Brain Research

- It is important to realize much of the research on the brain as it relates to learning has been done on animal models. The research that is done on humans consist of the study of discrete tasks in isolation.
- This research can however, give us important ideas about how to make learning more effective.

(Dr. Janet Zadina, Neuroscientist and Educator)

Slides available for download at:

www.learnercenteredteaching.com

Presentation Outcomes

By the end of the presentation participants will:

1. Have a better understanding of how to help students learn in harmony with their brains.
2. Have developed new ideas for integrating exercise and movement into the learning activities of their students.

Workshop Outcomes

By the end of the presentation participants will:

3. Have developed new ways of using information patterns to enhance your students’ learning.
4. Have developed new ways to help students recall course content.
5. Have developed new ways to use multisensory approaches to teaching.
6. Have developed new ways to help students use multisensory approaches to learning.
Critical Thinking

- The ability to think critically is greatly enhanced when people are maximizing their brains' learning abilities.

Basic Principle of Learner Centered Instruction

It is the one who does the work who does the learning

Learning is when Neurons Wire

- Learning is a change in the neuron-patterns of the brain.

Definition of Learning

Learning is a biological process for survival

Teachers' Definition of Learning?

Learning is the ability to use information after significant periods of disuse and it is the ability to use the information to solve problems that arise in a context different (if only slightly) from the context in which the information was originally taught.

Use it or Lose it

- When new material is not practiced the new dendrite tissue is reabsorbed to conserve resources.

- (Dr. Janet Zardina, 2010)
**Learning Activates the Brain’s Reward Pathways**

- Real life, meaningful, and authentic learning activates the reward pathways in the brain.
- It is this pathway that keeps us alive.

(Dr. Janet Zardina, 2010)

**Progress is Vital**

- A feeling of making progress is what allows humans to deal with tasks, especially tasks we don’t necessarily like to do.

(Dr. James Zull, 2002)

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**Part One**

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**The Human Brain**

- The human brain weighs three (3) pounds but uses 20-25% of the body's energy.

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**The Human Brain**

- The human brain has 100 billion neurons (it does grow thousands of new cells daily).

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**The Human Brain**

- These 100 billion neurons are capable of making 40,000,000,000,000,000 (forty quadrillion connections).

(James Ratey, Users Guide to the Brain)
The Brain and Learning

• The human brain was designed to solve problems of survival in outdoor, unstable environments while in almost constant motion.

[Dr. John Medina, Developmental Molecular Biologist, University of Washington and Author of Brain Rules]

The Brain and Learning

• “If educators had set out to design a learning environment that was in complete opposition to what the human brain is good at they would have designed the schools of yesterday and today.”

(John Medina, Brain Rules, 2008)

The Brain and Learning

We actually are just beginning to understand the incredible complexity of the human brain.

However, there 12 things we do know about how the brain processes information and these are significant to your students’ learning. (Dr. John Medina)

Twelve Things We Know for sure about the Human Brain

1. Exercise significantly enhances brain function

Exercise and Learning

• Exercise is the single most important thing a person can do to improve their learning.


Exercise and Learning

• Exercise influences learning directly, at the cellular level, improving the brain’s potential to log in and process new information.

• Ratey, p35
Newest Findings

- Exercise increases production of neurotransmitters that help:
  1. Focus and attention
  2. Motivation
  3. Patience
  4. Mood (more optimistic)

(Ratey, 2008)

Exercise and Learning

- Exercise—enough to sweat and 4-5 times a week improves:
  1. All brain systems
  2. Executive functioning
  3. Creativity
  4. Learning

(Ratey, 2008)

Exercise and BDNF

- Exercise produces BDNF (Brain-derived neurotrophic factor)

(Ratey, 2008)

BDNF

- Improves brain health
- Enhances the wiring of neurons
- Is a stress inoculator
- Makes the brain cells more resilient

BDNF and Synapses

- BDNF gives synapses the tools they need to:
  - Take in
  - Process
  - Associate
  - Remember
  - Put in context

Exercise and BDNF

- The more intense and complex the exercise the more BDNF that is made.
BDNF and Exercise

• “In particular BDNF seems to be important for long term memories” (John Ratey, 2008)

Long Lasting Benefits

• Morning aerobics will cause improve brain performance for 6-7 hours—concentration, attention, focus as well as learning

  (John Ratey, 2008)

Exercise Reduces Bad Behavior

• Exercise produces the neuro-chemicals that aid the brain in self control

• Studies show dramatic declines (66%) in suspensions and discipline referrals in public schools involved in test studies

  (Ratey, p. 14)

Exercise and Brain Pathologies

Exercise reduces significantly the potential for the brain to succumb to certain pathologies

• 1. Alzheimers 50%
• 2. Dementia 60%
• 3. Depression 70%

  (Dr. John Medina, Brain Rules, 2008)

Questions

• How could we introduce movement into our classes?

• How do we get our students to engage in aerobic exercise?

• How do we redesign learning environments to keep learners active and moving?
The Brain is Social

2. Survival is accomplished by working with other brains
   Groups of brains almost always outperform a single brain

The Brain is Social

- Group work has tremendous potential to aid understanding and learning—if the groups understand their roles and what they are trying to accomplish

Brains are Wired Differently

3. All brains are wired differently
   Our experiences make us different

Brains are Wired Differently

- It is these differences that can make working together in teams and groups such a powerful learning experience

Attention and Learning

4. The brain can only pay attention to one thing at a time

Attention and Learning

- It is not possible to multitask when it comes to activities that require the brain’s attention
Lapses in Students’ Attention

• One explanation for the lapses in students’ attention is that the “information transfer” model of the traditional lecture does not match what current cognitive science research tells us of how humans learn.

(The "Change-Up" in Lectures Joan Middendorf and Alan Kalish Teaching Resources Center Indiana University)

Lapses in Students’ Attention

• Research tells us the brain handles information by reducing it into meaningful chunks that we call categories.

• Learning consists of fitting this reduced information into already existing categories or, sometimes, of forming new ones.

(Multi-tasking)

Multitasking

• Studies with college students and adults show if the challenge demands a lot of attention, mental performance is particularly poor.

• (David Walsh of the National Institute on Media and the Family)

Multitasking

• Multi-tasking violates everything we know about how memory works

• There is objective scientific evidence that multi-tasking impairs learning.

• The imaging data indicated that the memory task and the distraction stimuli engage different parts of the brain and that these regions probably compete with each other.

(Multi-tasking)

Memory

5 +6.

Memory

Repetition over time and elaboration are necessary for memory formation and recall

(Multi-tasking)

Multitasking

• Our brain works hard to fool us into thinking it can do more than one thing at a time. It can’t.

• When trying to do two things at once, the brain temporarily shuts down one task while trying to do the other.

(De, K. K., Barch, D., and Anderson, J. R. 2007.)
Listen to the Music

• Do you know the lyrics to songs that you did not try to learn and do not want to know the lyrics to?

YES

Practice over Time

• Practice, Use, Repetition, Review, Reflection or any other way we engage with new learning over time is a major key to its recall.

Sleep and Memory

• "Periods of slow-wave sleep are very long and produce a recall and probably amplification of memory traces. Ensuing episodes of REM sleep, which are very short, trigger the expression of genes to store what was processed during slow-wave sleep."
  • Sidarta Ribeiro, Duke University, 2004

Sleep and Memory

• The MRI scans are showing us that brain regions shift dramatically during sleep,

• "When you’re asleep, it seems as though you are shifting memory to more efficient storage regions within the brain. Consequently, when you awaken, memory tasks can be performed both more quickly and accurately and with less stress and anxiety."

  • Matthew Walker, PhD, director of BIDMC’s Sleep and Neuroimaging Laboratory and Assistant Professor of Psychiatry at Harvard Medical School.

Sleep and Memory

• This means
• Less sleep
• Less time for memory formation
• Bad for learning

Working Memory

Held: 18-36 hrs.
Focus: 10-20 min. In a single mode
Out is Out!

7 "chunks"

Sense
Meaning
Cramming
Memories are Reconstructed

- The more senses used in learning and in practicing what has been learned (seeing, hearing, touch, taste and smell) the more pathways are available for reconstruction (recall).

Elaborations are the Key

- “For better or worse, our recollections are largely at the mercy of our elaborations” (Daniel Schacter author of the Seven Sins of Memory)

Elaboration is the Second Major Key to Recall

- Step One. Accuracy
- Step Two: Reflection
- Step Three: Review
- Step Four: Mapping
- Step Five: Recoding

Accuracy

Reflection

- Reflection expands connections, understanding and insights.

Keys to Review

Daily is Best
Concept Mapping and Review

• A concept map simply represents visually (easiest thing for the brain to learn, Zull, 2002) the important concepts and ideas being studied and how they relate to one another.

Practice Includes Recoding

• Recoding is the simple process of translating the new knowledge into your own words.

  • Examples include paraphrasing, summarizing, and annotating

Why Students Forget

Review helps to limit the 3 “Sins” of Memory that commonly occur among students.

1. Blocking – information stored but can’t be accessed (Schacter, 2001)
2. Misattribution – attributing a memory to the wrong situation or source (Zola, 2002)
3. Transience – memory lost over time – 65% of a lecture is lost in the first hour (Schacter, 2001)

Keeping Memories

• The best way to minimize memory decay is to use elaborative rehearsal strategies—
  • Visualizing
  • Singing
  • Writing
  • Semantic Mapping
  • Drawing Pictures
  • Symbolizing
  • Mnemonics.

Emotions and Memory

• Research shows learners recall information that is emotional more easily than information that is factual or neutral in nature. (Zull, 2002)

• Which of the following slides would be easier to recall after two weeks?
Emotion and Memory

• Emotional arousal organizes and coordinates brain activity (Bloom, Seal & Kupfer 2003)

• When the amygdala detects emotions, it essentially boosts activity in the areas of the brain that form memories (S. Hamann & Emony, UN.)

Questions

• 1. How can we teach to promote long term recall?

• 2. What kinds of assessments would promote long term recall?

• 3. What kinds of assignments would promote long term recall?

Sleep

7. Sleep

The brain needs sleep to process information

Stress

8. Stress

Stress diminishes/harms brain function
Multiple Senses

9. The brain works best when multiple senses are involved

We Use all our Senses

- The traditional belief among neuroscientists has been that the five senses operate largely as independent systems.
- However, mounting data suggest interactions between vision, hearing, smell, touch and taste are the rule, rather than the exception, when it comes to how the human brain processes sensory information and thus perceives things. (Aaron Seitz – Journal Current Biology, 2006)

20 Ounces of Coke

74 grams of sugar or 2.7 oz

A Burger King Whopper

47 grams of fat

Using all Our Senses to Learn

- Those in multisensory environments always do better than those in unisensory environments
- They have more recall with better resolution that lasts longer, evident even 20 years later.

(John Medina, Brain Rules)

Smell and Learning

- Proust Effect is the unusual ability of smell to enhance recall
- Best results when smells are congruent with the situation
  - Brain Rules, p.212
Smell and Learning

• Emotional details or autobiographical memories have the best recall results from using smell

( Brain Rules, pg 212)

Multimedia Exposure and Learning

Cognitive Psychologist Richard Mayer—

• 1. students learn better from words and pictures than from words alone

Temporal Congruity Principle

• Students learn better when words and pictures are presented simultaneously rather than successively

Spatial Congruity Principle

• Students learn better when words and pictures are near to each other on the page rather than far from each other.

Coherence Principle

• Students learn better when extraneous material is excluded

Modality Principle

• Students learn better from animation and narration than from animation and screen text
10. Vision trumps all other senses

- The more visual the input becomes the more likely it is to be recognized and recalled
- This is called the Pictorial Superiority Effect

Text and oral presentations are not just less efficient than pictures for retaining information they are way less efficient

Oral information has a recall of about 10% after 72 hours
- Add a picture and the recall increases to 65%

Humans pay a lot of attention to the size of things and to things in motion.
Questions

• How can we teach to our students’ senses?

• What kinds of assignments would engage our students’ senses?

Men’s and Women’s Brains are Different

11. There are differences in the brains of men and women

The Brain was Designed to Learn

12. The brain was meant to explore and learn

The Brain’s Needs

The brain needs to function effectively:

• 1. Exercise
• 2. Sleep
• 3. Oxygen
• 4. Hydration
• 5. Food (glucose)

Brain Health

• Daily multiple vitamin
• Daily fish oil capsule
• Reduce or end caffeine use

Brain Health

• Reduce (to very low levels) or eliminate alcohol intake
• Learn to meditate
• Drink adequate amounts of water daily
Brain Health

- Eat a healthy diet
- Get at least 8 hours of sleep each night
- Exercise daily -- aerobic is best

Brain Health

- Don’t put your brain in harms way
- Avoid toxic chemicals- If using them use in well ventilated areas
  
  (Making a Good Brain Great, Daniel Amen)

Patterns and Learning

- Which of the following slides is easier to remember and WHY?

SLIDE ONE

▶4915802979

Slide Two

(491) 580-2979
Which is easier?

• Counting backwards from 100

• Reciting the alphabet backwards

Patterns and Learning

• The brain is a pattern seeking device that relates whole concepts to one another and looks for similarities, differences, or relationships between them.” (Ratey, 2002, pg.5)

Visual Patterns

Patterns that Aid Learning--Mapping
Reading a textbook

- 90% of the time the 1st sentence of a paragraph is the **Main Idea** of the paragraph.

**Reading Patterns**

- Lists
- Sequences
- Definitions
- Cause and Effect
- Similarity and Difference
- Spatial Order

**Similarity and Difference**

The most common pattern used in schools is similarity and difference.

**Information Learned in a Complete Pattern**

- When information is learned as part of a whole (a complete pattern) it becomes easier to recall.

**Example--Baseball**

- Who are the two players that play in front of the Right Fielder?

**Patterns and Learning**

- Zull's Natural Learning Cycle
Patterns and Learning

- However, if all a person did was memorize the names in order 1-9… trouble!!!

Questions

- 1. What are the most common patterns found in your course content?
- 2. What patterns of presenting information to students have you found to be most effective?
- 3. Are there information patterns you find students struggle to recognize or understand?

References

Diamond, Marion. (1988).

The End