

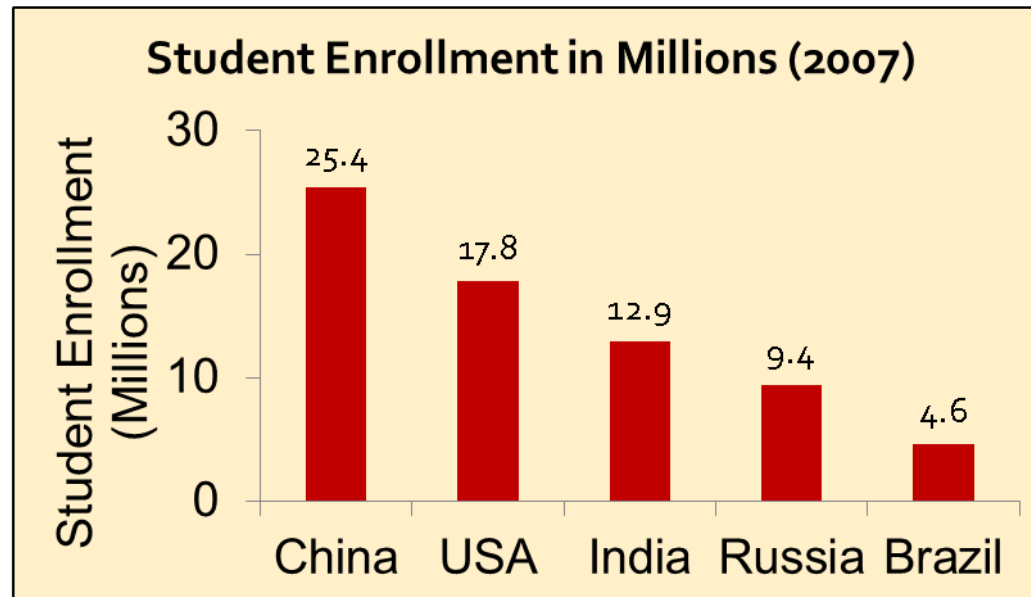
Innovations in Education

Improving Engineering Education Worldwide
Through Evidence-Based Learning Research

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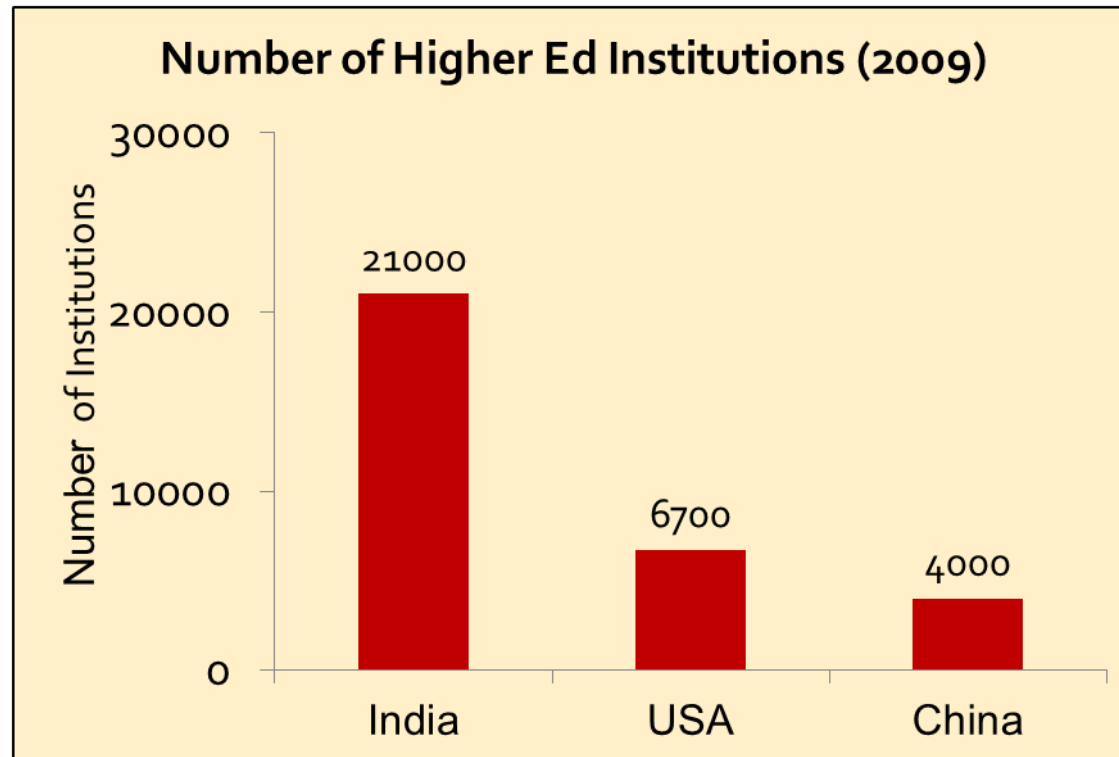
World Engineering Education Forum
Wednesday, September 25, 2013

How many students are enrolled in higher education?



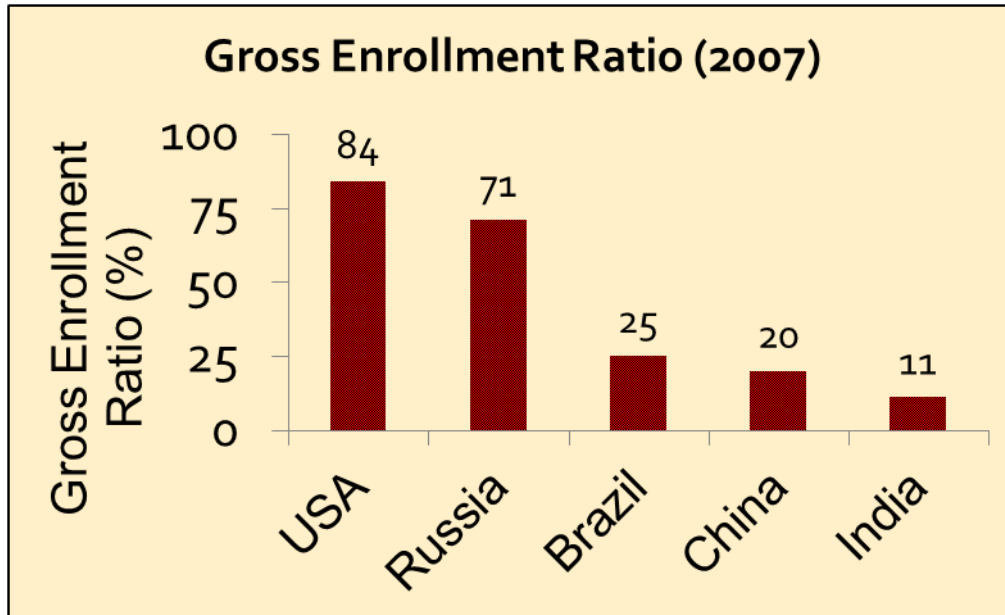
Source: Making the Indian higher education system future ready FICCI Higher Education Summit 2009

How many education institutions are available?



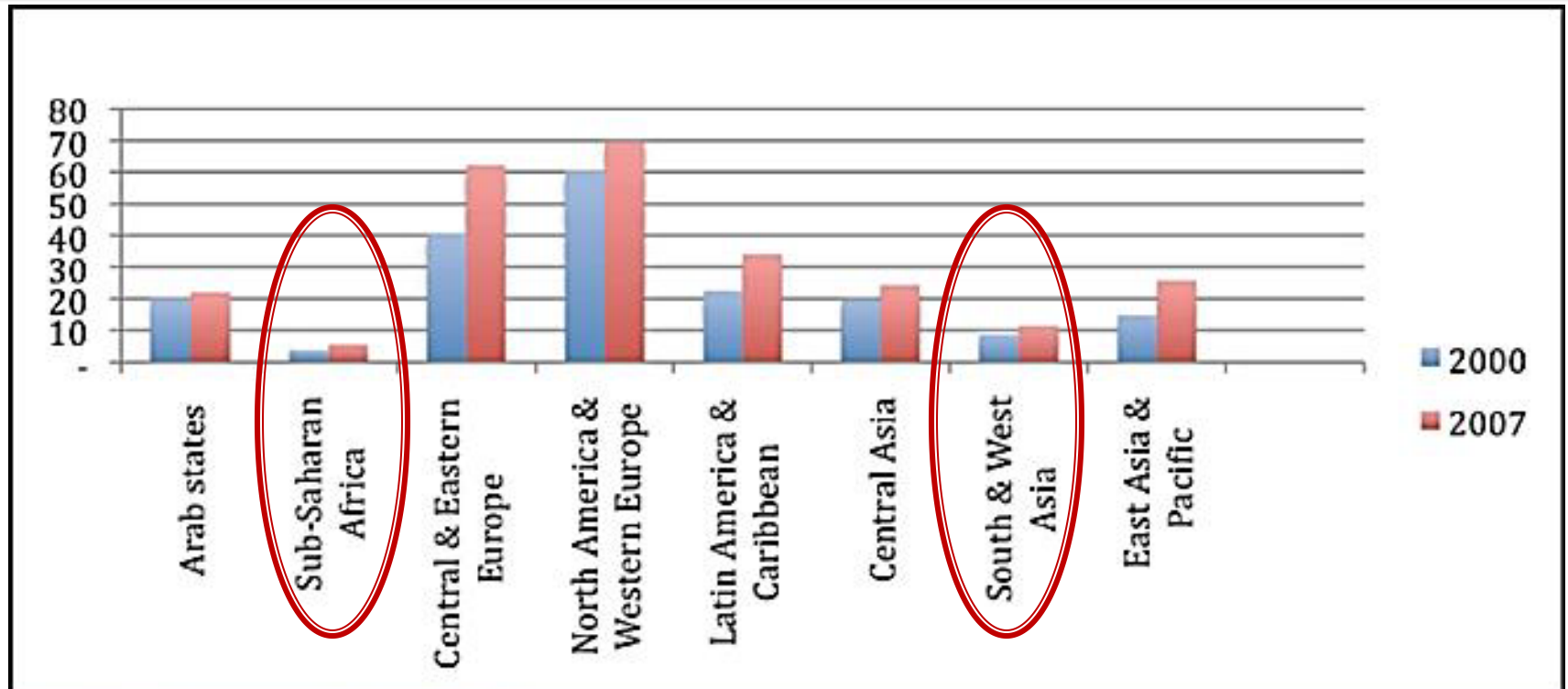
Source: Making the Indian higher education system future ready FICCI Higher Education Summit 2009

What proportion of students are in tertiary education?



Gross enrollment ratio (GER) is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education.

Gross enrollment ratio for tertiary education by regions



Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education

MOOCs

MOOCs

■ Massive Open Online CourseS.

Course – It is a course

Online – It is offered online

Open – Do not need to pay a fee or be registered student

Massive – Designed to support indefinite number of students



Will MOOCs help?

- What are the issues with MOOCs?
- What are MOOCs good for?
- How are they evolving?
 - cMOOCs
 - xMOOCs
 - bMOOCs

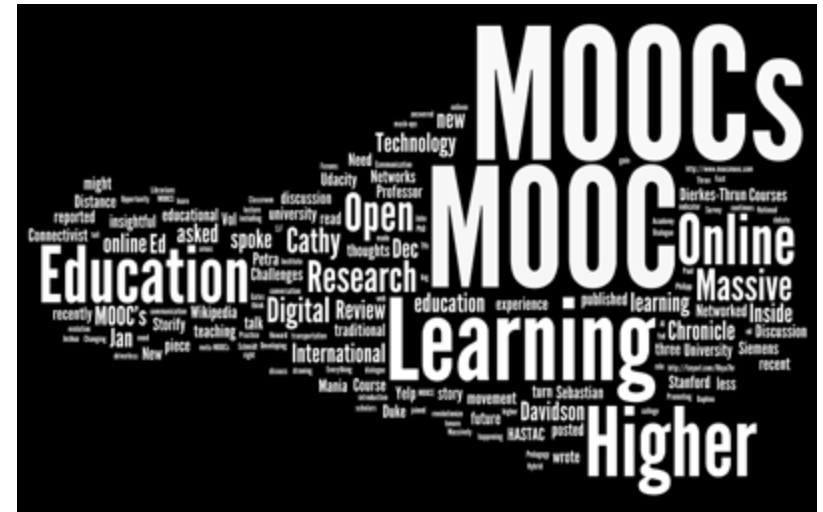


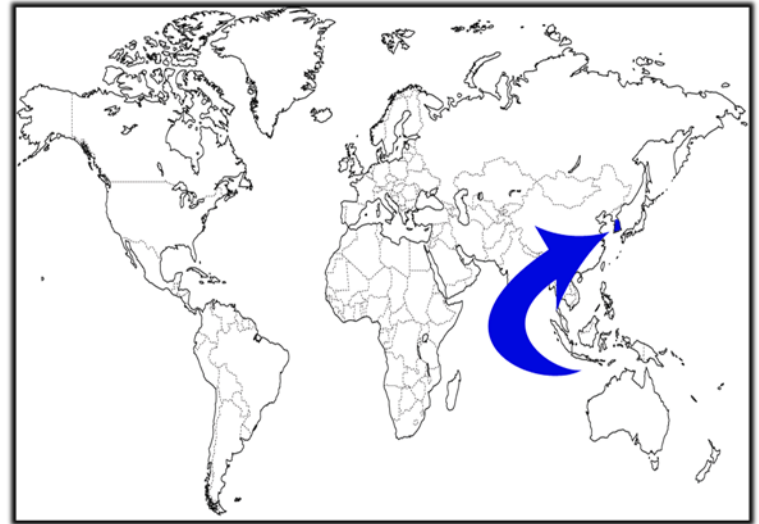
Image: Courtesy of hastec.org

Learning Approaches

Two extreme approaches that work!



Guided Discovery



Fully Guided Instruction

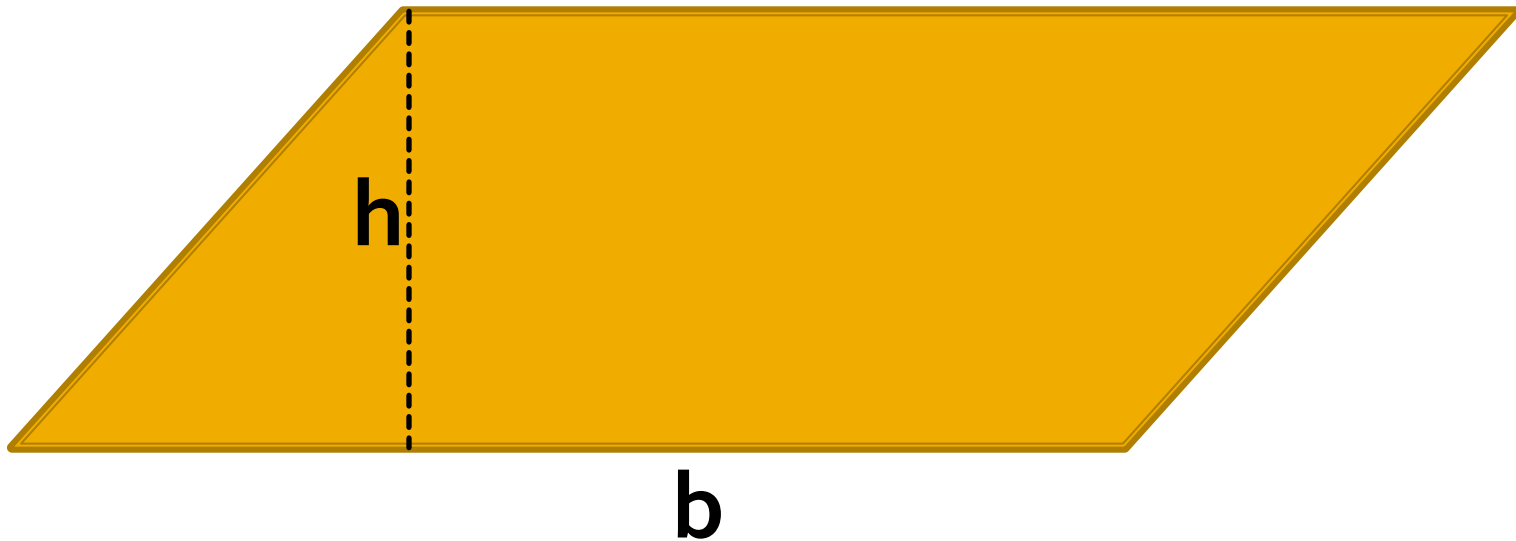
A simple recipe for optimal learning!

Follow the evidence-based pedagogy of Universal Design Learning (UDL) of giving multiple forms of

- 1. Perception**
- 2. Expression**
- 3. Engagement**

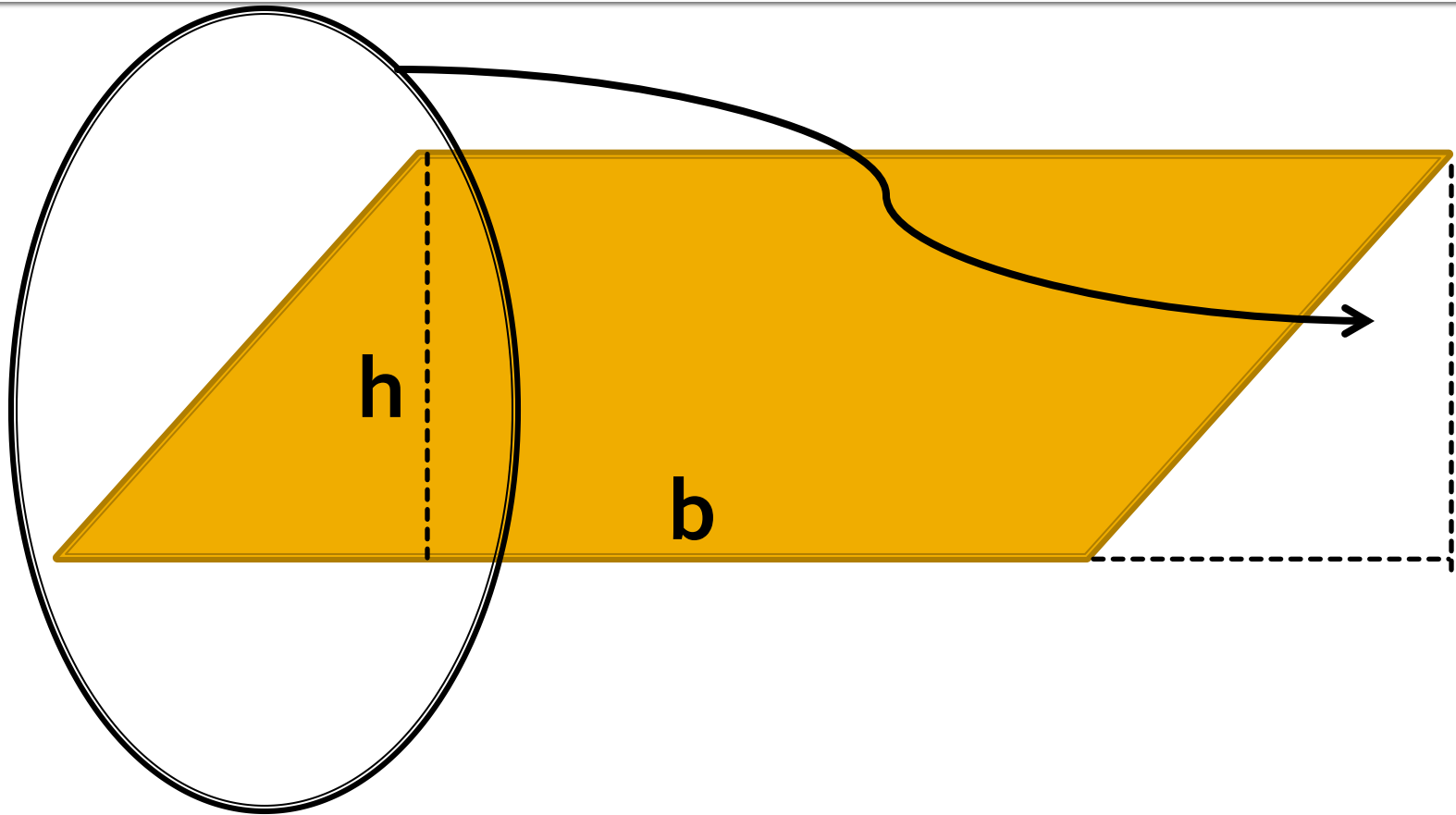
Rote vs Understanding Method

Rote method

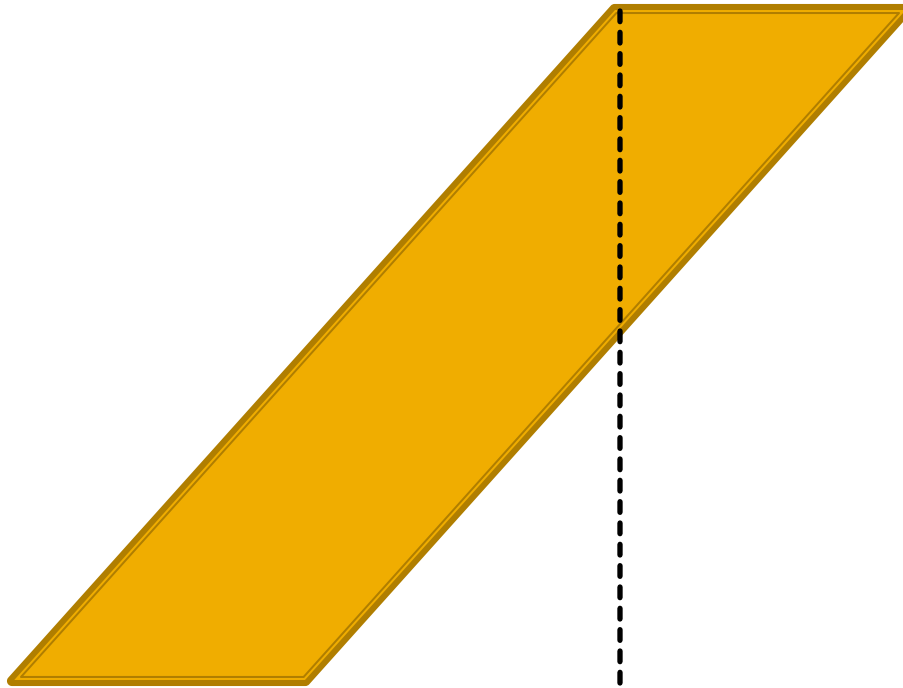


$$\text{Area} = b * h$$

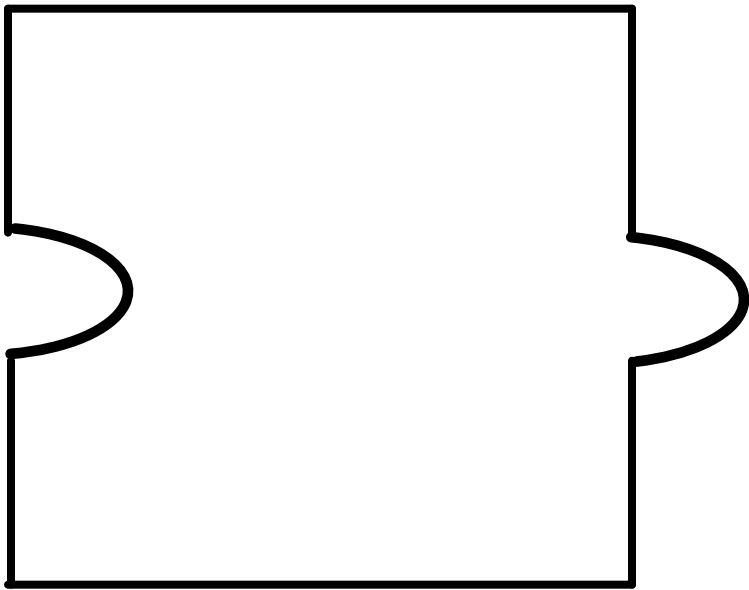
Understanding method



How does it transfer?



Solvable and unsolvable problems



Which Learning Techniques are Best?

Ten common learning strategies

- | | |
|------------------------------|-----|
| 1. Elaborative interrogation | |
| 2. Self-explanation | |
| 3. Summarization | Low |
| 4. Highlighting/underlining | Low |
| 5. Keyword mnemonic | Low |
| 6. Imagery for text | Low |
| 7. Rereading | Low |
| 8. Practice testing | |
| 9. Distributed practice | |
| 10. Interleaved practice | |

Ten common learning strategies

- | | |
|------------------------------|----------|
| 1. Elaborative interrogation | Moderate |
| 2. Self-explanation | Moderate |
| 3. Summarization | Low |
| 4. Highlighting/underlining | Low |
| 5. Keyword mnemonic | Low |
| 6. Imagery for text | Low |
| 7. Rereading | Low |
| 8. Practice testing | |
| 9. Distributed practice | |
| 10. Interleaved practice | Moderate |

Ten common learning strategies

- | | |
|------------------------------|----------|
| 1. Elaborative interrogation | Moderate |
| 2. Self-explanation | Moderate |
| 3. Summarization | Low |
| 4. Highlighting/underlining | Low |
| 5. Keyword mnemonic | Low |
| 6. Imagery for text | Low |
| 7. Rereading | Low |
| 8. Practice testing | High |
| 9. Distributed practice | High |
| 10. Interleaved practice | Moderate |

**QUESTION: What is the Biggest
Hindrancel to Learning?**

MULTITASKING!

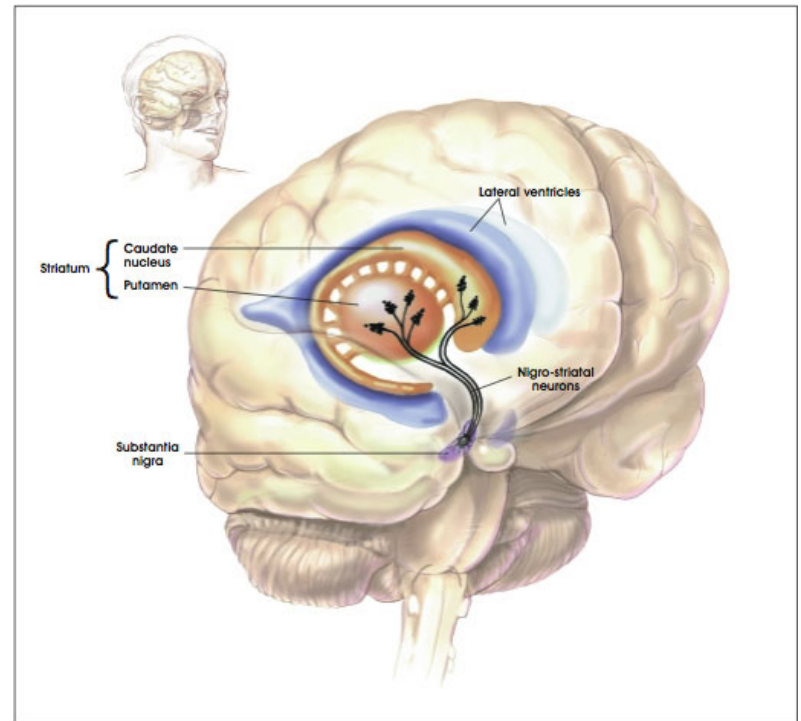
The two circuits in the brain

Circuit 1 This one is for reactive attention

Circuit 2 This one sets our mind to concentrate on something

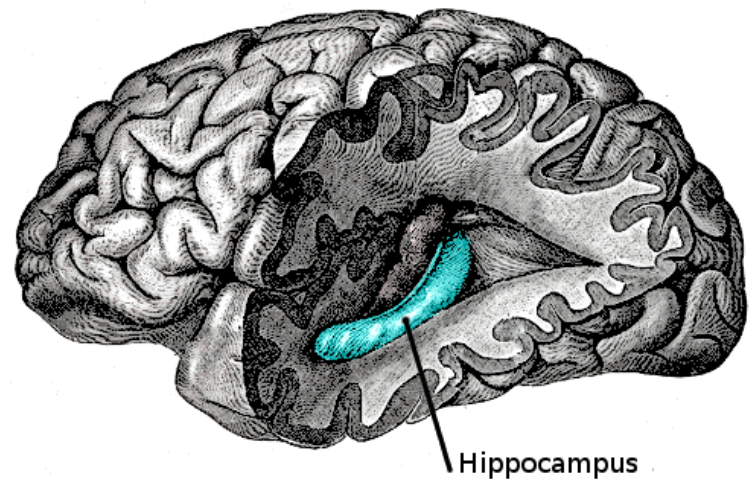
Multitask learners (Circuit 1)

- Multitaskers fire up striatum needed for routine learning. Not bad if you want to be on an assembly line.



Focused learners (Circuit 2)

- Focused learners rely on hippocampus that is needed for learning abstract rules to novel problems. Needed for learning mathematics and programming based work.



Negative consequences of multitasking while doing college work

- Time Spent
- Mental Fatigue
- Memory Failure
- Inept Deep Learning



Adaptive Learning

Personalized learning makes learning more effective

- Adapts digital lessons and assessments
- Empowers educators with tools
- We can do this now using the learning management systems quizzing options

ADVISING

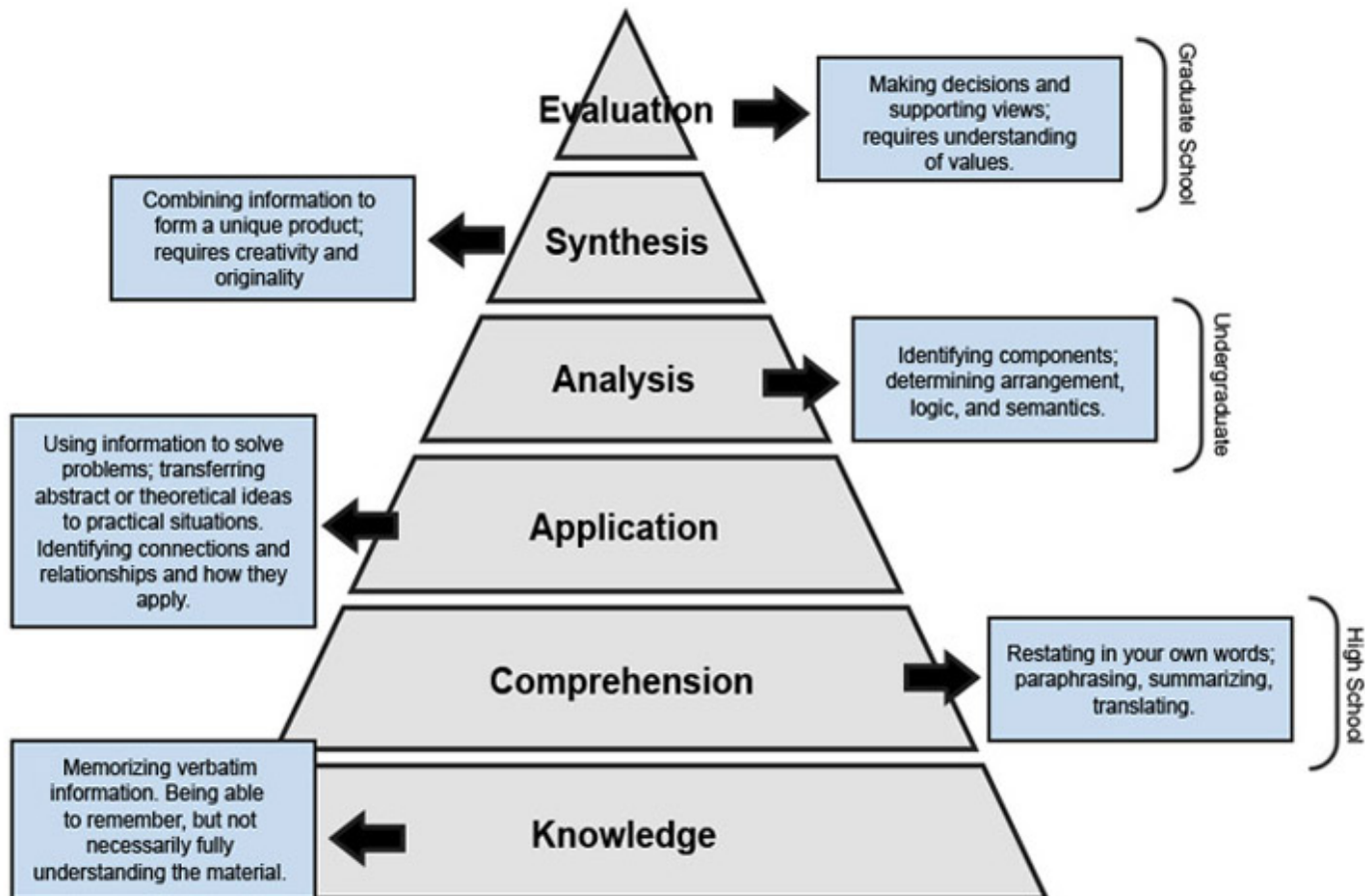
Improve retention of students

- Non-cognitive factors are crucial
- Improve direction via online tools

A Learning Taxonomy

What is Bloom's Taxonomy?

Bloom's Taxonomy



Six Levels of Bloom's Taxonomy

- **Knowledge:** (repeating verbatim)
 - List, State
- **Comprehension:** (demonstrate understanding)
 - Explain, Interpret
- **Application:** (applying learned info to solve problem)
 - Calculate, Solve

Six Levels of Bloom's Taxonomy

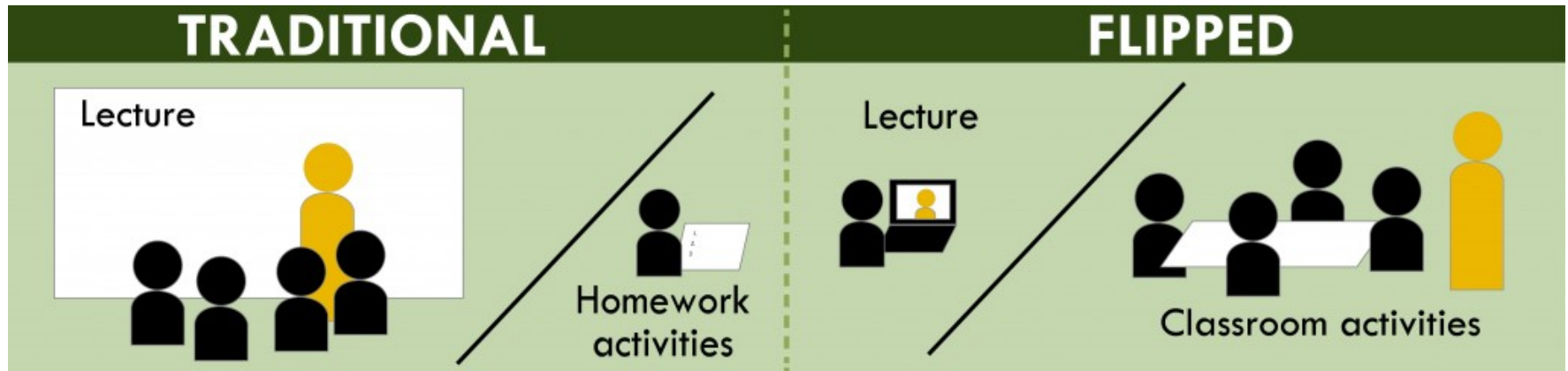
- **Analysis:** (breaking things down, formulating mathematical models)
 - Derive, Explain
- **Synthesis:** (creating something, combining elements)
 - Formulate, Makeup, Design
- **Evaluation:** (making and justifying judgments, selection from alternatives)
 - Determine, Select, Critique

Let's Review With a Video

[A short video on Bloom's Taxonomy](#)

ACTIVE LEARNING

Flipped Classroom



Transmission in class and Assimilation at home
TO Transmission at home and Assimilation in class.

Flipped Classroom

[A short video](#)

What to do in class: 15 minutes clicker quizzes; 20 minutes answer questions; 15 minutes in-class exercises.

Peer-To-Peer Interaction



END