to consider the emotional nature of learning and the critical role emotions play in the making of the mind. To ignore that is to fail children.

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Emotions, Cognition, and Becoming a Reader

Biography

Carol A. Lyons is a professor of education at The Ohio State University in Columbus, Ohio. She teachers graduate courses in developmental and corrective reading, literacy curriculum development and evaluation, teaching and learning, and the Reading Recovery theoretical courses for teacher leaders and university trainers. Dr. Lyons has conducted research and published numerous articles in the field of cognitive processing, learning and reading disability, and teacher learning, curriculum development, and practice. She is the co-author of two books: Partners in Learning: Teachers and Children in Reading Recovery and Bridges to Literacy. Dr. Lyons is past president of the Reading Recovery Council of North America.