PERSISTENCE THROUGH BRAIN-BASED LEARNING:

A HUMANITIES TRANSLATION OF THE NEUROSCIENCE BEHIND UNIVERSAL DESIGN

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UDL: A Framework for ALL Learners
Brain-Based Learning

A. Young readers

B. Older readers

NI > DYS (positive)
DYS > NI (negative)
Benefits of Universal Design for Learning

- Provides you the **framework** to consider how you teach in a structured and systematic manner.

- Enables you to *reach a diverse student population* without modifying your academic expectations.

- Increases student participation, achievement, and satisfaction and therefore **PERSISTENCE**
How many have been teaching:

- 15+ years?
- Less than 10?
- First year?
How many teaching strategies?

- Flipped classroom
- On Course (affective engagement)
- Learning styles
- Multiple intelligences
- Differentiated Instruction
- Mindset (growth vs fixed)
- Grit (perseverance)
How many “difficult” attempts?
Brain Quiz: True or False?

1. We only use 10% of our brain (or access 20%)
2. Classical music increases reasoning ability
3. Individuals learn better through preferred learning style
4. Short breaks for exercise will improve grades
5. Some people are Right-brain vs Left-brain
Caveat 1:

“Oversimplification or inappropriate interpretation of complex neuroscience research is widespread among curricula claiming that brain-based approaches are effective for improved learning and retention.”

Caveat 2:

- English Instructor
- 1 year as Faculty Fellow (research & 2 CAST Institutes)
- Certificate in Universal Design: Technology Integration at Landmark College
  - Universal Design: Principles and Practice
  - Cerebro-Diversity: Serving Students Who Learn Differently
- Landmark College is the only accredited college in the United States “designed exclusively for students with LDs including dyslexia, attention deficit hyperactivity disorder (ADHD), autism spectrum disorder (ASD) or other specific learning disabilities.”
Presentation Goals

- Introduce the principles of UDL
- Summarize neuroscience basis for UDL framework
- Provide examples, strategies and resources for UDL
- Offer Next Steps
Pedagogically, Does One Size Fit All?

STEP 1: ASSEMBLE PART A TO PART B. STEP 2: GLUE THESE PIECES SECURELY. STEP 3: FIND PART C AND CONNECT TO PART D...
Universal Design in the physical environment

• Architectural term coined by R. Mace (NC State)

• Environment design for access without needing adaptation
  • Barrier free

• Retrofitting insufficient
Universal Design Solutions

Intentional approach to design:

- Anticipates a variety of needs
- Broadens usability
- More economical
- Respects diversity
The Principles of Universal Design

1. Equitable Use
   The design is useful and marketable to people with diverse abilities.

2. Flexibility in Use
   The design accommodates a wide range of individual preferences and abilities.

3. Simple and Intuitive Use
   Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or education level.

4. Perceptible Information
   The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

5. Tolerance for Error
   The design minimizes hazards and the adverse consequences of accidental or unhandled actions.

6. Low Physical Effort
   The design can be used efficiently and comfortably and with a minimum of fatigue.

7. Size and Space for Approach and Use
   Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.
Universal Design for Learning in an educational environment

Learner differences are as varied as the physical.

UDL is the proactive design of curriculum to ensure it is pedagogically accessible regardless of learning style, physical or sensory abilities.
# Learning Networks

## I. Provide Multiple Means of Representation
- Perception
- Language, expressions, and symbols
- Comprehension

## II. Provide Multiple Means of Action and Expression
- Physical action
- Expression and communication
- Executive function

## III. Provide Multiple Means of Engagement
- Recruiting interest
- Sustaining effort and persistence
- Self-regulation
Learning Networks

- **Recognition Networks** - The "what" of learning:
  - Present information and content in different ways
    - learning styles, differentiated instruction, document format & design, accessibility, technology.

- **Strategic Networks** - The "how" of learning:
  - Differentiate the ways that students can express what they know to varying degrees of difficulty
    - mindset, grit, learning transfer, scaffolding

- **Affective Networks** - The "why" of learning:
  - Provide options for varied interests, effort and persistence levels
    - multiple intelligences, personality, On Course, adult learning theory
Diverse neurological conditions appear as a result of normal variations in the human genome

- “'Neurotypical' in Context” by POV (PBS documentary)
- SPECTRUM DISORDERS from DSM-V
Neuroplasticity

- Brains are plastic throughout our lives
- Reorganized by stimuli
- IQ changes over time

Connectivity

- Neurons are highly connected
- Structural and functional differences visible before the onset of symptoms
Human brain has ~86 billion neurons (chimps have ~7 billion)
~ 100 trillion connects

These connection pathways are unique to each individual and can act as analogous to fingerprints
A “connectome” maps the brain communicating with different parts of itself— WIRED
Imaging of brain stimuli

(Posner & Raichle, 1994)
Imaging of brain stimuli


- YELLOW = visual recognition
- BLUE = haptic recognition
- GREEN = overlapping
These three functional magnetic resonance images (fMRI) show brain activity patterns of three different people performing the same simple, finger tapping task.
HCC differences:

- Average age- 26 yr
  - Range 16-60
- Financial Aid recipients- 39%
- 1st Generation college- 38%
- Minorities- 18%
- Programs- 22 degrees and 51 certificates
- languages spoken- 43
Brain-Based Learning
Brain-Based Learning

- The brain is constantly **forming and pruning** connections
  - Unused pathways are lost
- **Time and effort** are needed to establish new pathways
  - Attaching new knowledge onto existing neural networks is more efficient than creating new networks
- **Repeated** use of a pathway improves speed and efficiency
Blue represents maturing of brain areas.
ADHD Brain Maturation
Neural Systems for Reading

Typical vs Dyslexic Readers

©Sally Shaywitz, M.D., Overcoming Dyslexia
The Many Strands that are Woven into Skilled Reading
(Scarborough, 2001)

- LANGUAGE COMPREHENSION
- BACKGROUND KNOWLEDGE
- VOCABULARY KNOWLEDGE
- LANGUAGE STRUCTURES
- VERBAL REASONING
- LITERACY KNOWLEDGE

- WORD RECOGNITION
- PHON. AWARENESS
- DECODING (and SPELLING)
- SIGHT RECOGNITION

Skilled Reading — fluent coordination of word reading and comprehension processes

Increasingly strategic

Increasingly automatic

Reading is a multifaceted skill, gradually acquired over years of instruction and practice.
children with strong pre-reading scores have a bigger, more robust...arcuate fasciculus (bottom right) while children with very low scores have a small and not particularly well-organized arcuate fasciculus (top right). (Saygin et al. 2013,)
children with strong pre-reading scores have a bigger, more robust…arcuate fasciculus (bottom right) while children with very low scores have a small and not particularly well-organized arcuate fasciculus (top right). (Saygin et al. 2013,)
A group of women crammed in to the Crenshaw Boulevard bus, getting on at the Grove Street stop. Shoving students and other passengers out of the way, by pushing and heaving, they forced themselves into a space to make room for themselves where none seemed to be. As the trip to the long RUN to Huntington Street, the women settled in their private worlds, creating the illusion of space for themselves, separating them from the others on the bus. The worlds they made for themselves were made from newspapers and magazines, behind blank stare and fixed at the panels of advertising that lined the space above their heads.

2-1. Why was it difficult to get on the bus?

A. The bus tried to skip the stop.
B. The bus was under construction.
C. The bus had lots of people on it.
D. Everyone had bookbags.

2-2. Staring at the people served the same purpose as staring at the people served the same purpose as staring at the people served the same purpose as staring at the people served the same purpose as staring at the people served the same purpose as staring at the people served the same purpose as staring at the people served the same purpose as staring at the people served the same purpose as staring at the people served the same purpose as staring at the people served the same purpose as staring at the people served the same purpose as staring at the people served the same purpose as staring at the people served the same purpose as staring at the people served the same purpose as staring at the people served the same purpose as staring at the people served the same purpose as staring at the people served the same purpose as staring at the people served the same purpose as staring at the people served the same purpose as staring at the people served the same purpose as staring at the 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What is REPRESENTATION?

“How do I present essential course content to my students?”

- Lecture
  - Strength=
  - Limitation=

- Discussion
  - Strength=
  - Limitation=

- Reading
  - Strength=
  - Limitation= 
REPRESENTATION:
Perception & Instructions
REPRESENTATION: Perception & Instructions

- Semi-concrete/Representational
  \[ \bullet + \square = \bullet \bullet \bullet \]

- Abstract/Symbolic
  \[ 1 + x = 3 \]
MINDSET

Summary:

Carol Dweck popularized the idea that people generally fall into 2 types of thinking patterns, which she calls Mindset. According to Dweck, there are the Fixed or Growth types of thinking.

In a fixed mindset, people believe their basic qualities, like their intelligence or talent, are simply fixed traits. They spend their time documenting their intelligence or talent instead of developing them. They also believe that talent alone creates success—without effort. They’re wrong.

In a growth mindset, people believe that their most basic abilities can be developed through dedication and hard work—brains and talent are just the starting point. This view creates a love of learning and a resilience that is essential for great accomplishment.1

<table>
<thead>
<tr>
<th>Fixed Mindset</th>
<th>Growth Mindset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intelligence is static.</td>
<td>Intelligence can be developed.</td>
</tr>
<tr>
<td>Leads to a desire to look smart and therefore a tendency to avoid challenges</td>
<td>Leads to a desire to learn and therefore a tendency to embrace challenges</td>
</tr>
<tr>
<td>give up easily due to obstacles</td>
<td>persist despite obstacles</td>
</tr>
<tr>
<td>see effort as fruitless</td>
<td>see effort as path to mastery</td>
</tr>
<tr>
<td>ignore useful feedback</td>
<td>learn from criticism</td>
</tr>
<tr>
<td>be threatened by others’ success</td>
<td>be inspired by others’ success</td>
</tr>
</tbody>
</table>

Background Article:

(Excerpt from “Fixed vs Growth: The Two Basic Mindsets That Shape Our Lives” by Maria Popova)

“If you imagine less, less will be what you undoubtedly deserve,” Debbie Millman counseled in one of the best commencement speeches ever given, urging: “Do what you love, and don’t stop until you get what you love. Work as hard as you can, imagine immensities…” Far from Pollyanna platitudes, this advice actually reflects what modern psychology knows about how belief systems about our own abilities and potential fuel our behavior and predict our success. Much of that understanding stems from the work of Stanford psychologist Carol Dweck, synthesized in her remarkably insightful Mindset: The New Psychology of Success an inquiry into the power of our beliefs, both conscious and unconscious, and how changing even the simplest of them can have profound impact on nearly every aspect of our lives.

One of the most basic beliefs we carry about ourselves, Dweck found in her research, has to do with how we view and inhabit what we consider to be our personality. A “fixed mindset” assumes that our character, intelligence, and creative ability are static given which we can’t change in any meaningful way, and success is the affirmation of that inherent intelligence, an assessment of how those givens measure up against an equally fixed standard, striving for success and avoiding failure at all costs become a way of maintaining the sense of being smart or skilled. A “growth mindset,” on the other hand, thrives on challenge and sees failure not as evidence of unintelligence but as a hardening springboard for growth and for stretching our existing abilities. Out of these two mindsets, which we manifest from a very early age, springs a great deal of our behavior, our relationship with success and failure in both professional and personal contexts, and ultimately our capacity for happiness.2

Quiz:


Videos:

- https://www.youtube.com/watch?v=OGvR_0mNpWM
- http://www.ted.com/talks/carol_dweck_the_power_of_believing_that_you_can_improve#49054
Graphic Organizers
Representation Takeaway: Perception

- Offer ways of customizing the display of information
  - Put course content on-line
  - Offer alternatives for auditory & visual information
  - Record lectures & provide a copy of instructor notes
- Use guided notes to list essential concepts
- Outlines and graphic organizers
- Accessible document design
Neural Processing

Detailed Information Processing Model

- Information from Environment
  - Sensory Memory
    - Transferred
      - Short-Term Memory
        - Transferred
          - Long-Term Memory
            - Rehearsed
              - Transferred (Retrieved)
                - Forgotten
REPRESENTATION: Comprehension & Memory

• Memory Activity
  – Who is on the US penny?
  – What are the eight features of the US penny?
Which is the Real US Penny?
Memory: What can go wrong?

- Sensory issues
- Failure to move information to Long-term memory
- Memory decay
- Memory interference
- Failure to retrieve a stored memory
Representation Takeaway: Comprehension

- **Guide information processing**
  - Activate or supply *background knowledge*
    - Explicit links
  - Highlight *patterns, ideas, and relationships*
    - Maximize transfer and generalization

- **Allow sufficient time** for the formation of memories
- **Revisit** information to strengthen memory
  - Within 24 hours to strengthen new connections
  - Revisit often to increase speed and efficiency
- **Minimize interference**
  - Avoid presenting multiple concepts at once
What is ENGAGEMENT?

“How do I involve my students in the learning process?”

- Provide clear goals that are relevant & meaningful
  - Use course materials based on current events
  - Allow choice in student topic
  - Allow students to design activities

- Utilize frequent formative assessments in low stakes environment
  - Develop self-assessment and reflection
    - Explicit coaching or training in managing frustration
    - Detailed project timelines with deadlines for sub-goals
Takeaway Engagement Strategy:
The Pause Procedure

- **What:** Short (4-minute) periodic breaks to review notes and/or discuss course content.

- **Why:** Increases accuracy of notes (Ruhl & Suritsky, 1995); higher exam scores and less need for sustained attention (Braun & Simpson, 2004).

- **How:** Pause at natural breaks (15 minutes). Provide clear instructions, signal beginning and ending of PP and include time for unresolved questions.

- **Ways:**
  - Independent review of notes
  - Short writing assignment (Quick write)
  - Group (Think-Pair-Share) discussion of notes or material
“How do I ask my students to show what they know?”

Best Practice:
- Alternate long essay, short tests, True/False etc
- Include oral assessments
- Allow technological options
- Allow multiple avenues of completion when possible
Next Steps

**Spring:**
- Faculty Academy II: UDL Book Discussion

**Fall:**
- 1 Day UDL Workshop
Sources

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