The Brain Targeted Teaching Model

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During the past decade the neurological and cognitive sciences have produced a vast frontier of knowledge on how the brain processes, stores, and retrieves information. As educators have increasingly recognized their role as consumers of this emerging knowledge, translating brain research into classroom instruction often becomes a challenge for the typical educational practitioner.

In an era of high-stakes accountability for student performance, many teachers feel pressured to prepare students to meet proficiency levels on standardized tests. At the same time, they are often required to implement a plethora of ever-changing educational initiatives and reforms handed to them by well-meaning school district supervisors. In this climate, it would not be surprising for new teachers to feel overwhelmed and seasoned teachers to view any educational initiative, including perhaps research in the neurosciences, as merely a fad that soon will be replaced by yet another new initiative. Perhaps this thinking accounts for the fact that educational research is largely ignored by practitioners; as a result little actual change has occurred in our nation's classrooms during the last several decades.

In order for any research, especially current brain research, to become readily accessible to teachers, fragmented initiatives must be integrated into a cohesive model of instruction. The Brain-Targeted Teaching Model is designed to meet this need. It provides teachers with a format for using research in the neurosciences as well as research-based effective instructional practices to guide them in planning, implementing, and assessing a sound program of instruction. The model also assists administrators, supervisors, and professionals supporting instruction as they guide teachers in implementing research-based effective teaching strategies.

First, it might be wise to address those critics who scoff at the term brain-based learning. Some, for example, might contend that the term has no meaning since all learning is brain-based. "After all," they may say, "we don't think with our feet!" We know, of course, that all learning involves the brain. Yet we also know that not all teaching results in learning. Thus, while all learning is "brain-based," all teaching is not. Unfortunately, many teaching practices that regularly occur in our schools defy what neuroscience tells us about the brain's natural learning systems. The language of this model, therefore, does not refer to brain-based learning but rather to brain-targeted teaching.

The Brain-Targeted Teaching Model presents six stages, or "brain targets" of the teaching and

learning process and describes brain research that supports each stage. While each brain target is presented separately, the components are interrelated. For example, Brain-Target One describes the importance of establishing a positive emotional climate to foster high levels of learning; these strategies are applied throughout the entire model. At the same time, evaluating leaning, Brain-Target Six, is an integral part of each component or target of the model.

BRAIN-TARGET ONE: THE EMOTIONAL CLIMATE FOR LEARNING

Neuroscientists have recently described the intricate interactions between the emotional and cognitive brain systems. Research has shown that the brain's limbic system, located just above the brain stem at the base of the brain, is responsible for our emotional responses. Neuroscientists tell us that information that comes to the brain is processed first in this emotional center before being processed in the cognitive or "thinking" center, located in the frontal lobe of the cerebrum. With information processing short-circuited first to the emotional center, chronic stress may impair long-term memory and deep learning. The effects of stress and threat on learning have clear implications for educators.

While we may be unable to control all the factors of stress in the lives of our students, the adept teacher can minimize threat-causing practices within the classroom. At the same time, the teacher should maximize strategies that promote positive emotion. Research has shown that while threats impede learning, positive emotional experiences, during which the brain produces certain chemicals or neurotransmitters, can contribute to long-term memory.

In the Brain-Targeted Teaching Model, teachers are encouraged to deliberately plan for positive emotional connections within the framework of a specific unit of study, referred to as a learning unit. Such connections include specific activities that will connect the students emotionally to the content. The infusion of the visual and performing arts is an effective way to tap into children's emotional response systems to enhance learning and should be included within the activities of every learning unit.

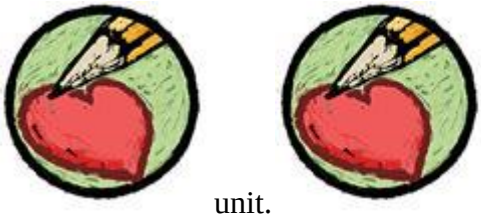
BRAIN-TARGET TWO: THE PHYSICAL LEARNING ENVIRONMENT

While Brain-Targeted One focuses on establishing a positive emotional climate, Brain-Target Two fosters the careful planning of the physical learning environment. We know that our eyes register about 36,000 visual images per hour, with about ninety percent of the brain's sensory input coming from visual stimuli. With this vast visual capacity, the active brain constantly scans the environment seeking stimuli.

Researchers tell us that the brain's visual attending mechanism is strongly influenced by novelty in the environment. Studies compared the effects of bland, unchanging environments with classrooms that provided students with stimulation through frequently adjusting and changing classroom displays. Findings revealed that children were off task more often in settings that lacked novelty.

Sound, lighting, and scent also appear to have an effect on learning. Soft background music can help to relax students and provide a comfortable learning environment. However, while performing tasks that demand high levels of concentration, a quiet setting appears to be most effective. In studying the effects of lighting, researchers have shown increases in achievement of students who were taught in classrooms with the most natural and full spectrum lighting compared to dark classrooms or those with cool-white fluorescent lights (Kosik & Heschong, 2000). Scent can also be used to enhance memory, as olfactory input moves directly to the limbic system or emotional center. This accounts for the vivid recollection that an encounter with a familiar scent may invoke.

In the Brain-Targeted Teaching Model, teachers carefully plan the physical learning environment by deliberately planning for novelty, order, and beauty within each learning



unit.

BRAIN-TARGET THREE: DESIGNING THE LEARNING EXPERIENCE

Brain-Target Three encourages teachers to design the learning experience in a way that is compatible with the brain's natural learning systems. While it may seem natural for teachers to write lesson plans that present information to students in sequential order until all of the content has been covered, this approach may in fact impede learning. Neuroscientists tell us that the brain categorizes new stimuli into concepts that are either familiar or novel, then combines these concepts to create new patterns of thinking and understanding—a concept referred to as patterning. The brain filters new information through the lens of prior experience and prior

knowledge in order to create new meaning. New information, then, becomes integrated into a holistic pattern of cognition.

Imagine completing a jig-saw puzzle without ever having seen the overall image that the puzzle displays. Without giving students "big picture concepts" of the content that they will learn in a unit of study, students are often learning disconnected bits of information that too often never come together into an overarching concept or pattern. Lack of conceptual understanding typically results in loss of retention of the disjointed facts and details.

In The Brain-Targeted Teaching Model, teachers are encouraged to use content standards and curriculum guidelines to design overarching goals and concepts, then to display these learning goals in non-linguistic representations such as concept maps or graphic organizers. Activities are then designed to allow students to understand how the objectives they will learn during the unit relate to the big picture concept. As they continue through the content, students are referred back to the concept map to reinforce the relevance of each learning activity.

BRAIN-TARGET FOUR: MASTERY OF SKILLS, CONTENT, AND CONCEPTS

The next stage of The Brain-Targeted Teaching Model is to engage students in activities that will enable them to demonstrate mastery of skills, content, and concepts. Brain-Target Four promotes mastery of learning goals and objectives by planning multiple activities to activate the brain's memory systems.

In teaching for mastery, teachers must provide students with learning activities to create and sustain new engrams, or memory patterns. Cognitive scientists have identified three types of memory systems: short-term, working, and long-term memory. Short-term and working memory systems provide a form of temporary storage; short term memory allows us to retain information for a few seconds or minutes, while working memory serves as a "desk top" for retrieval of information when it is in immediate use. Once the brain determines that the information in our working memories is no longer needed, it is partially or totally forgotten. Unfortunately, too often what is presented in our classrooms is designed for students' working memories—students learn information so they can retrieve it on a test or quiz then quickly forget much of it as they move on to the next topic.

Clearly the goal of teaching and learning is for students to acquire knowledge, processes, and skills that they can use to build new knowledge, a process that requires the use of long-term memory systems. Leading researcher on memory, Larry Squire (2002), tells us that the most important factor in determining how well we remember information is the degree to which we rehearse and repeat that information. Based on the method and frequency of presentation,

memories consolidate as the brain reorganizes, modifies, and strengthens synaptic connections among neurons. During tasks that involve only working memory, the brain uses proteins that currently exist in brain synapses (Ratey, 2001). When information moves, however, from working to long-term memory systems, new proteins are created. Effective teaching can result in biochemical changes in the brain!

Brain Target Four of The Brain-Targeted Teaching Model encourages teachers to plan for repeated rehearsals of content, skills, and concepts so that the information becomes part of students' long-term memory systems. Such repetition would be terribly boring for students (and teachers too) if the same activities were presented multiple times in the same way. Instead, teachers are encouraged to plan varied experiences so that students can manipulate information within a variety of modalities. The best way to accomplish this is through the integration of artful teaching into content instruction.

Integration of the arts encourages meaningful connection to concepts, encouraging teachers to pair visual, kinesthetic, and musical thinking with linguistic learning tasks. As Howard Gardner (1983) states, "The abilities involved with the visual arts, with sculpture or painting, with drama, mime, use of the body, with music, all represent separate sets of cognitive skills." Cognitive learning and higher-order thinking can be enhanced with meaningful connection to the arts through such activities as musical performance, role-playing, visual representations, creative movement, drama, poetry, and creative writing.

By providing students with multiple ways to manipulate content, skills, and concepts, teachers are not only promoting long-term memory but are providing the opportunity to differentiate instruction based on students' emotional needs, academic goals, and cognitive learning styles.

BRAIN-TARGET FIVE: EXTENDING AND APPLYING KNOWLEDGE

The acquisition of knowledge is only the beginning of a sound instructional program. Brain research supports what educators know to be the hallmark of effective instruction—life-long learning best occurs when students are able to apply content, skills, and processes to tasks that require them to engage in higher-order thinking and problem-solving skills. Using knowledge meaningfully requires students to extend thinking by examining concepts in deeper, more analytical ways, thus requiring the brain to use multiple and complex systems of retrieval and integration. Brain researchers have used the concept of the modular brain to describe differentiated functions of brain regions. Modules from one part of the brain connect to other modules when we perform complex tasks. Research has demonstrated, for example, that the motor cortex, originally thought only to control motor functions, becomes activated when the brain engages in problem-solving that includes such cognitive components as memory, language,

emotion, and active learning.

Brain-Target Five promotes the use of performance-based instructional activities within each learning unit. Such activities require students to engage in inductive and deductive thinking, analysis, and problem-solving skills. It allows students to apply what they have learned in tasks that have real-world application. Within the Brain-Targeted Teaching learning unit, Brain-Target Five activities include conducting investigations, designing experiments, creating metaphors and analogies, examining cause and effect patterns, analyzing perspective, and engaging in creative thinking through the visual and performing arts.

BRAIN-TARGET SIX: EVALUATING LEARNING

While Brain-Target Six is the last stage of the Brain-Targeted Teaching Model, each stage of the model includes evaluation activities. The goal of evaluation is to provide students with relevant feedback about their performance so that the student can adjust learning habits and the teacher can make sound instructional decisions. Cognitive science supports what teachers know by experience: Immediate feedback strengthens learning and memory patterns. The Brain-Targeted Teaching Model supports the use of an evaluation measure for each objective and activity. In addition to traditional grading methods (quizzes, tests, essays, etc) evaluation measures should also employ a combination of tools including scoring rubrics, grading keys, and self-grading tools, student-generated reflections.

THE BRAIN-TARGETED TEACHING LEARNING UNIT

By using the following format of the Brain-Targeted Teaching Learning Unit, teachers can be assured that they are implementing research-based effective teaching strategies as well as implementing what the neurological and cognitive sciences tell us about how the brain thinks and learns. Teachers who have implemented this model are quick to say that, while it requires more "front-loaded" planning than a traditional planning format, once completed they can focus on lesson implementation rather than planning for the two or three week learning unit time segment. They have also related that the model requires them to think more deeply about instructional implementation, fostering more creative and innovative lessons. By using the Brain-Targeted Teaching Model, teaching and learning not only becomes more effective, it becomes more fun!

Please visit Dr. Hardiman's site on her Brain-Targeted Teaching Model for Sample Units and a Learning Unit Template to help you plan your own units using this model.

Dr. Hardiman's latest book, *Connecting Brain Research with Effective Teaching: The Brain-Targeted Teaching Model,* is available at the New Horizons for Learning Store.

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