“I am not a teacher: only a fellow-traveler of whom you asked the way. I pointed ahead—ahead of myself as well as you.”
–George Bernard Shaw

The Neurobiological Basis for Adult Learning Theory

G. Anthony Wilson, MD
Associate Professor
Department of Family Medicine
Course Director of Educational Enhancement Series
UT Graduate School of Medicine
Kolb describes the process of learning from life experience, as opposed to classroom learning.

“Experiential learning” – four continuous steps:
- Reflective observation
- Abstract hypothesis
- Active testing
- Concrete experience.
Experiential Learning

- Concrete Experience
- Reflective Observation
- Abstract Hypothesis
- Active Testing

Zull went a few steps further in explaining how this process works biologically in the brain.
- Hindbrain (sensory cortex and temporal lobe) are both involved in
  - Receiving information (the concrete experience)
  - Reflective observation
- Forebrain (motor cortex and frontal lobe)
  - Active testing.
  - Emotions—Zull believed this was the key to forming long-lasting memory.

The Neurobiological Basis for Adult Learning Theory
Experiential Learning

Motor Cortex  Sensory Cortex

Frontal Lobe

Temporal Lobe

Experiential Learning

Forebrain

Abstract Hypothesis  Active Testing  Emotions

Concrete Experience

Reflective Observation

Hindbrain

Zull, James
Experiential Learning

Hindbrain
- Senses Experiences
- Reflects on Experiences
- Automatic Behaviors
- Fast
- Short-term Memory

Experiential Learning

Forebrain
- Generates new thoughts
- Analytic behavior
- Slow
- Changes information to understandable, storable long-term memory
The Neurobiological Basis for Adult Learning Theory

- Why is all of this complex discussion of adult learning theory and the biological basis behind the theory important?
  - Application in graduate medical education of Kolb's theory of experiential learning is demonstrated in the hands-on experience of residents in clinics and the hospital, taking care of real life patients.
  - Didactic time is designated so that particular topics may be more formally taught. If a classroom can offer an experience other than passive reception of information in a lecture, different areas of the brain are stimulated, leading to greater knowledge retention. (Zull)

The Neurobiological Basis for Adult Learning Theory

- Giving slide-based lectures is not always wrong
  - Slides can augment and highlight information, especially with pictures that illustrate pathology and disease processes
  - Multi-sensory approach to learning is more effective. (Doyle, Zakrjasek)
  - You must engage your audience.
Interactive Classroom Styles

- Takes more time in preparation for the instructor and for the learner
- Allows the learner practice the knowledge learned, and thus retain it
- Learner-centered, instructor-facilitated (McLaughlin)
- Residents are given assigned readings and are expected to come prepared to discuss the assigned material
- Instructor gives a short lecture, after which the learners go through cases and apply the material learned prior to the session.
Evidence for Flipped Classroom:

- Pilot study from 2014-2015
- 39/40 Pediatric PGY-2's at Children's National Health System in Washington, DC
- Utilized a novel flipped classroom curriculum to provide RAT training
- Measured effects

Table 1

<table>
<thead>
<tr>
<th>Domain</th>
<th>Preworkshop score, mean (SD)</th>
<th>Postworkshop score, mean (SD)</th>
<th>Difference in pre- and postworkshop scores</th>
<th>p value</th>
<th>Standardized effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching a skill</td>
<td>2.72 (0.51)</td>
<td>3.33 (0.60)</td>
<td>0.61</td>
<td>&lt; .001</td>
<td>1.10</td>
</tr>
<tr>
<td>Giving feedback</td>
<td>4.21 (0.43)</td>
<td>4.56 (0.43)</td>
<td>0.35</td>
<td>.005</td>
<td>0.81</td>
</tr>
<tr>
<td>Orientating a learner</td>
<td>3.79 (0.50)</td>
<td>4.31 (0.50)</td>
<td>0.53</td>
<td>&lt; .001</td>
<td>1.06</td>
</tr>
</tbody>
</table>

Abbreviations: OSTE indicates objective structured teaching examination; SD, standard deviation.
*OSTE performance scores had a possible range of 1 to 5.
Evidence for Flipped Classroom:

- 2017 systematic review
- 46 articles
  - 9 controlled studies
- Promising teaching approach
  - Motivation, task value, engagement
- Students generally like the FC

Interactive teaching styles are more effective

- Study of 9 residency programs
- Three different teaching styles for same topic
  - Traditional slide-based lecture
  - Engaged classroom
  - High-tech simulation
- Pre-test given prior to session
- Post-test given two weeks later
- Engaged classroom and high-tech simulation resulted in greater knowledge retention and learner satisfaction than traditional slide-based lecture

Let’s practice some interactive teaching styles

1. Ask your audience of learners to think about a specific area of the topic under discussion.
2. Pair with another learner and discuss it with each other for a few minutes.
3. When you bring the group back together, ask each pair to share their thoughts.
Divide the learners into small groups of three to five

Assign each of the groups a sub-topic

After giving them time to research and discuss (differential diagnosis, possible lab workup and imaging studies, and recommended treatments, etc.) have a spokesperson from each group present the findings to the class

Supplement with your own discussion/slides, etc.

Usual group time—about 10 minutes

Usual full class time—about 30 minutes
Group 1: Lobster Bisque
Group 2: Caesar salad with homemade dressing
Group 3: Beef Wellington
Group 4: Tiramisu

HINT: In these interactive lecture styles, don’t specify a time for the discussion. Listen to your audience. At the beginning, as the learners are starting the discussion amongst themselves, it will be relatively quiet until they become more engaged. The sound will reach a crescendo in a few minutes, after which it will taper off. When it begins to crescendo again, stop the discussion—that is when the group begins talking about things other than the assigned topic.
Experiences

DEBATE—"CONSTRUCTIVE CONTROVERSY" (JOHNSON)
WALKING LECTURE
DEMONSTRATION (HPA AXIS)

The HPA Axis
AS TAUGHT BY JUSTIN JENKINS, DO,
CLINICAL ASSISTANT PROFESSOR OF FAMILY MEDICINE
The HPA Axis In Action

- Bean Bags - CRH
- Yellow Whiffle Balls - ACTH
- Salt - mineralocorticoid (aldosterone)
- Sugar - Glucocorticoid (cortisol)
- Rubber Bands - negative feedback

Online Resources

- Prezi
- Poll Anywhere
- Kahoot
Games

JEOPARDY (LATESSA)  BAR TRIVIA

High-tech Simulation
Virtual Reality
Augmented Reality
3D Printing from MRI/CT
Topics Jigsaw Exercise

Objectives written (That’s another lecture)

How will you teach these topics

References

HARPER

HUDSON