

# **Learning, Doing & Assessment: An Integrated Approach**

Texas Woman's University ~ 2013



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# **Framing our Problem: Two Visions of Students Today**

## The 5-Minute University



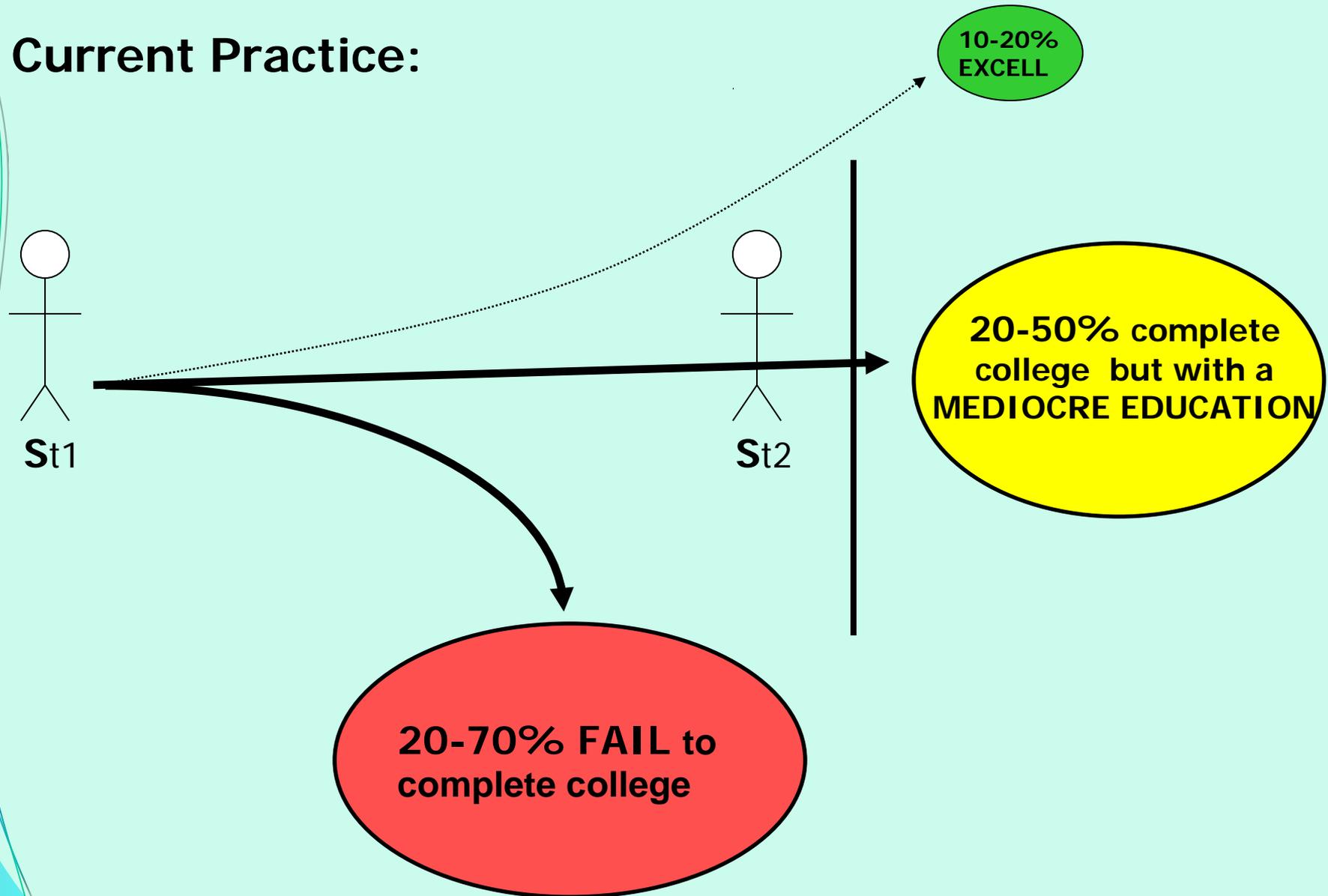
## A Vision of Students Today

# The Problem:

- ④ **PASSIVE LEARNING** (an oxymoron)
- ④ Habits of learning students developed in high school aim at lower-level thinking skills and encourage passive, dependent learning.
- ④ In college those learning habits don't work well.
- ④ Habits of passive learning create motivation and engagement problems that further erode students' academic performance—and learning.

# Consequences of Passive, Dependent Learning

Current Practice:



# One Solution: Civic Engagement

- ④ Teach students *how to learn actively*—to learn by doing
  - Show them how to learn by themselves, for themselves
  - Improve learning and academic performance
  - Increase students' motivation and engagement
  - Make them more successful inside and outside class

# Objectives for Today

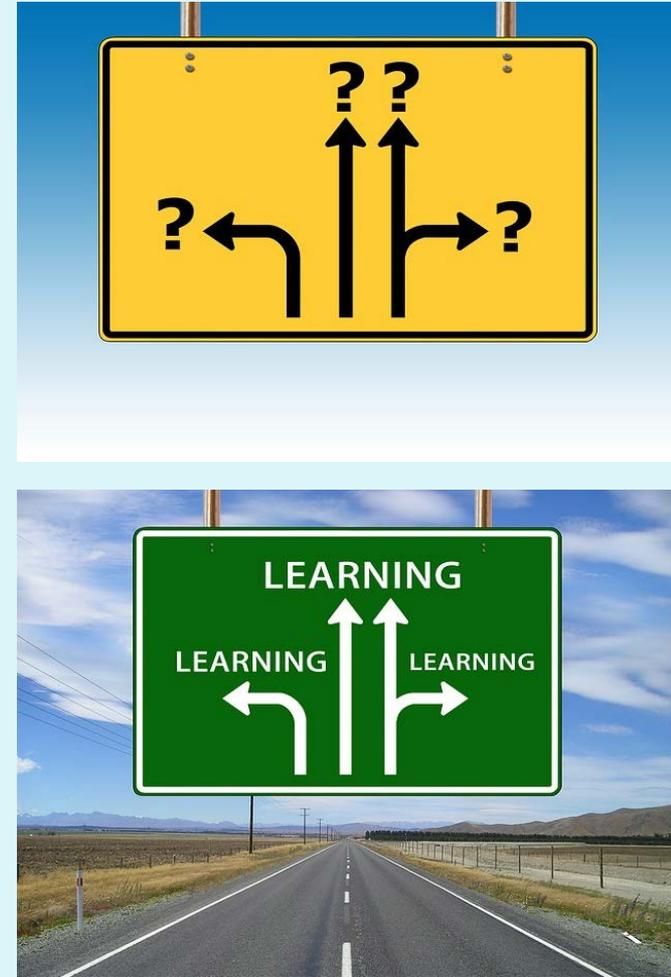
- ② Investigate our own epistemologies of learning
- ② Learn a few basic principles of how learning works
- ② Consider civic engagement as a learning accelerator
- ② Develop one civic engagement-based learning activity in service of a significant learning objective



# Epistemology of Learning

What is learning?

- What does it mean to learn something?
- How can you tell when you've learned something?



# Typical Answers - Understanding

- @ Knowing something
- @ Understanding something
- @ Being able to teach something
- @ Getting it
- @ Eureka!
- @ Making a connection to something new
- @ Insight
- @ Discovery
- @ Enlightenment
- @ Knowing that (vs. knowing how)
- @ Memorizing
- @ Being able to recall
- @ Remembering something
- @ Understanding the principles
- @ Seeing the logic
- @ Being able to extrapolate
- @ Seeing how it works
- @ Epiphany

# Typical Answers - Skills

- @ Being able to do something
- @ Knowing how
- @ Facility
- @ Doing it
- @ Mastering a procedure or process
- @ Increasing level of proficiency
- @ Following correct procedures
- @ Being able to use what I know
- @ Being able to apply something in a new situation
- @ Acquiring the knack of something
- @ Gains in craftsmanship
- @ Getting better at something

# Typical Answers - Affective

- @ Learning to like something
- @ Getting engaged
- @ Being inspired
- @ Being motivated
- @ Finding joy
- @ Wanting to do more
- @ Wanting to practice
- @ Looking for chances to use what I know
- @ Learning to love something
- @ Learning to see the beauty or complexity or artistry in something
- @ Learning to appreciate something
- @ Gaining confidence
- @ Becoming more interested in something

# Typical Answers – Habits/Integrations

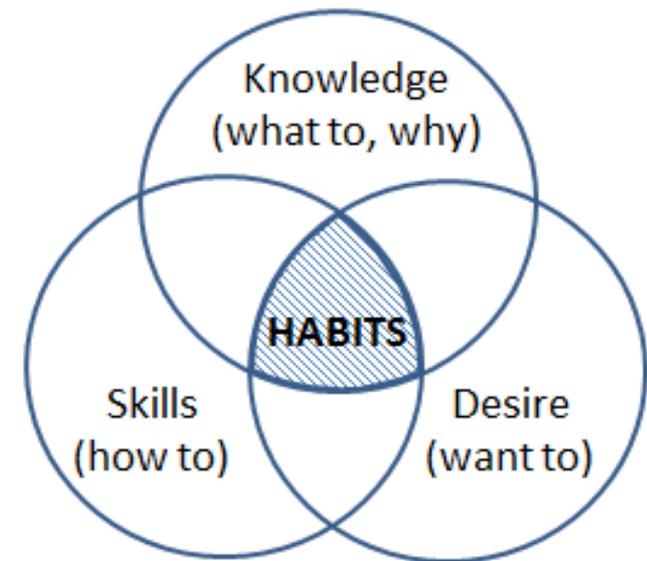
- @ Integrating what I know into my life
- @ Using what I know as a matter of course
- @ Being able to do something without paying a lot of attention
- @ Knowing when to use what I've learned
- @ Doing things automatically
- @ Ability to improvise based on what I already know

# Epistemology of Learning

Facilitating *durable learning* depends on changing students' **attitudes** in ways that motivate them to form new **habits** of using what you have taught them.

# Learning is Forming New Habits

- ② Fueled by attitudes and desires (emotion)
- ② Supported by skills and understanding



# Epistemology of Learning

How we define *learning* affects how we teach and shapes how students learn in our classes far more than how we define teaching or what we say about our goals.

TEACHing

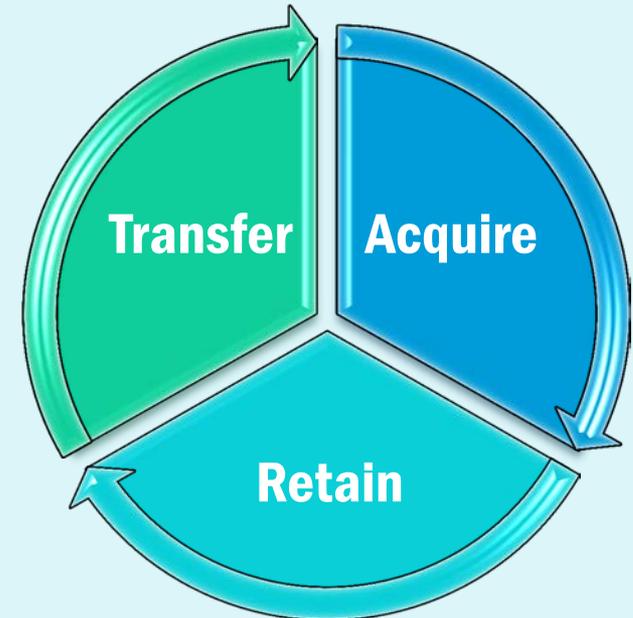
≠ LEARNing

# The ART of Learning

@ **A** Acquire new material

@ **R** Retain new material

@ **T** Transfer use of new material



# The ART of Learning.

The A in ART is for Acquisition

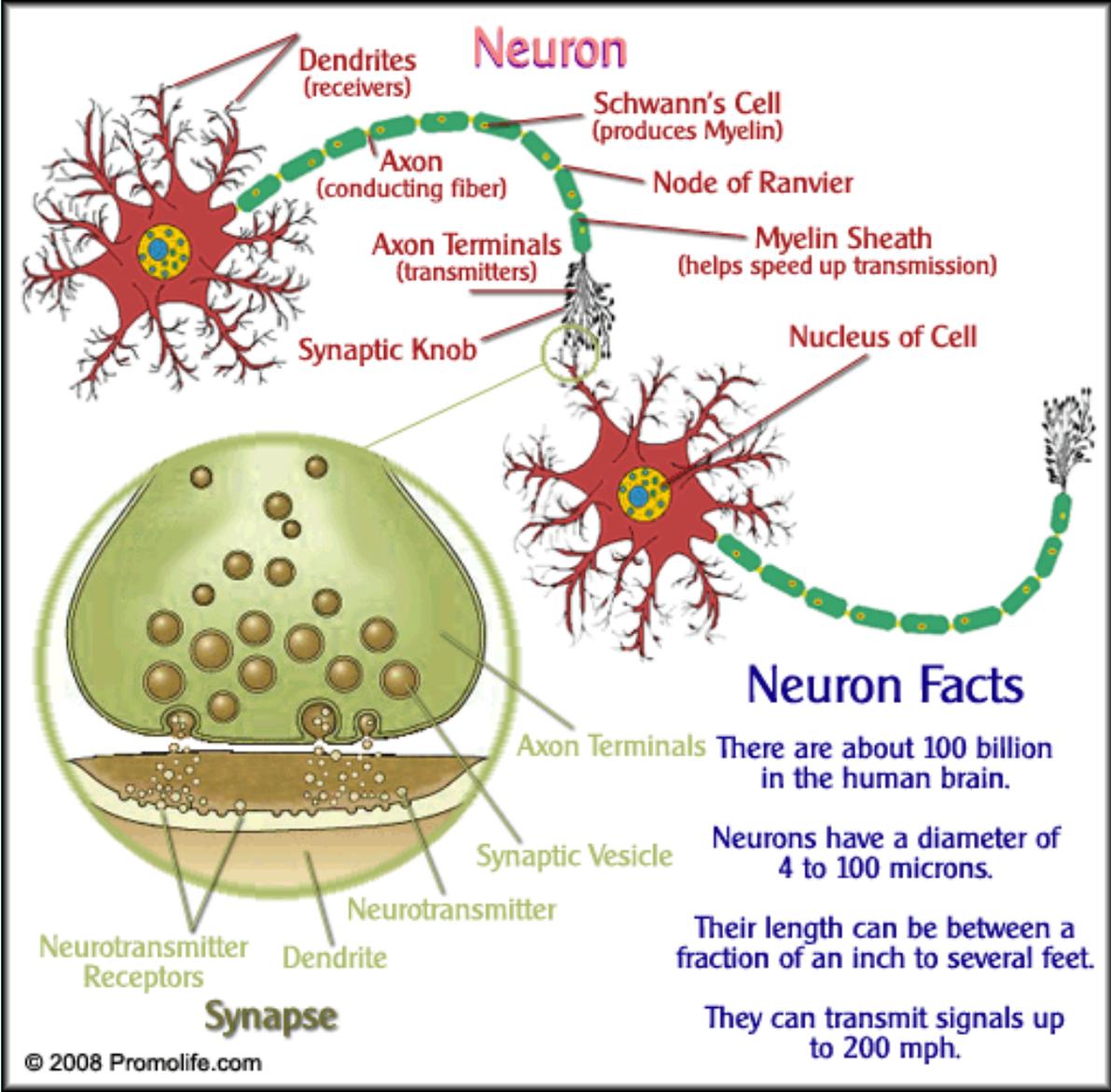
Mnemonic:

Actively

Build

Connections





# Neuron

Dendrites  
(receivers)

Schwann's Cell  
(produces Myelin)

Axon  
(conducting fiber)

Node of Ranvier

Axon Terminals  
(transmitters)

Myelin Sheath  
(helps speed up transmission)

Synaptic Knob

Nucleus of Cell

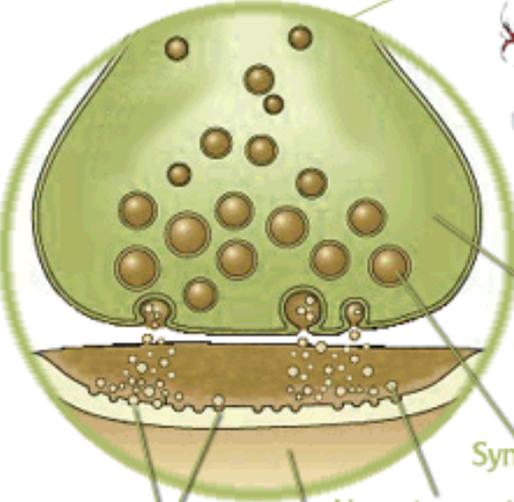
## Neuron Facts

There are about 100 billion in the human brain.

Neurons have a diameter of 4 to 100 microns.

Their length can be between a fraction of an inch to several feet.

They can transmit signals up to 200 mph.



Axon Terminals

Synaptic Vesicle

Neurotransmitter

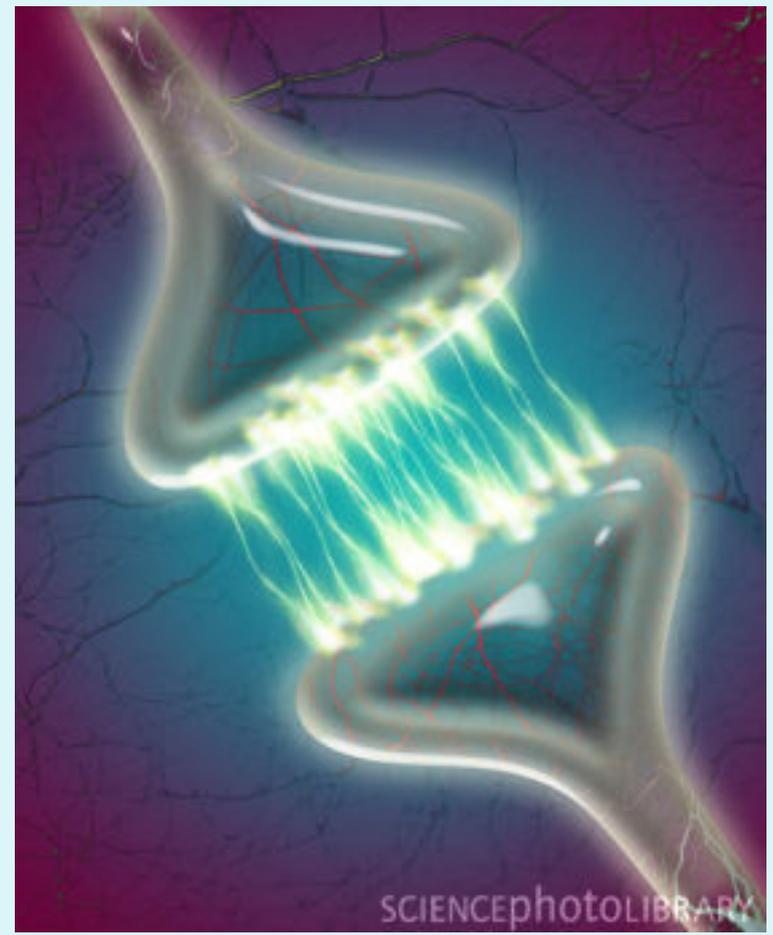
Neurotransmitter Receptors

Dendrite

## Synapse

# Learning IS Making Connections

Learning ONLY happens when it is **active** and **intentional**, so keeping students engaged is vital

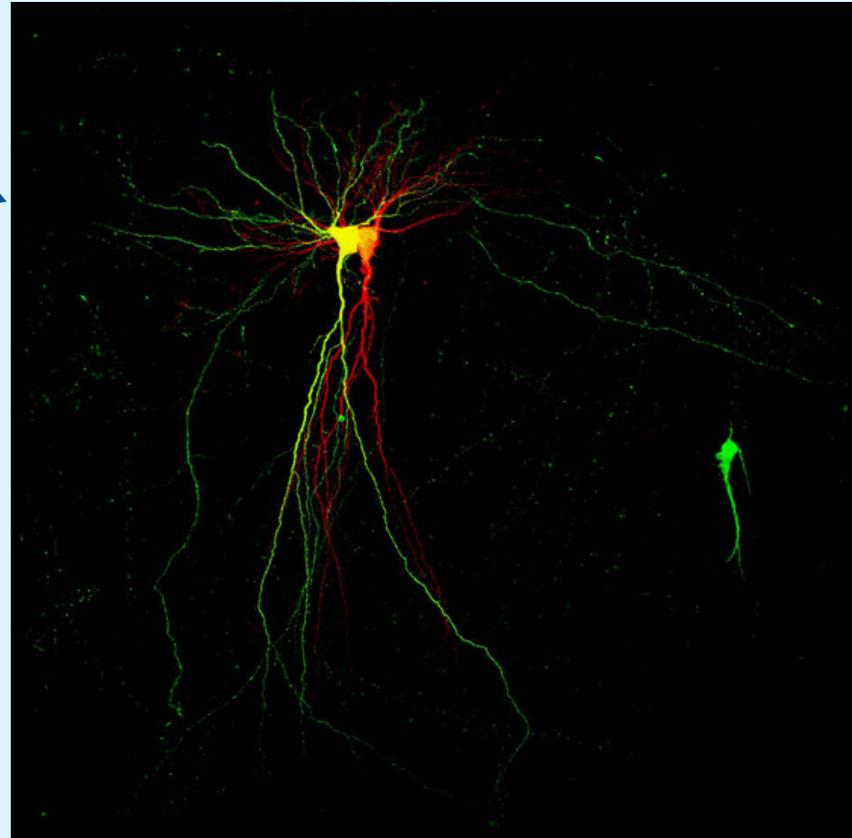


# Learning IS making connections: Neurons that fire together wire together

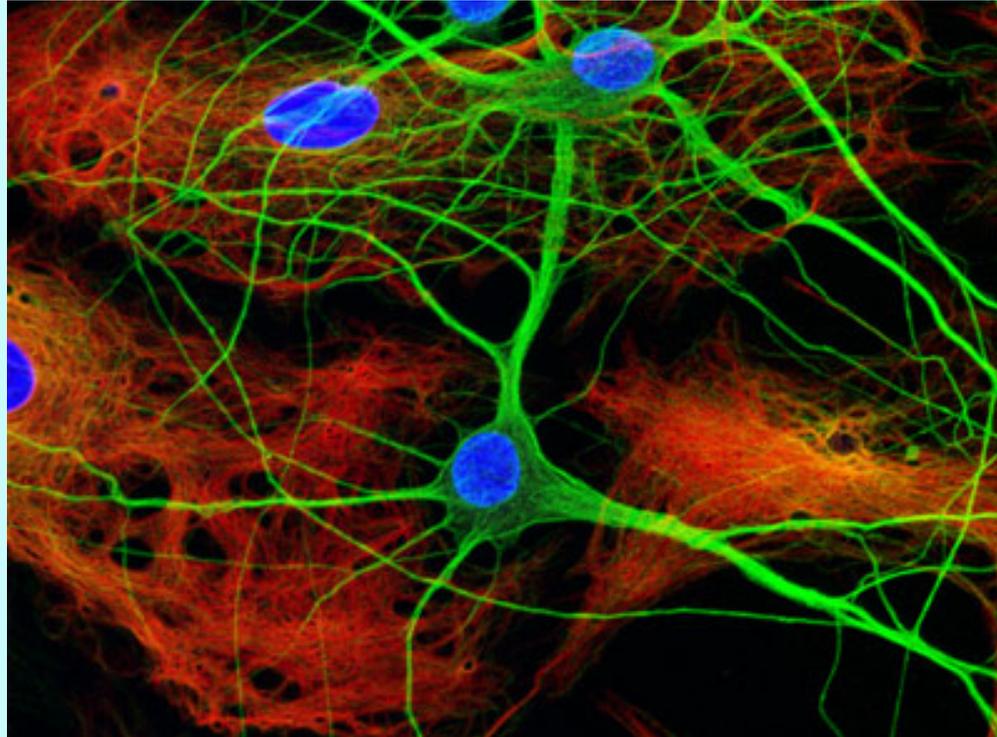
2 pyramidal neurons  
forming a synapse



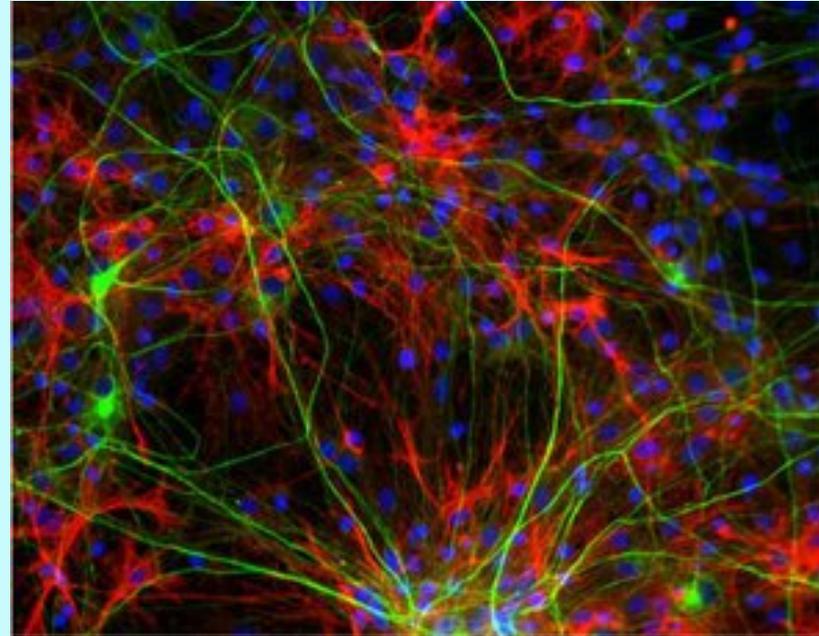
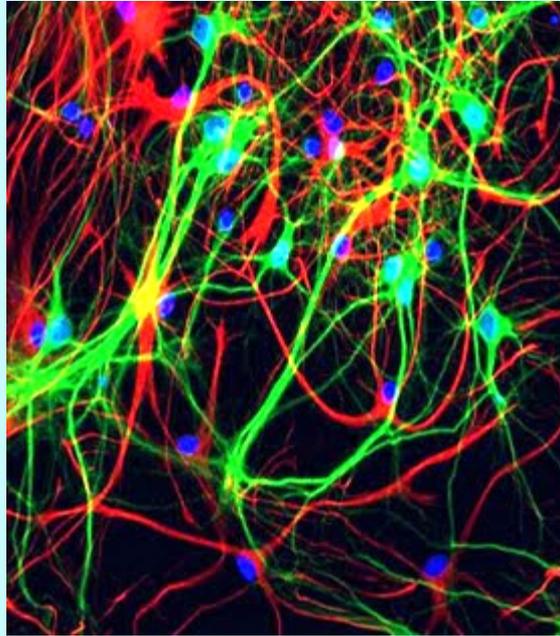
Focus teaching on helping  
students connect new  
information to old (not on  
uptake of content)



# Ideas are patterns of neural firing



# More complex ideas are more complex patterns—made up of smaller patterns



Focus teaching on patterns and meaning, not on facts and information

# Learning IS Making Connections

- ② Learning has the physical and metaphorical structure of an analogy.
- ② Therefore we must teach analogically, not *de novo*.
- ② “Nothing we learn can stand in isolation; we can sustain new learning only to the degree we can relate it to what we already know.” (Sci Am Mind, July 2010.)

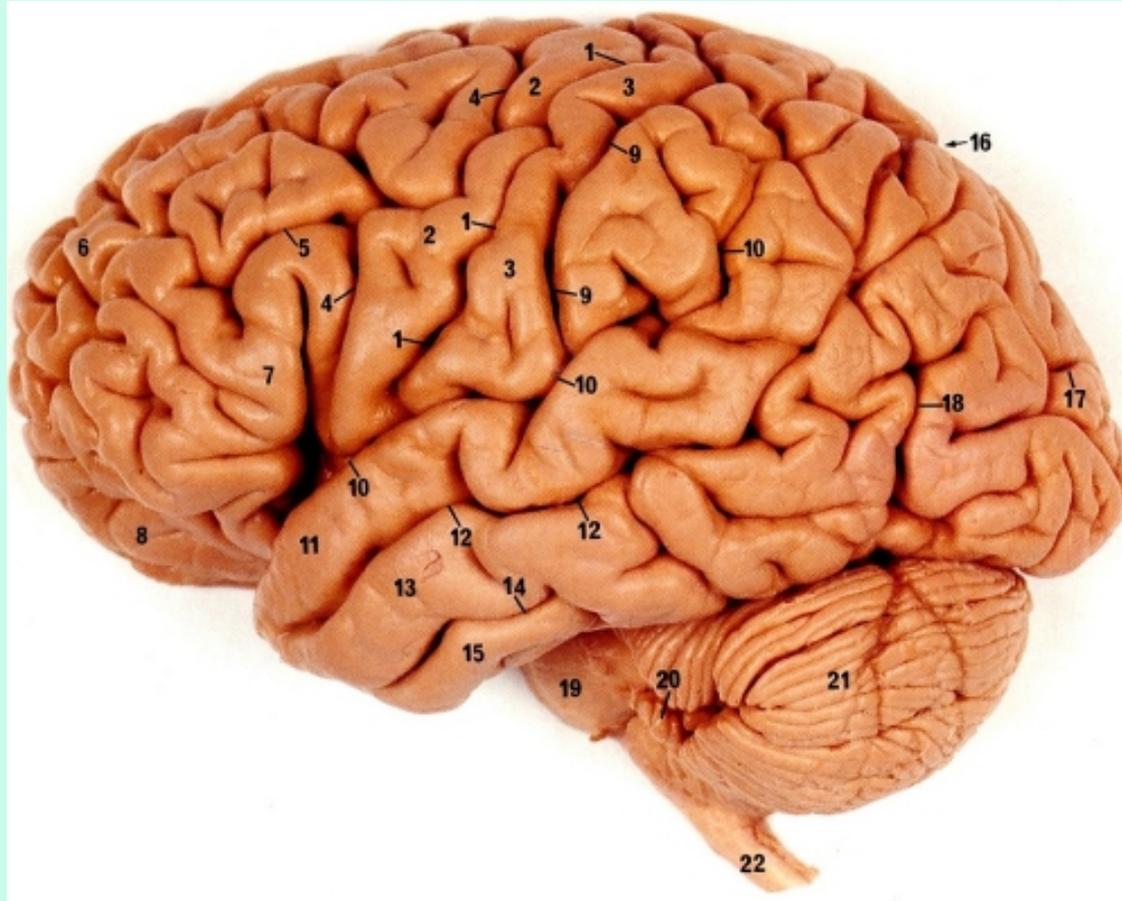
Focus on helping students make connections between what they know and what they are trying to learn

# Learning Changes the Brain



A Basic Brain—not very fold-ey

# A Better Brain—more fold-ey



Make sure that relevant learning happens every day in every class session

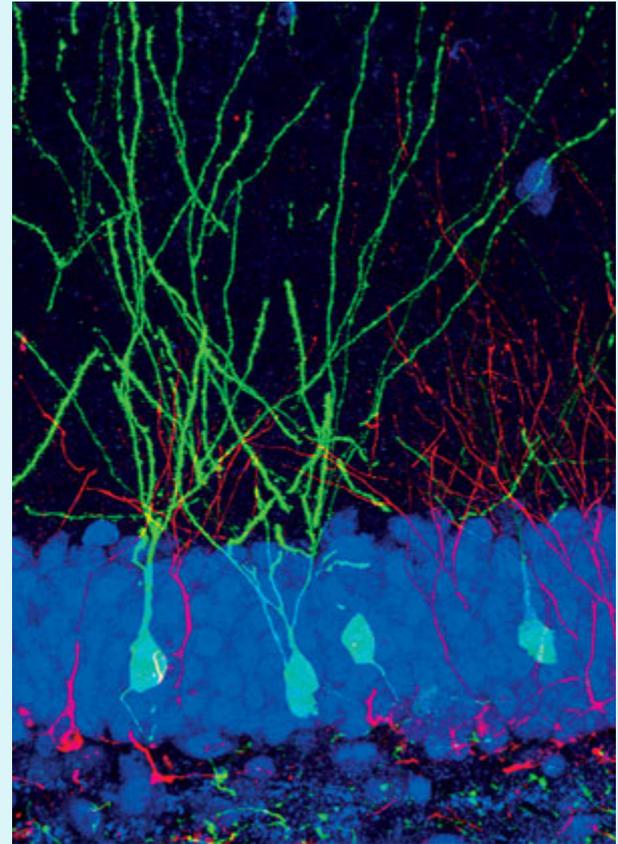
# Learning Increases Brain Plasticity

- Ⓢ Therefore we need our students to regularly experience sustained, challenging learning tasks
- Ⓢ The more they learn, the better learners they will become
- Ⓢ Analogy: Like building muscle or learning a foreign language (use it or lose it/working makes it stronger)

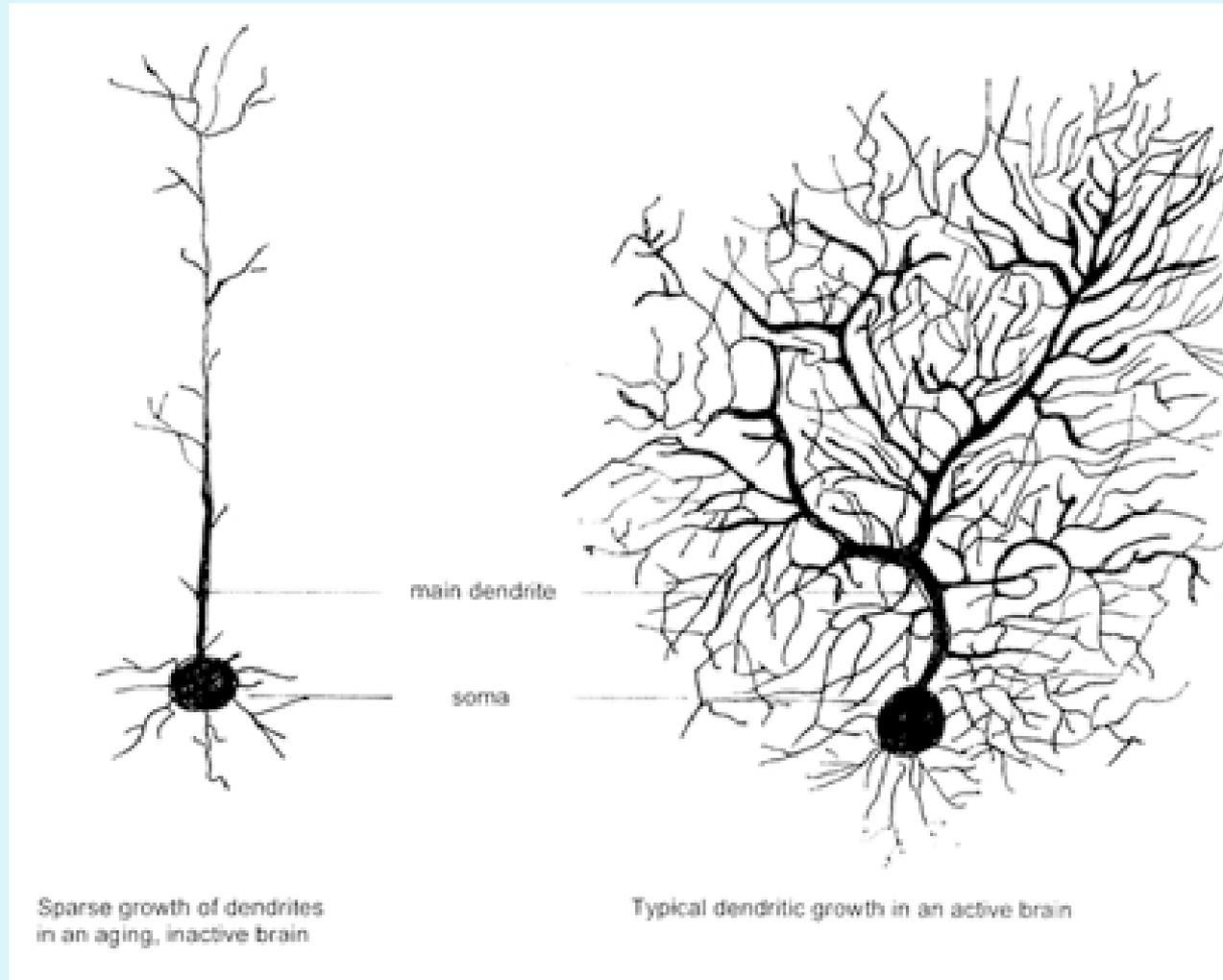


# Learning Hard Stuff Grows Your Brain

**New Brain Cells Forming**



# Learning Builds and Maintains Healthy Neurons



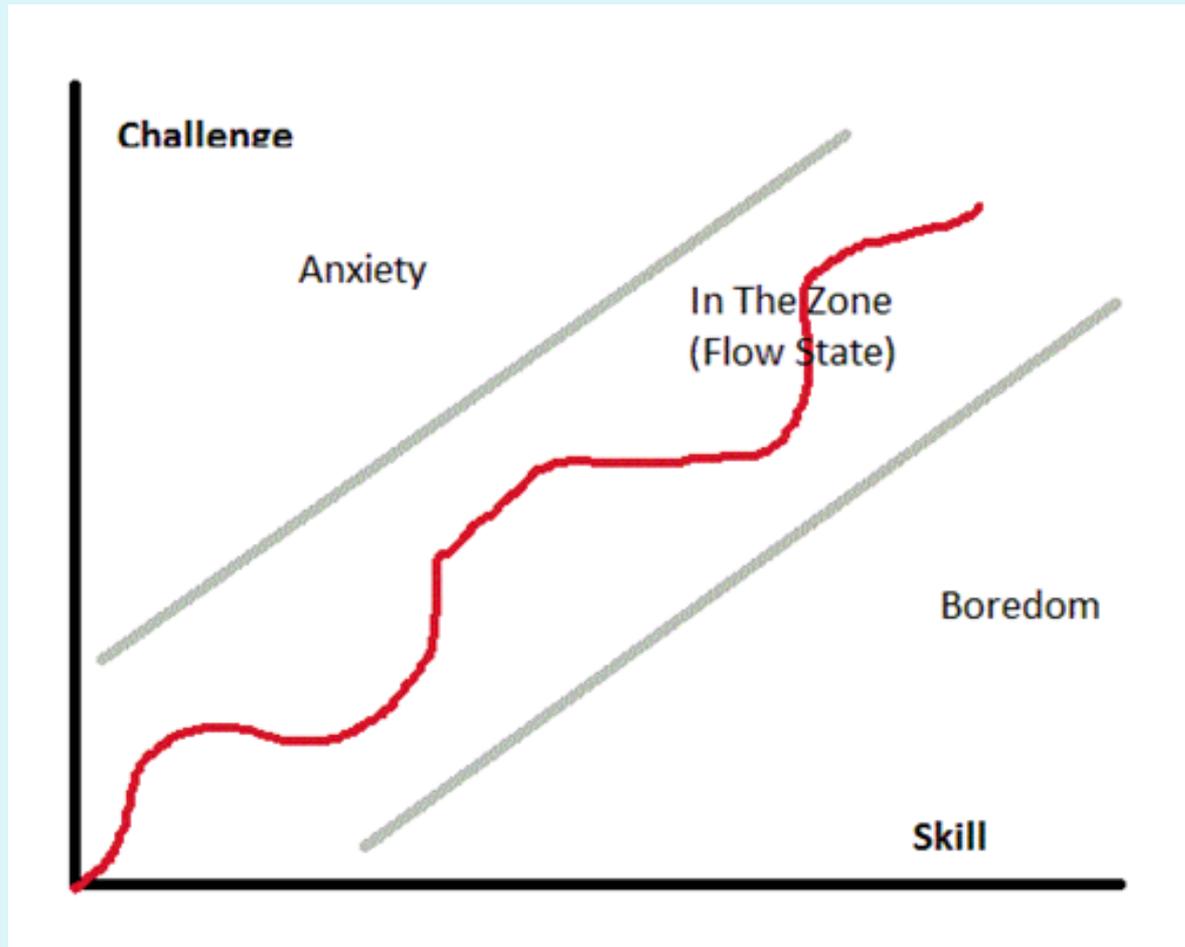
Vary students learning tasks so they practice multiple modes of learning

# Learning works best when it is difficult

- ② Therefore, we must teach our students to seek challenge
- ② Always prefer the difficult over the routine or the easy
- ② Optimal learning occurs in “flow state”—midway between boredom and anxiety
- ② Analogy: crosswords and sudokus

Make sure that students are constantly challenged—but not overwhelmed

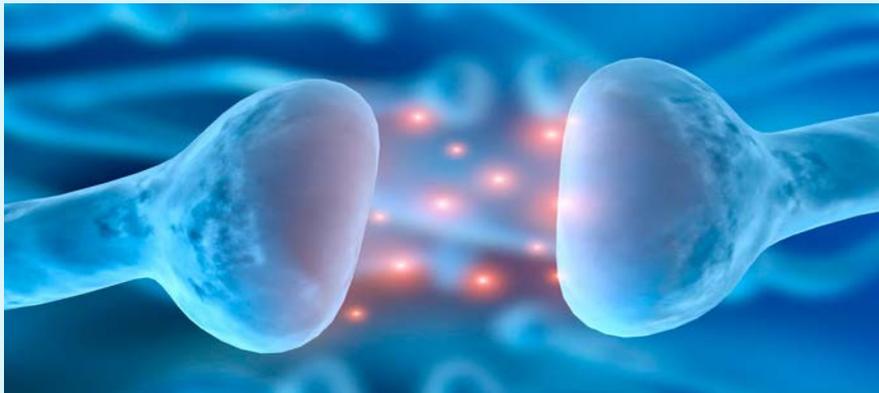
# Difficulty Increases Engagement



Based on *Flow*, by Mihaly Csikszentmihalyi (2002)

# Key Factors Shaping Acquisition

- ② Learning IS making connections
- ② Learning has the structure of an analogy: this is why analogies, metaphors, models, and mnemonics are so effective
- ② It is ALWAYS active and almost always intentional: it only happens when we are paying attention
- ② Positive engagement, motivation and emotions increase uptake



# Civic Engagement and Acquisition

**Learning by doing facilitates acquisition because it:**

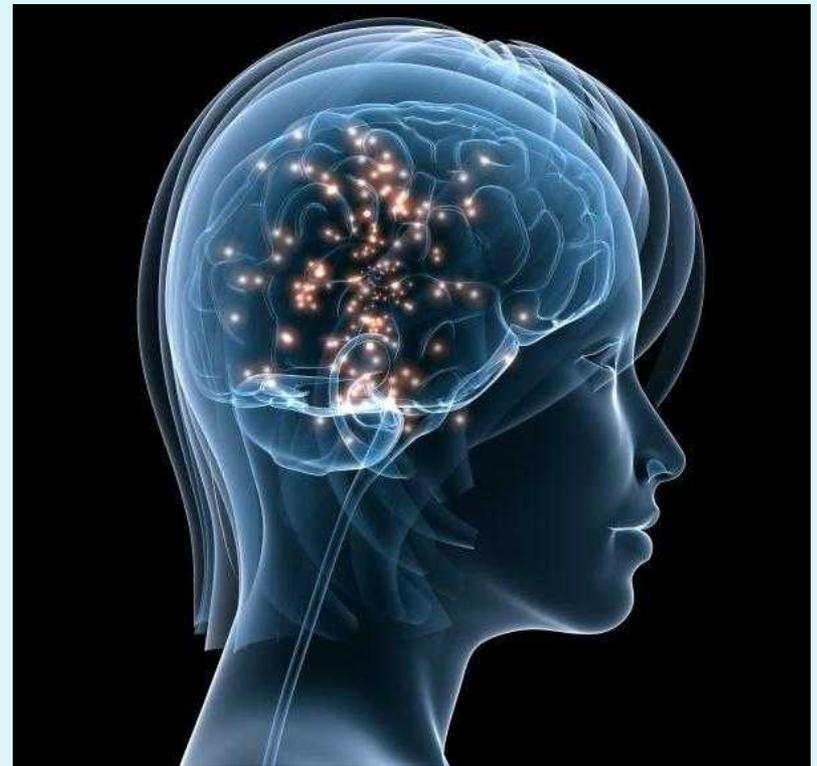
- ② is always active and intentional and immersive
- ② helps students connect what they know to what they are doing and learning
- ② helps students see the value and meaning of what they are learning (engagement and affective change)
- ② ensures relevant learning happens every day; it requires constant effort and provides always-appropriate challenge
- ② enriches the learning environment and the variety of learning tasks

# The ART of Learning

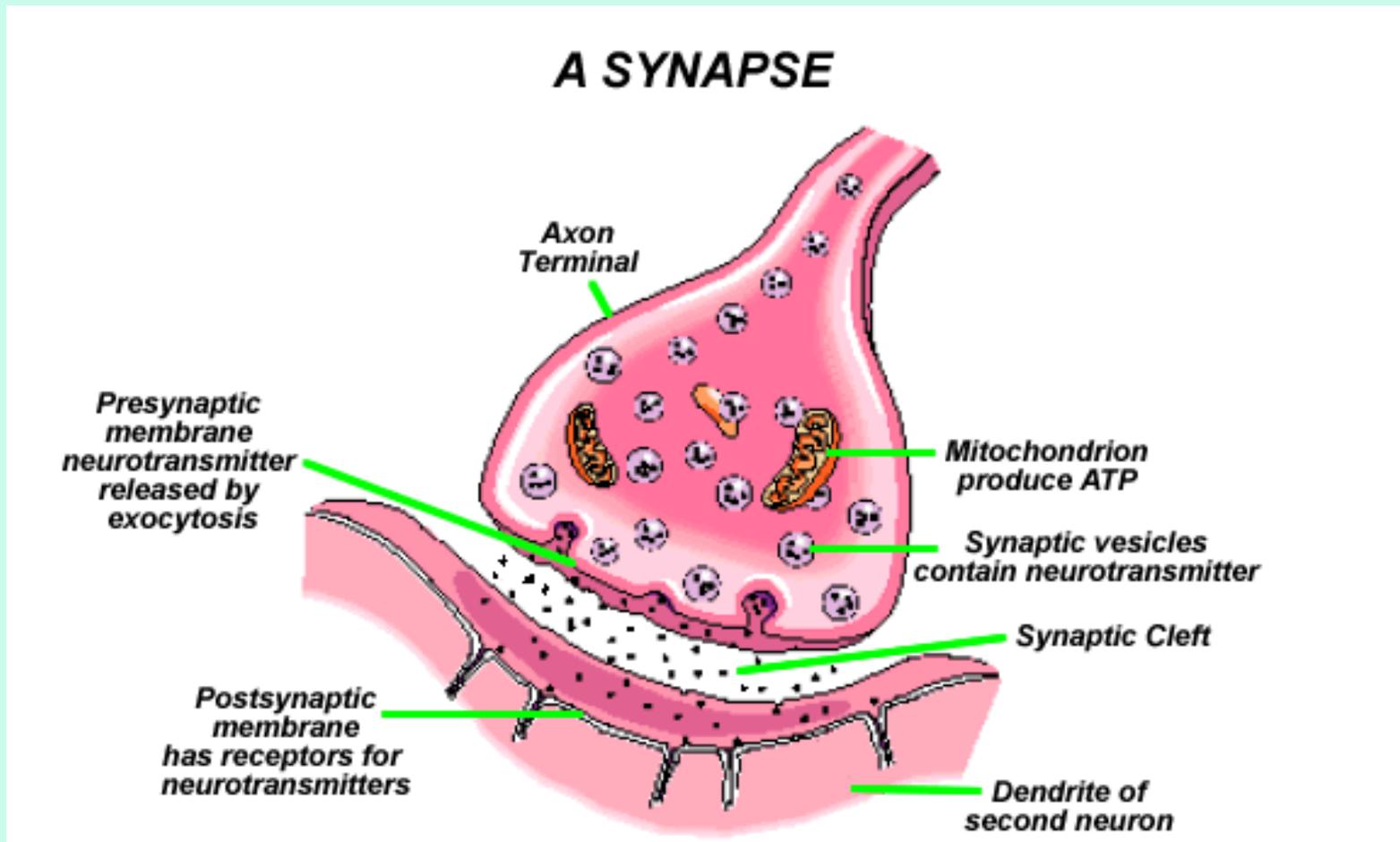
R is for RETAIN (Acronym)

- Repetition,
  - Emotion,
- 

- Test,
- Analyze,
- INtegrate.



# Retention is controlled by Repetition and Chemistry



# Repetition

- ④ Repetition grooves the neural pathways
- ④ Review before sleep to encode memories
- ④ Review within 24 hours to move to long-term memory
- ④ Make review a regular part of classroom activity
  - Daily review at start of class
  - Daily summaries at end of class
- ④ Repeated low-stakes testing and distributed study are the best ways to learn

Repeated review is ***necessary*** for habit formation and transfer (it's also the best way to study)

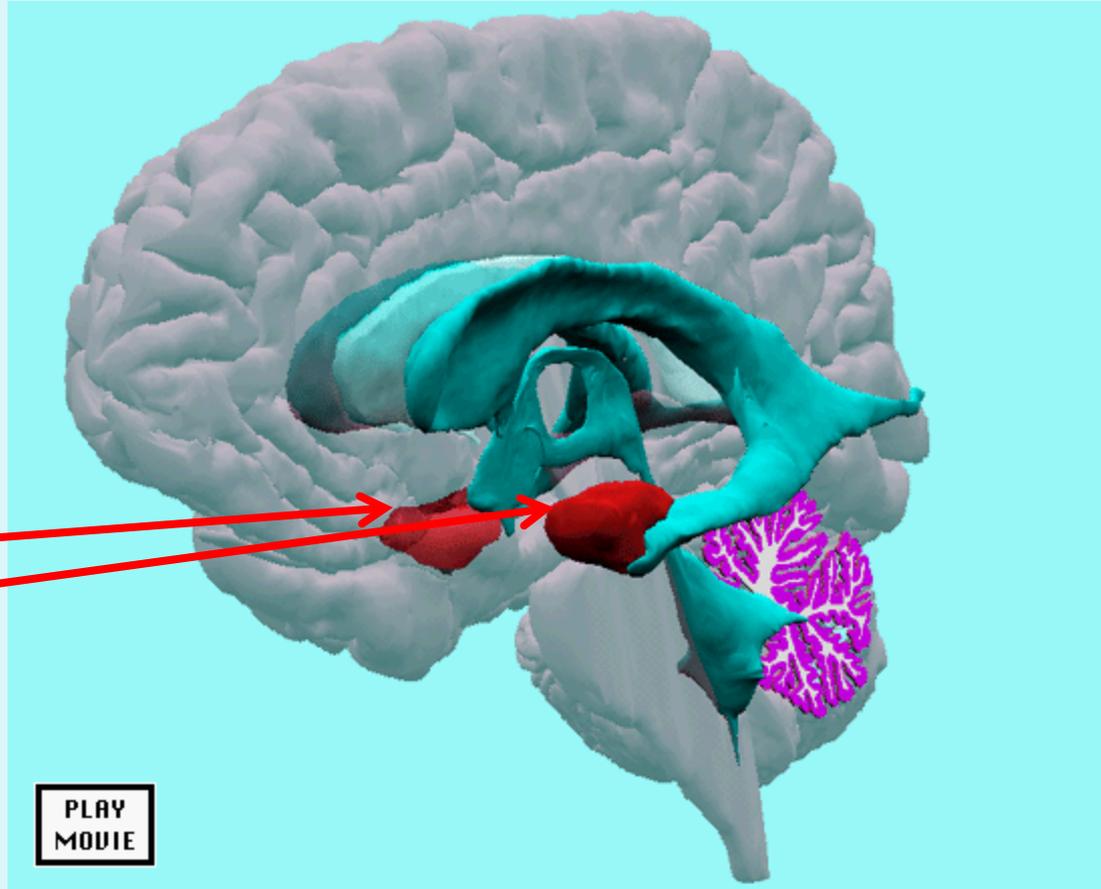
# Emotion

- ① Most powerful determinant of memory
  - Emotions control connection-formation (acquisition)
  - AND the ability to recall what was learned
- ① Negative emotions (especially fear and stress) block the ability to learn and to recall
- ① Positive emotions enhance engagement, motivation and retention of what was learned

Manage emotions in your classroom to create an environment conducive to learning

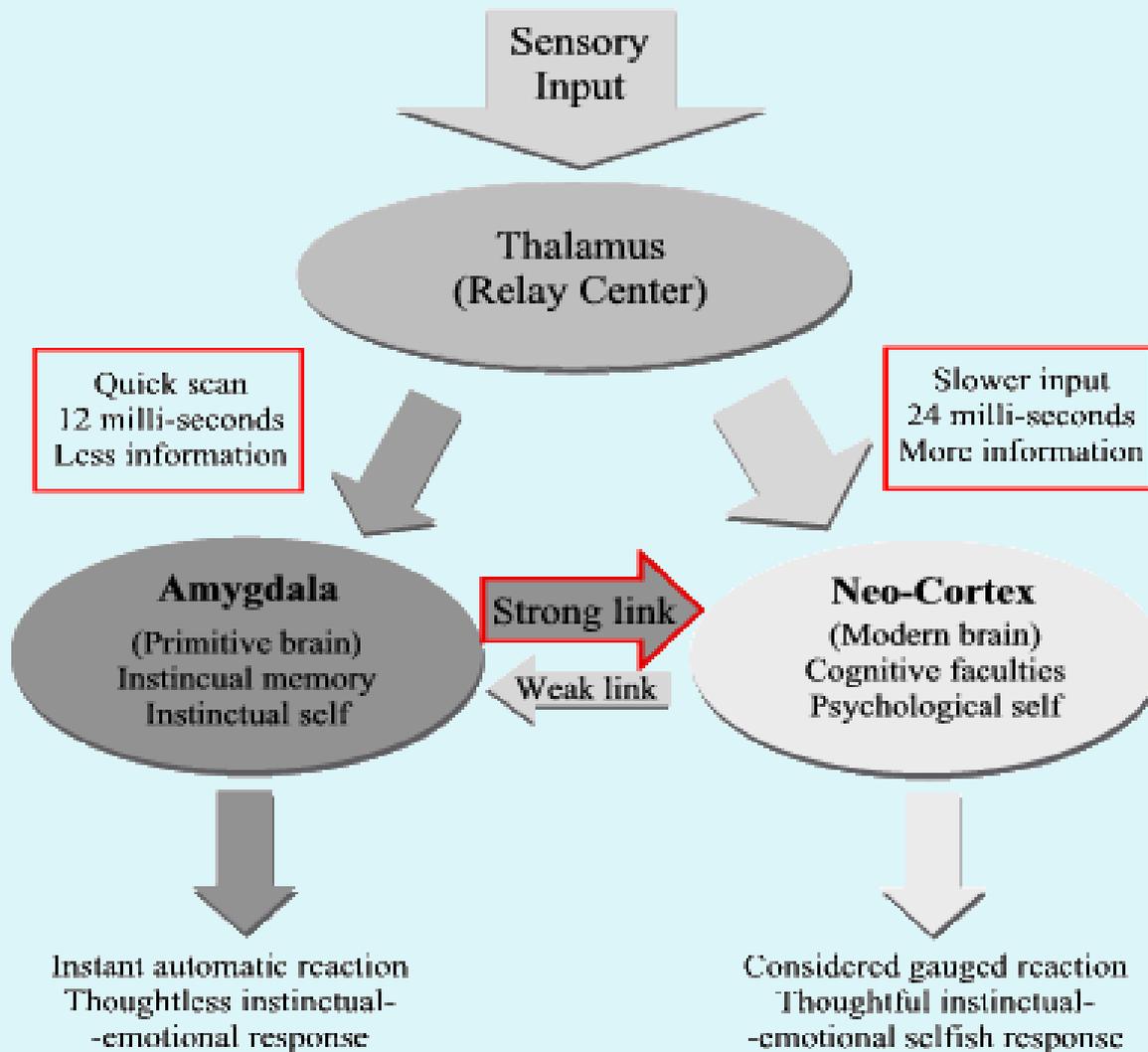
# Emotion and chemistry: Your amygdalas

Amygdalas



# Emotion: Fear response

## Simplified Schematic View of the Brain's Circuitry



# The Power of **E**motions



VS.



# Test, Analyze, INtegrate

- ② Passive review has low correlation with ability to recall what was learned. Don't highlight or reread.
- ② Ability to recall depends on practice of recall: Frequent (self-)testing is possibly best way to learn.
  - **Test** ability to recall frequently for low stakes
  - **Analyze** successes and failures (seek patterns)
  - **Integrate** those patterns into learning strategies
- ② Note the connections to Bloom's higher-order thinking skills (HOTS)

Teach students in class how to do the learning you expect them to do outside of class

# Key Factors Shaping Retention

- ② Strong emotion
- ② Repetition and reinforcement
- ② Richness of the learning and studying environments



# Civic Engagement and Retention

Learning by doing facilitates retention and habit-formation because it:

- ① creates a constant need for repetition and review
- ① constitutes repeated low-stakes testing and requires distributed practice
- ① engages students' emotions in positive ways
- ① provides a richer learning environment

# The ART of Learning

T is for Transfer (Bus transfer, job transfer)

Transfer applies what you know in a new context or to a new type of problem



# Teaching for Transfer

- ② Transfer depends on **pattern recognition** and **changing set**
- ② It is the most difficult part of learning ... and the least practiced!
- ② Students need to practice as much as possible

Teach transfer explicitly and give students frequent opportunity to practice—in class and out

# Civic Engagement and Transfer

Civic engagement aids transfer because it:

- ① requires pattern recognition at ever-increasing levels of complexity
- ① encourages rapidly changing mental set and integration of knowledge acquired in different disciplines to solve problems
- ① forces students to constantly move back and forth from theory to practice in always-changing contexts

# Principles derived from neurobiology:

- 1) Learning IS making connections/patterns.
- 2) Learning ONLY works when it is active and conscious.
- 3) Learning connects new ideas to old information.
- 4) Involving multiple senses enhances learning.
- 5) Learning requires real effort (difficult is good).
- 6) Learning depends on managing emotions well.
- 7) Practice is critical:
  - a) Multiple modes of practice create richer and more persistent connections
  - b) Reinforce learning within 24 hours to move what was learned from short-term to long-term memory.

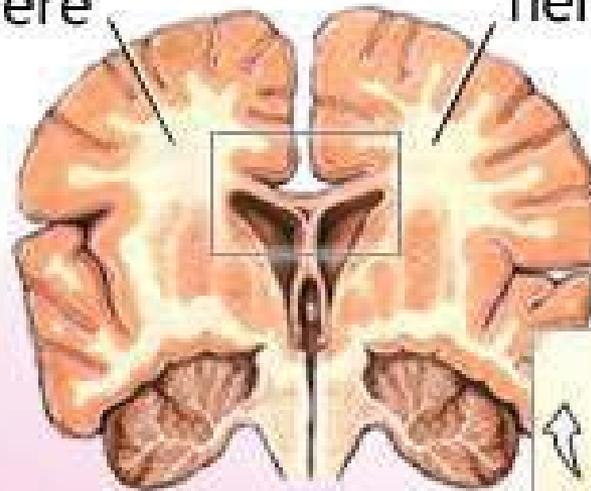
# Conclusion

Pedagogies based on civic engagement and learning by doing are exceptionally effective because they align teaching practices with how people actually learn.

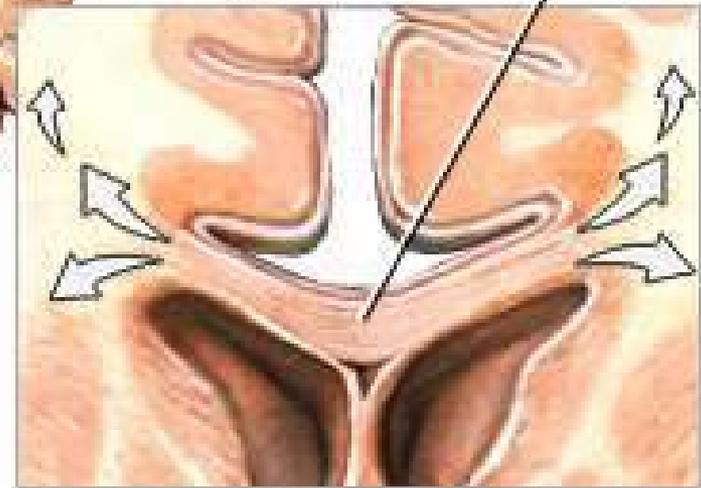
# A Cross-lateral Neurobic

Right hemisphere

Left hemisphere



Corpus callosum

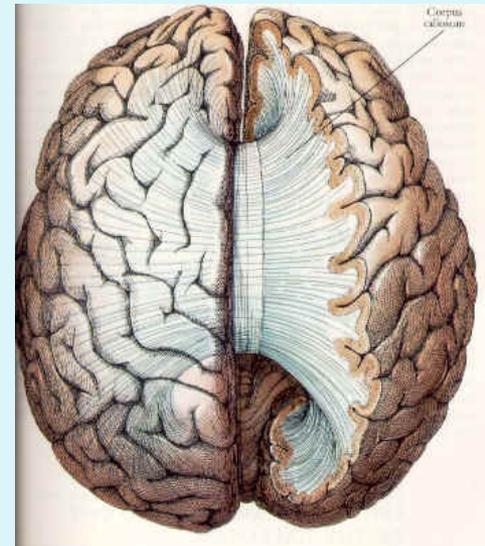


Brain

# Cross-lateral Activity

Cross-lateral activity opens up the corpus callosum

- Gets more of your brain involved
- Balances the load
- Aids memory
- Makes learning easier



# Think about the last class you taught

Can you list what you covered?

Can you list what your students learned?

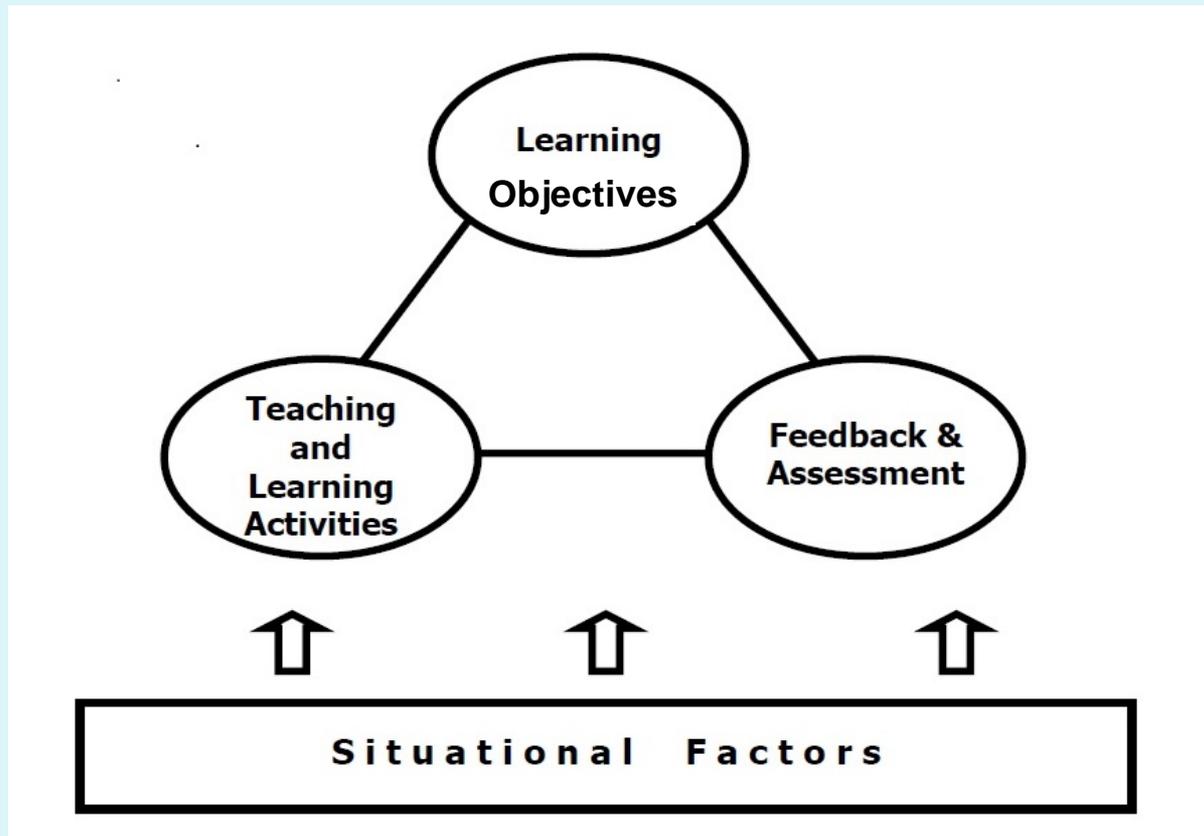
Why is the first question easier to answer than the second?

# Teaching-Centered versus Learning-Focused

- ② To the extent that we were trained at all, we were trained as teachers, not so much about how people learn.
- ② Until recently, evaluation metrics focused on teaching, not learning.
- ② But teaching (even teaching well) doesn't guarantee learning.
- ② And increasingly, we are being held accountable for what our students learn.
- ② Despite the painfulness and poor execution of this shift, it makes sense: we want our students to learn.

# Aligning Teaching and Learning

## Key Components of Integrated Design



<http://serc.carleton.edu/NAGTWorkshops/course设计/tutorial/index.html>

<http://www.deefinkandassociates.com/GuidetoCourseDesignAug05.pdf>

# Crafting Effective Learning Objectives

Find the right level:

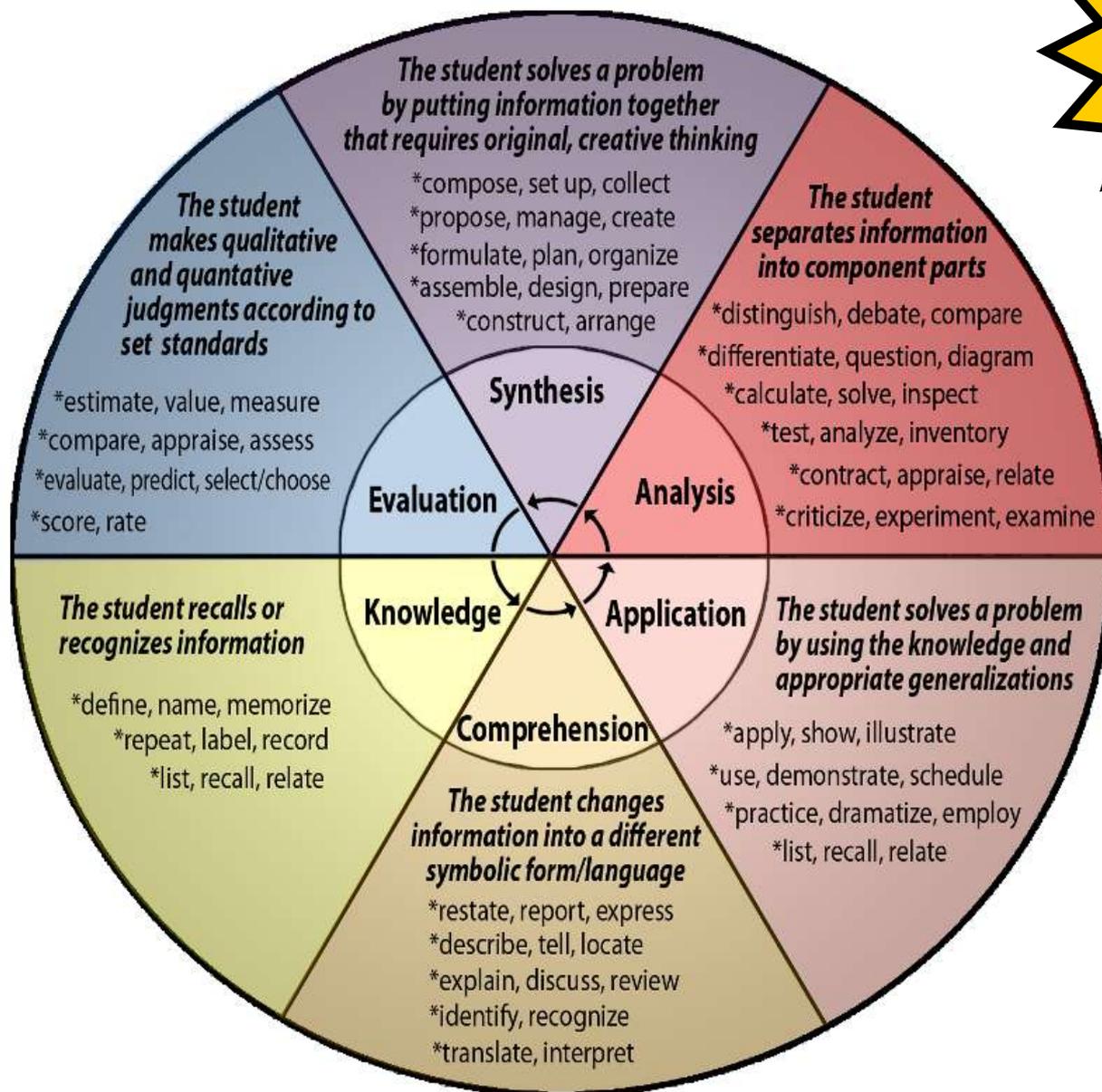
Hopes	(Mission)	Biggest picture desiderata: in most cases, these things aren't fully attainable. Example: Teach all students to write well.
Ends	(Goals)	Operationalized desiderata: possibly attainable, usually not directly measurable. Example: Develop critical thinking and cultural awareness.
<b>Aspirations</b>	<b>(Objectives)</b>	<b>Concrete, observable, measurable desiderata.</b> <b>Example: Write with a critical point of view.</b>
Targets	(Outcomes)	Actual criteria by which desiderata are measured. Example: Essays analyze multiple, clearly-marked, and opposed positions or points of view using tools discussed in class.

# Getting Started

- ② Pick (or make up) one habit-level learning objective—something that you want your students to do ten years from now. Pick one that includes some civic engagement—something that will improve the lives not just of our students, but of the community as well.
- ② Realistically, you can't accomplish more than a couple of habit-level learning objectives in one course because it takes daily (or at least weekly) practice to develop a robust habit.
- ② Check your Bloom level. If your objective isn't clearly among the Higher-Order Thinking Skills (HOTS), elevate your learning objective until it is.

# Bloom's Taxonomy of Educational Objectives

**For the  
Cognitive  
Domain**



# Scaffold to support your Objective

- ② What attitudes will students need to develop and support the habit you want them to retain?
  - These will be your affective learning objectives
  - Plan on 2-3 of these (they take time to build)
- ② What skills will students need to develop and support the habit you want them to develop?
  - These will be your skills learning objectives
  - You can have more of these, maybe 5-8
- ② What knowledge will students need to develop and support the habit you want them to retain?
  - These will be your understanding learning objectives
  - You can have many of these; they're easy to reach

# Building your Pedagogy

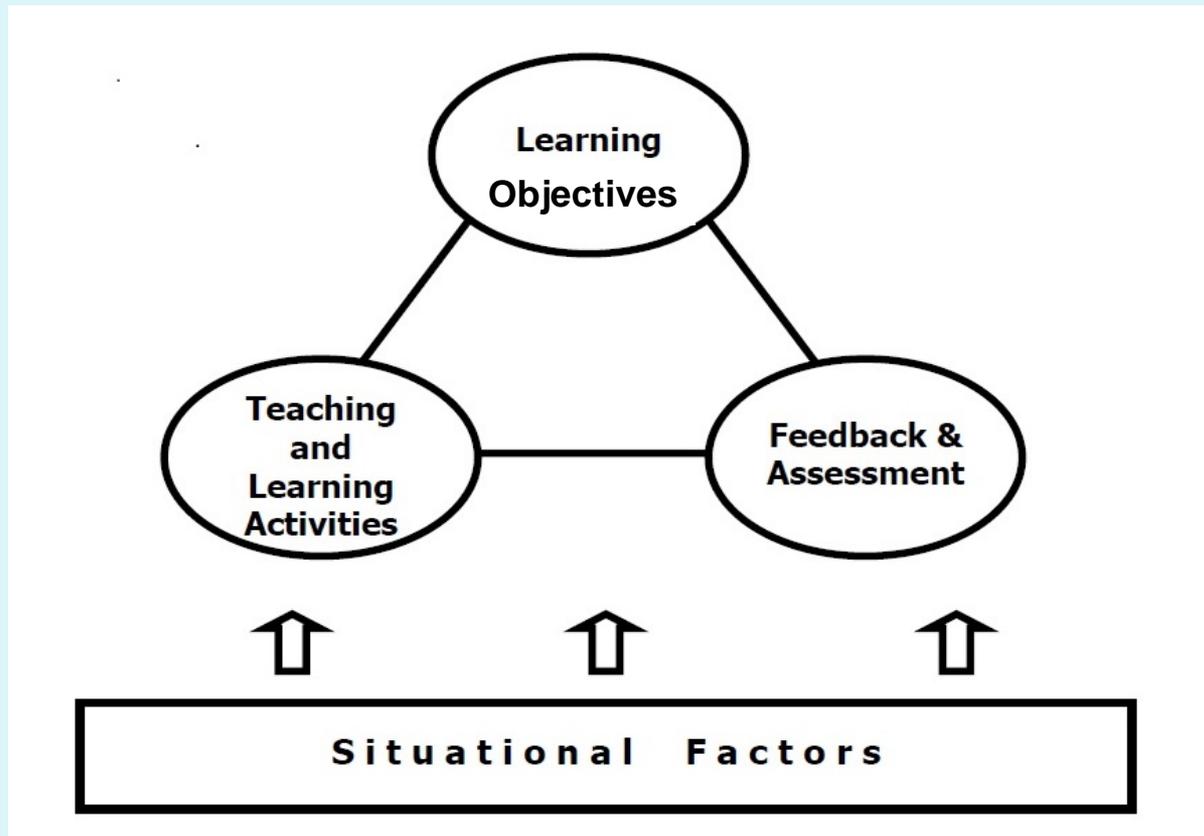
- Ⓜ Now that you have a clear and rationally organized set of learning objectives, you are ready to design your learning activities.
- Ⓜ What resources, lessons, assignments, activities, etc. will help your students develop and maintain the habit you have in mind?
- Ⓜ You want your students to learn by doing because practice is the best way to learn anything.
- Ⓜ Activities and assignments that require civic engagement will help you accomplish multiple learning objectives at the same time.

# Assess, Rinse and Repeat

- ② You already know what you need to assess: Just turn your learning objectives into questions.
- ② This will work for everyday low-stakes assessments, course exams and end-of course evaluations.
- ② Once you know what worked well and what didn't, you can modify your learning objectives or your pedagogy to get closer to your goals next time.

# Aligning Teaching and Learning

## Key Components of Integrated Design



<http://serc.carleton.edu/NAGTWorkshops/coursedesign/tutorial/index.html>

<http://www.deefinkandassociates.com/GuidetoCourseDesignAug05.pdf>

# Learning Assessment for Courses

The Student  
Assessment  
of their  
Learning Gains  
(SALG)

Free Tools at  
[www.salgsite.org](http://www.salgsite.org)



[www.salgsite.org](http://www.salgsite.org)

**A powerful new tool for faculty:** The Student Assessment of their Learning Gains (SALG) instrument is designed to help faculty improve their teaching. It offers useful feedback on how well aspects of your teaching helped your students learn and what progress they made toward your course learning goals.

**Focuses on learning gains:** The SALG is based on Elaine Seymour's finding that student's assessments of *what they gained* are more reliable and informative than their observations about *what they liked* about the course—or about you as their teacher.

**Puts pedagogy first:** The first part of the SALG instrument asks students how effectively aspects of the course helped them learn. Six sections cover course design, class activities, graded assignments, resources, information given to students about the course, and support for students as learners.

# Why SALG?

- ② Research shows that students will punish innovative teaching on standard student course evaluations even if the students learned more and even if the students recognize that they learned more.
- ② Therefore, to protect yourself, you need to use an evaluation instrument that focuses on learning, not on teacher behaviors and/or student satisfaction.

# Evidence that Civic Engagement Improves Learning

- ② Over the past 5 years, SENCER faculty have consistently scored higher in all learning categories (understanding, skills, affective, integrations) than their STEM colleagues.
- ② The marginal advantage is highest in affective and integrative gains, meaning that the learning gains students make in SENCER courses are likely to be more durable than those made in other STEM courses.

# More Evidence

- ② SENCER faculty who made changes to their pedagogies based on their SALG results got consistently higher scores in all categories even than other SENCER faculty.

***Thank You!***

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# Inspiration

What Teachers Make