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Research Brief

Brain-based Learning

Question: What does brain-based research say about how adolescents learn?

Summary of Findings:
The 1990s was declared as the Decade of the Brain by President Bush and Congress. With the advancement of MRIs (Magnetic Resonance Imagining) and PET (positron emission tomography) scans, it has become much easier to study live healthy brains. As a result, the concept of "brain-based learning" and how to utilize it to meet the needs of students, has become an integral part of the current research and literature. The researchers caution when incorporating new information into the classroom, to use good sense about implementing what is known about good instructional practices.

Major Conclusions:

Basic Brain Information:
The adolescent brain:

- is a parallel processor-it talks to and communicates with both hemispheres
- is pattern seeking-it looks for prior knowledge to which to connect new information
- is naturally curious, looks for novelty and will embrace meaningful and complex investigations
- is unique and thrives when given choices
- takes in information in the immediate and peripheral environment
- learns from an emotional base
- learns when it feels physically and emotionally safe
- learns information from whole-to part-to whole
- learns best from a stimulating, however, not an over stimulating, environment, which is optimal for more synaptic connections to occur and for dendridic connections to be made
- builds on prior knowledge and experiences in order to make long-term and meaningful connections
- begins a major pruning process around age 11 and continues through the early 20s. It removes little used pathways so that the more often used ones are more readily available so they can function at an optimal level.
- continues to develop well into the 20s, as the frontal lobe is the last to mature

- needs sleep, about 9 hours and 15 minutes. Their body clocks and circadian rhythms are set differently than when they were younger. During sleep, the hormones for growth and sexual maturity are released, brain cells are replenished, and information gained throughout the day is processed.

Adolescent male and female brains:
These are general statements based on solid research, however, about 20% (1 in 5) of the population are considered to be "bridge brains," which means that their brain chemistry may in many ways, reflect that of the opposite gender.

Females:
- The corpus collasum that allows for communication between the right and left hemispheres is 20% larger in females. This allows them to use more oral vocabulary.
- Absorb more sensory data, hear and smell better. They take in information more effectively through touching.
- Increased production of estrogen promotes sudden growth of the hippocampus (front part of the brain) which allows for better memory of names and faces in social situations and relationships.
- Are more verbal and more adept at multi-tasking.
- Estrogen produces more emotions, which promotes more immediate discussion and handling of problems.
- Need to move from specific and concrete in order to build up to conceptualizations.
- Work better in groups and in darkened rooms.

Males:
- Take in more information through spatial and abstract means. They need clear evidence.
- Unable to successfully multitask .
- During puberty, boys receive 5-7 daily surges of testosterone, which creates aggressiveness and stimulates abstract thinking.
- When physically active, testosterone is produced, which increases competitive behavior.
- Push down emotions that will often fester from several hours to days, then they will have more of a tendency to physically explode.
- Plan a strategy to a problem, challenge, often individually.
- Prefer to work independently.
- Hear a louder voice better than a softer one.
- Work better in a well-lit room.
- Until about the age of 15, they need more physical space in which to work.

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Online Resources:

- Active Research Leads to Active Classrooms
  One of the criticisms of brain-based research is that is being conducted by neuroscientists who are not in the classroom and do not know what information educators need. This article describes a research project conducted in Salt Lake City, Utah, where teachers and neuroscientists teamed in order to better and accurately determine in what areas and sequences students were really learning.
  http://www.help4teachers.com/activeresearch.htm

- Advantages to Layered Curriculum
  Teachers working with students to establish specific expectations and giving students choice in their assignments is described.
  http://www.help4teachers.com/whyy.htm

- Becoming a Wiz at Brain-based Teaching
  A brief synopsis of each chapter in this book is provided. The book, available through ASCD, is reader friendly and usable. More information is available in the Books section of this reference list.
  http://www.lecturemanagement.com/speakers/sprenger_marilee.htm

- Brain-based learning
  A brief list of 12 principles that should be in place in order for maximum learning to take place is provided.
  http://www.funderstanding.com/brain_based_learning.cfm

- Brain Biology: Basic Gardening
  The concept of the pruning process that goes on in an adolescent's brain and the importance of sleep to learning are described and discussed.
  http://www.help4teachers.com/gardening.htm

- Brain Research and Education: Fad or Foundation?
  This is the second article on the site. An overview of recent research on the brain and memory are presented. It provides some ideas for classroom teachers on helping students to develop long term memory.
  http://www.patwolfe.com/index.php?pid=100

- Caine Learning Center

This is the web site for two of the foremost researchers in this field. The site includes information on books, articles, and research on brain-based learning as well as workshops that are available.
http://www.cainelearning.com/

- Growing Bigger Brains: Research Affects How Teachers Teach
  An overview on ways for classroom teachers to help students' learning be meaningful and long term utilizing how the brain processes information is laid out here.
  http://www.education-world.com/a_curr/curr140.shtml

- How Can Research on the Brain Inform Education?
  This article provides some basic facts about how the brain processes information, along with suggestions of things that can be done in the classroom to support each given fact.
  http://www.sedl.org/scimath/compass/v03n02/brain.html

- In Search of …Brain-based Education
  A dense article cautioning the reader to be aware of what the research in this field is finding. It does provide some strong support for brain-based education.
  http://www.pdkintl.org/kappan/kbru9905.htm

- Inside the Teen Brain
  This is a video produced by PBS on the development of the adolescent brain. This site provides a synopsis of this documentary and purchase information.
  http://www.shoppbs.org/product/index.jsp?productId=1759490

- Kathy Nunley's Layered Curriculum
  A thorough definition and description of a layered curriculum is provided, along with ample of examples.
  http://brains.org/store/lc/pg1.htm

- Mind Matters, Inc.
  This web site contains information on and articles written on the brain by Patricia Wolfe, a leading authority in this field.
  http://www.patwolfe.com/

- Principles of Brain-based Learning
  A brief overview of 9 important principles of brain-based learning is presented along with ideas of ways each can be incorporated into the classroom.
  http://www.unocoe.unomaha.edu/brainbased.htm

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- Sampled Layered Curriculum Units
  Numerous units in all content areas for secondary students utilizing the layered curriculum concept are available at this site.
  http://help4teachers.com/samples.htm

- 12 Design Principles Based on Brain-based Learning Research
  A brief list of principles from brain research that can directly apply to the classroom is presented in this article.
  http://www.designshare.com/Research/BrainBasedLearn98.htm

Articles:

- Caine, R. N. (2000, November) Building the bridge from research to classroom. *Educational Leadership,* 58, (3*).*
  This article describes what happens to the brain and learning, when downshifting occurs.

- Caulfield, J., Kidd, S., and Kocher, T. (2000, November). Brain-based instruction in action. *Educational Leadership* 58 (3), 62-65.
  Emotions have a direct effect on learning. A description of what happens when the brain feels threatened and some ideas on ways to handle this are addressed.

- Given, B. (2000, November). Theaters of the mind. *Educational Leadership* 58 (3).
  A description of how the brain is on and taking in information, 24-7 is provided. It has strong implications for educators on the types of learning students are expected to do and can actually do, based on brain-based research.

- Greenleaf, R. K. (1999, September). It's never too late! What neuroscience has to offer high schools. *NASSP Bulletin*, 80-89.
  The role of emotions, movement, and methods of presentation are tied into brain-based research. There are several suggestions for ways in which to work with students utilizing the research.

- Gurian, M. and Stevens, K. (2004, November). With boys and girls in mind. *Educational Leadership,*
  62 (3), 21-26.
  An overview on the differences between how males and females learn and process information.

- Tomlinson, C. A., and Kalbfleisch, M. L. (1998, November). Teach me, teach my brain. A call for differentiated classrooms. *Educational Leadership* 56(3), 52-55.
  Why classrooms need to be a safe place to take risks and building on prior knowledge in order for the brain to grow is described.

- Wolfe, P. (1998, November). Revisiting effective teaching. *Educational Leadership,* 56, (3).
  Brain-based research is compared to Madaline Hunter's Elements of Effective Instruction, and how it is still important and valid.

Books:

- Given, B. (2002). *Teaching to the brain's natural learning systems*. ASCD: Alexandria, VA.
  This book provides an overview of how the brain is structured. It covers the brain's systems of emotions, social, cognitive, physical, and reflective learning. It does provide applications of the ideas into the classroom.

- Gurian, M. (2001). *Boys and girls learn differently*! Jossey-Bass: San Francisco, CA.
  This book provides an overview of how male and female brains process differently. Specific information is presented by age groups.

- Gurian, M., & Ballew, A. C. (2003). *The boys and girls learn differently action guide for teachers*. Jossey-Bass: San Francisco, CA.
  A companion book for Boys and Girls Learn Differently, it has specific suggestions for ways to meet the needs of males and females in the classroom. It is divided into different age groups.

- Jensen, E. (1998). *Introduction to brain-compatible learning*. The Brain Store, Inc.: San Diego, CA.
  The author is one of the foremost authorities in this field. This book is easily understandable. It explains brain-compatible learning, applications of the information to learning and the environment, and how to use the information in the classroom.

- Sprenger, M. B. (2002) *Becoming a wiz at brain-based teaching*. Corwin Press: Thousand Oaks, CA
  An analogy is used to connect brain learning to the Wizard of Oz. It provides an overview of the physical structure of the brain, how the brain deals with stress, emotions, cognitive skills, and the learning environment.

- Tomlinson, C. A. (1995). How do differentiate instruction in mixed ability classrooms. ASCD: Alexandria, VA.

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According to this book there are two common characteristics in effective classrooms: every student is an active participant in their own learning, and all students are actively engaged in their own decision-making. There are many ideas on ways in which to reach every student in the classroom.

- Wolfe, P. (2001) *Brain matters*. ASCD: Alexandria, VA.
  This book is for those who would like more advanced information on the structure and function of the brain. The implementation section provides practical suggestions and projects for the classroom.

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