FIGURE 4.2:

Brain-Based Learning

- ***We have the ability to learn new things our entire life.*** Medina (2009), a molecular biologist, states that researchers did not know this until five or six years ago. Today, the prevailing notion is that some parts of the brain can grow new connections and strengthen existing connections throughout our lives.

- ***The growth of the prefrontal cortex (PFC) is greatest between the ages of 8 and 16.*** High-order thinking functions develop in the PFC. Stimulating these higher-brain networks during this stage of rapid development strongly influences students' lifelong executive functions of judgment, critical analysis, relational thinking, and prediction. Growth continues through age 25 before slowing, but we never totally lose our ability to change our brains (Sousa, 2010; Willis, 2011).

- ***Intelligence is not fixed.*** The brain is a muscle that improves with use, building brainpower through the very act of learning (Dweck, 2006). Challenging learning experiences with appropriate support stretch thinking muscles. To experience challenge, however, students must encounter a task or situation beyond current capability, suggesting that high-ability students may not build brainpower when limited to core curriculum experiences.

- ***The brain actively attends to concentrated information for eight to fifteen minutes.*** After fifteen minutes or less, the brain becomes distracted with daydreaming or attending to external stimuli (Medina, 2009; Sousa, 2010; Willis, 2011). Hence, factual lectures should be broken into shorter segments and interspersed with student application or interaction.

- ***The brain can only focus on one thing at a time.*** When it seems as if we are focusing on more than one thing, we are actually quickly switching between tasks. This rebuts the popular idea of multi-tasking (Medina, 2009; Tokuhama-Espinosa, 2010).

- ***Healthy social and emotional learning is paramount to achievement.*** When students feel anxious, the amygdala blocks learning by scrambling learning circuits and switching information to the lower 80 percent of brain used by animals for survival, instead of using the 20 percent of the PFC where higher learning occurs (Willis 2011). When teachers use strategies providing emotional comfort and pleasure as well as knowledge, students gain emotional resilience and learn more efficiently at higher cognitive levels (Willis, 2007a).

- ***Feedback is a mainspring of learning.*** Effective feedback guides student learning. Use formative assessment to check for advanced insights or misconceptions early and often in a segment of learning, and offer effort-based encouragement rather than discouragement (Dweck, 2010).

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- ***Physical exercise boosts brainpower.*** More cardio-vascular activity during the day increases the flow of oxygen-rich blood to the brain, heightening students' ability to concentrate. (Early childhood and kindergarten teachers have always seemed to know this!). Medina (2009) urges schools to combine fitness with academics to boost brainpower.

- ***Novelty shifts the brain to full attention.*** Willis (2010; 2011) explains that the reticular activating system (RAS) filters incoming stimuli, deciding if information deserves autopilot (daydreaming or off-task) or full attention. Changes in the learning environment and instruction can pique children's curiosity and reactivate the brain. Novelty is an attention-grabber for the brain. Bring new energy to a lesson with art, movement, music, students' interests, color, and surprise, such as walking backwards while discussing negative numbers (Willis, 2011).

- ***Sense and meaning arm understanding.*** Students exhibit significantly more brain activity and a dramatic improvement in retention when learning makes sense and is relevant to the individual. Effective teachers realize that they do not teach information and meaning; they facilitate so students develop meaning in the information they learn (Sousa & Tomlinson, 2010). Superior learning occurs when classroom experiences are relevant to students' lives, interests, and experiences (Willis, 2007a).

- ***Information is retained and retrieved only when applied or acted upon.*** Memorized information will not build long-term neural networks in the PFC, where higher order thinking occurs, unless students have the opportunity to construct relationships to their prior knowledge and/or apply new learning to new situations (Sousa & Tomlinson, 2010; Willis, 2011; Wolfe, 2010). Through a variety of active mental manipulations with prior knowledge, new information becomes incorporated into the established neural network of previously acquired related memory and leads to better retention (Sousa & Tomlinson, 2010).

- ***Joyful learning promotes attention and retention.*** When classroom activities have pleasurable associations linked with learning, the brain releases dopamine–a neurotransmitter that stimulates the memory centers and promotes increased, focused attention (Willis, 2007b).

For students to be best prepared for the opportunities and challenges awaiting them, they need to develop their highest thinking skills–the brain's executive functions. These higher-order neural networks are undergoing their most rapid development during the school years, and teachers are in the best position to promote the activation of these circuits.

–Willis, 2011

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