

Mindset and Cognitive Bandwidth in Teaching and Learning

Ben Dyhr*

Metropolitan State Univ. of Denver

Fall 2019

*Using some materials created by Dr. Mark Koester and Dr. Cynthia Dormer by permission.

We focus on two elements of learning identified by scientists in psychology, neuroscience and education

- **Mindset** – A key concept in educational research on brain physiology. Mindset research supports a growth mindset understanding of learning.
- **Bandwidth** – Cognitive bandwidth refers to the ability of the brain to use cognitive resources effectively.

Part I: Mindset

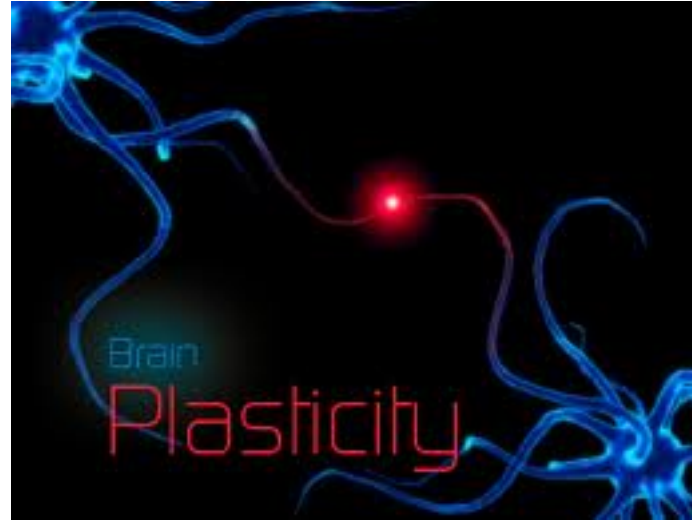


When learning happens ...

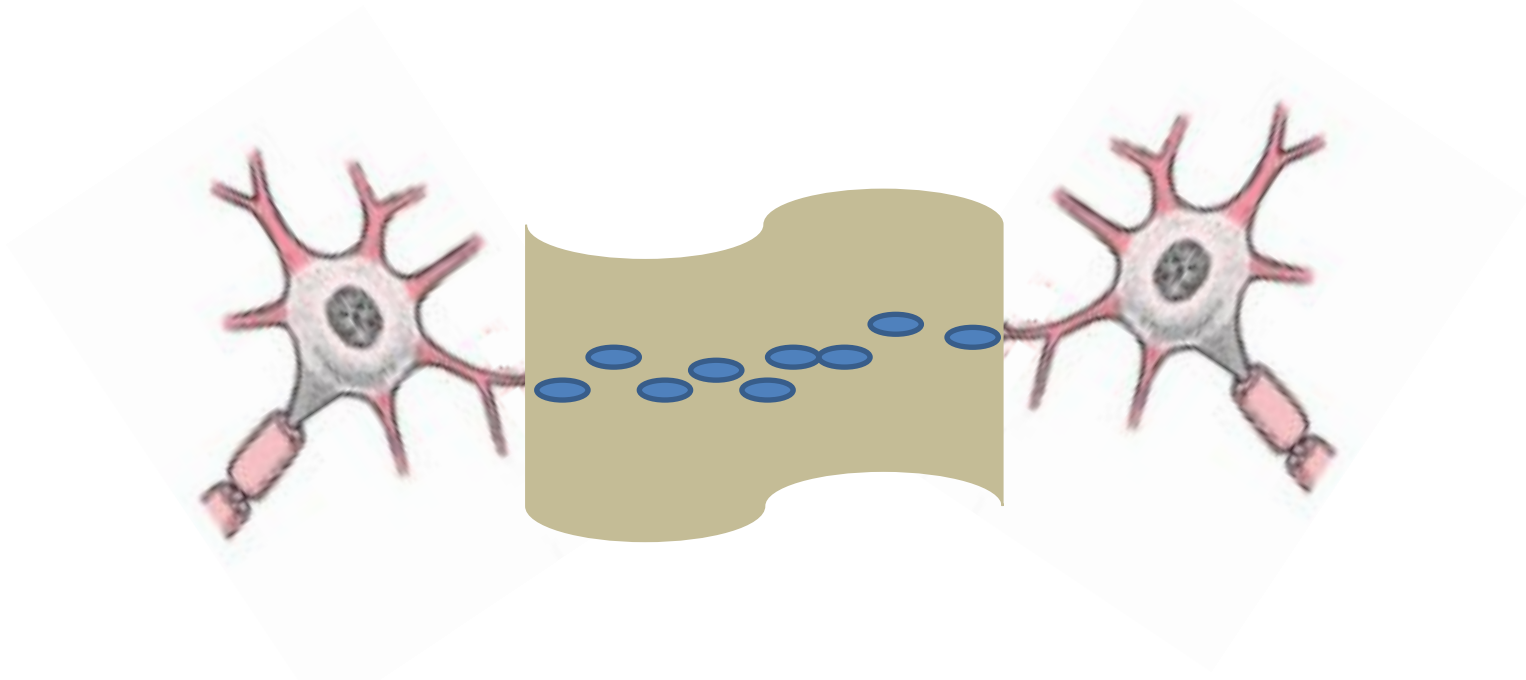


A synapse fires

Brain Plasticity



- Learning creates and strengthens synapses
- The plasticity of the brain means that these connections grow into adulthood
- If Pathways aren't followed they may be discarded
- “use it or lose it”



Synapses are like footprints in the sand – the brain follows the footprints and makes them deeper the more they are followed

Research on learning and the brain:

- Every child can excel in mathematics, from elementary school to college
- Intellectual growth has a physiological basis. Difficult material requires students to “work out” their brains regularly.
- Learning is more enjoyable as more brain growth occurs, much like exercise gets more enjoyable when it is done regularly.

Mindset attitudes

- The **fixed mindset** perspective ignores actual brain physiology and views subject ability (e.g. math, reading and writing ability) as a “gift.”
- The **growth mindset** perspective, supported by brain research, views subject ability as something that grows with experience.

How does a fixed mindset adversely affect student learning?

- Students that have experienced success because of fortuitous circumstances do not reach their full potential if they view themselves as ‘gifted’ and not needing to work for mental growth.
- Students seeing ability as a gift are vulnerable to common stereotypes of marginalized groups.
- Fixed mindset attitudes can lead to frustration that drains our **cognitive bandwidth**. Cognitive bandwidth is discussed in Part II of presentation.

How does a growth mindset benefit student learning?

Students with a growth mindset ...

- ... understand intelligence as in their control.
- ... feel completely responsible for their work.
- ... focus on opportunities to learn rather than demonstrate what they already know.
- ... show more persistence in accomplishing goals
- ... learn from their mistakes
- ... are encouraged by success of fellow students.

Discussion: What challenges do we face in adopting a growth mindset?

- Many social constructs still reinforce a fixed mindset attitude of learning that discriminate against race, gender and socioeconomic groups.
- People generally hold firm beliefs about their intelligence: it can be difficult for a person to transition from fixed to growth mindset.
- Social groups, schools, teachers and families often reinforce fixed mindset perspectives by proclaiming that members have or do not have certain abilities (e.g. “I’m/we’re bad at math”)

Strategies for adopting a growth mindset of learning

- Approach tasks with a desire to learn, not just a desire to show what you already know.
- Consider multiple entry points or multiple strategies for completing tasks.
- Set clear learning goals and take advantage of opportunities for feedback (e.g. office hours).
- Shift focus from just right/wrong to identifying errors and learning how to correct them.

Everyday practices that can promote brain growth and learning

- Eat healthy; plan meals and grocery purchases thoughtfully
- Drink plenty of water (especially in Colorado!)
- Sleep 9-10 hours a night (at least sometimes!)
- Practice time management
- Get regular exercise, especially in the morning
- Utilize calming and breathing strategies

Research on mindset and education:

- [*Mindsets and Equitable Education*](#) by Carol Dweck
- [*The Power of Mistakes: Creating a Risk-Tolerant Culture at Home and School*](#) by Lisa Blackwell
- [*Growth Mindsets: A Literature Review*](#) by Samantha Walters
- [*Make It Stick: The Science of Successful Learning*](#) by Brown/Roediger/McDaniel
- [*“Why sleep should be every student’s priority”*](#) article by Christine Ro, BBC.com

Part II: Cognitive Bandwidth

While awake, about 11 million bits per second of processing power is active in our brains. The part we have conscious control of, less than 100 bits (40 bits per second is typical), is referred to as our **cognitive bandwidth**. This is our bandwidth available for learning and conscious decision making.

Paraphrased from McEwen, 2002, in the *Neurobiology of Aging* Journal:

- **Allostatic load** refers to the price tissues or organs pay for an overactive allostatic response.
- Physiological mediators such as adrenalin, glucocorticoids and cytokines act upon receptors in tissues and organs to produce effects that are adaptive in the short run but damaging if the mediators are not shut off when no longer needed.
- When release of the mediators is not efficiently terminated, their effects on target cells are prolonged, leading to other consequences that may include receptor desensitization and tissue damage.

Effect on Bandwidth

“... we can no longer afford to have more than half of our population undereducated and underskilled because their mental bandwidth is being consumed by poverty, racism, and other differentisms.” - Cia Verschelden, *Bandwidth Recovery*

What occupies your bandwidth ...

- ... in the morning?
- ... while eating?
- ... while listening to music/watching videos?
- ... while on social media?
- ... while working?
- ... while in class?
- ... while working on homework?
- ... while taking a test?

What threatens our bandwidth?

- Financial concerns
- Housing concerns
- Family/relationship concerns
- Lack of belonging
- Stereotypes
- Micro-aggressions
- Depression
- Social stigma (“identity threat”)
- Multitasking (“myth of multitasking”)

What can we do to protect our bandwidth during class?

- Arrive on time and prepared
- Disable electronic distractions
- Sleep well and eat healthy meals before class
- Use breaks for breathing and reflection (not watching videos)
- Communicate effectively
- Sit where you need to sit to avoid distractions

How can we protect our bandwidth while working on HW?

- Begin homework prepared
- Avoid distractions, especially electronic devices
- Organize time for distraction-free homework
- Take advantages of spaces available for distraction-free homework
- Work on homework in a place where critical feedback is available, tutoring lab or near instructor's office
- Practice breathing exercises
- Spaced practice, varied practice and interleaved practice build long-term retention

What can we do to protect our bandwidth before an exam?

- Arrive at exam on time and prepared
- Get adequate sleep and hydration
- The minor stress of self-tests can prepare you for the intense stress of real tests
- Take a breath before starting each problem
- Writing down thoughts immediately before an exam can lessen the negative impact of exam pressure
- Use resources for improving test-taking skills
- Avoid substances that may create additional anxiety

Research on mindset and education:

- [*Bandwidth Recovery*](#) by Cia Verschelden
(digital copy available at Auraria Library)
- [*Everyday Antiracism: Getting Real About Race in School*](#) by Mica Pollock
- [*“Sex, stress and the hippocampus: allostasis, allostatic load and the aging process”*](#) by Bruce McEwen (*Neurobiology of Aging* journal)

Contact:

Ben Dyhr

bdyhr@msudenver.edu

SI 3017