

D.I.Y. Test Questions as a Tool for Deeper Learning

UNIV 101 / GENE 101 – Andrea Prier & Bill Owen
(Strategies and Skills for Academic Success)

WATERLOO
STUDENT SUCCESS
OFFICE &
FACULTY OF ENGINEERING

ECE 682 – David Wang
(Multivariable Control Systems)

CHE 102 – Mary Robinson
(Chemistry for Engineers)

MATH 115 -Paula Smith
(Linear Algebra for Engineers)

Intro to GENE 101 & ECE 682

GENE 101

- A 'learning strategies' course for students who are struggling
- Students consistently display a lack of study skills, time management and engagement
- Students take GENE 101 plus two other courses (CHE 102 & MATH 115) as part of the 'reduced load' program

ECE 682

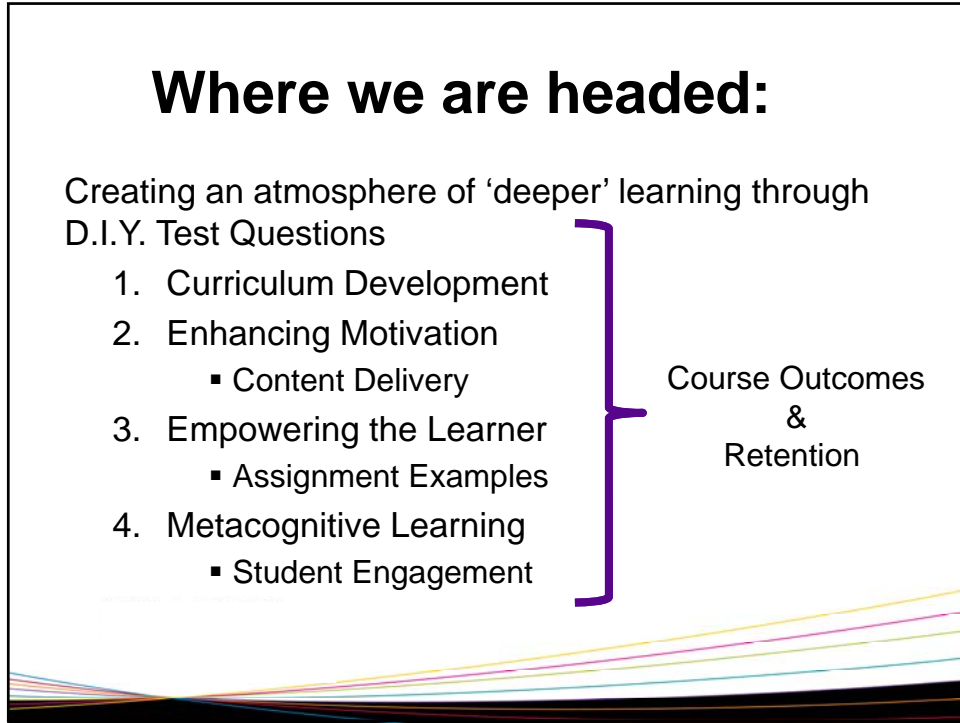
- A very theoretical course in control systems
- Lack of background, work ethic and engagement was increasing problem
- Over the previous 3 offerings, material was removed and simplified; ratings went down
- Perception of the difficulty of theory increased

Where we are headed:

Creating an atmosphere of 'deeper' learning through D.I.Y. Test Questions

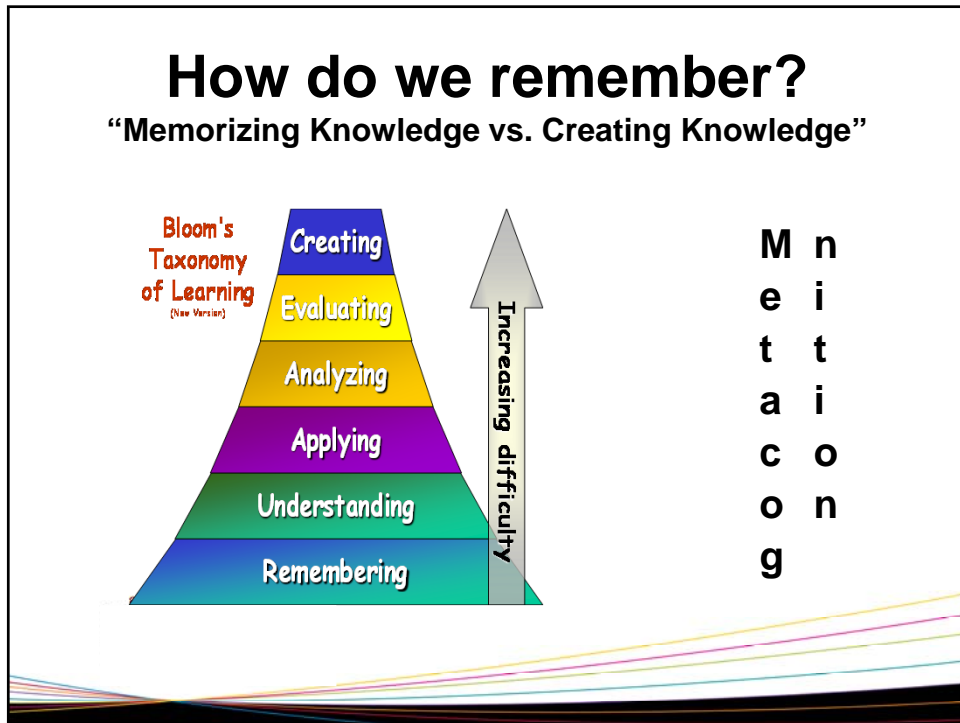
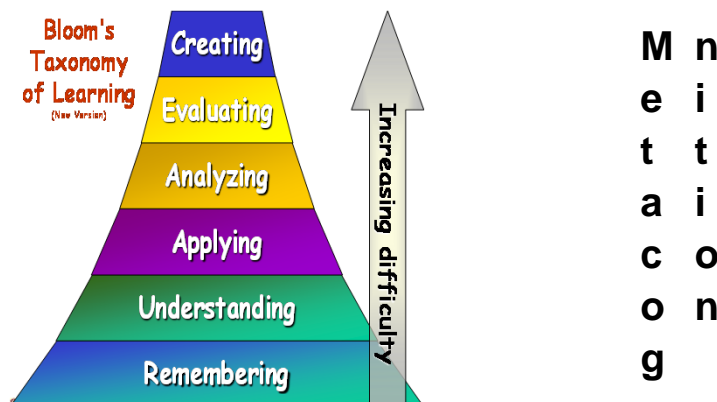
1. Curriculum Development
2. Enhancing Motivation
 - Content Delivery
3. Empowering the Learner
 - Assignment Examples
4. Metacognitive Learning
 - Student Engagement

Course Outcomes
&
Retention



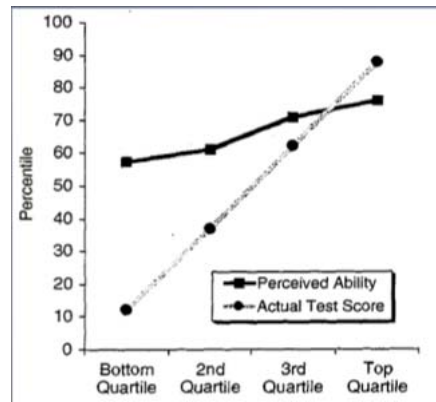
How do we remember?

“Memorizing Knowledge vs. Creating Knowledge”



Becoming Aware

First year Engineering beliefs about their math abilities



Kruger & Dunning, 1999

Thinking About Your Thinking

Everytime I see a math word problem it looks like this:

If I have 10 ice cubes and you have 11 apples.

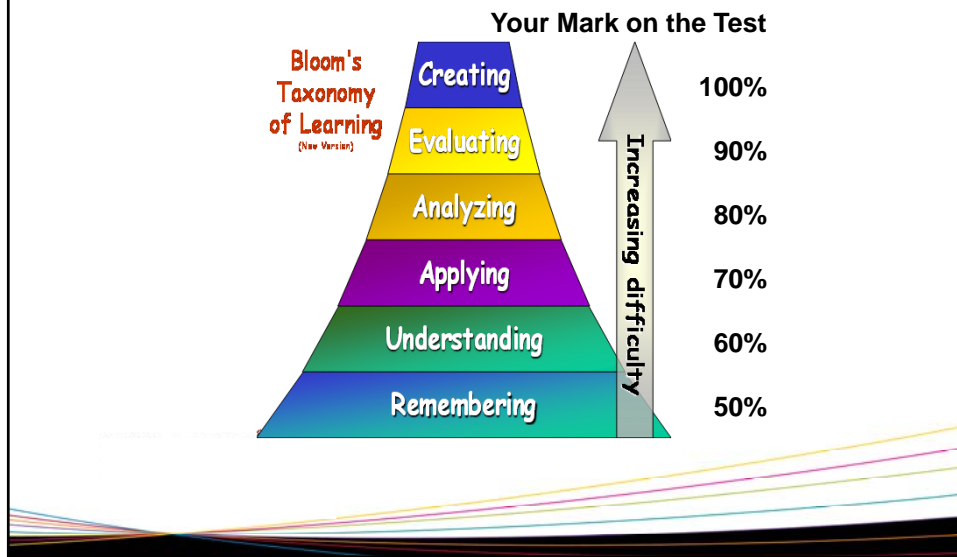
How many pancakes will fit on the roof?

Answer:

**Purple because aliens
don't wear hats.**

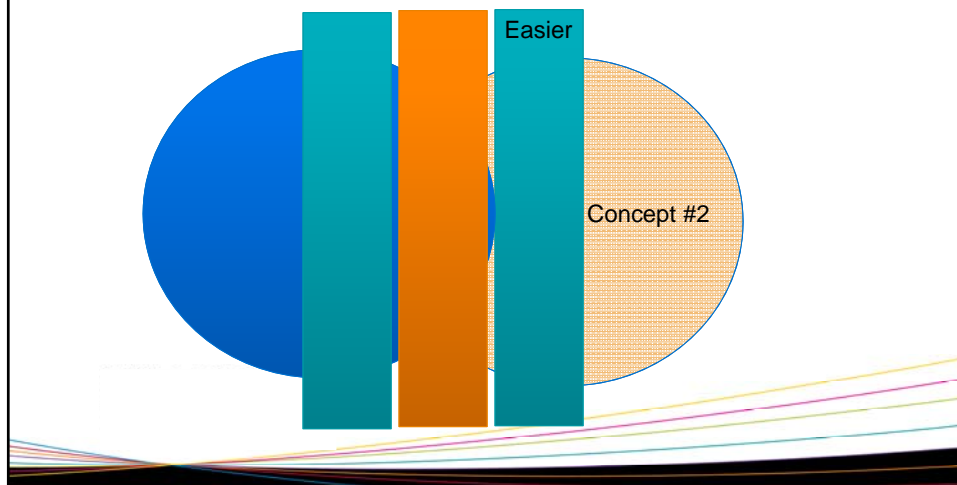


Thinking About Your Thinking... Like Your Prof



Thinking About Your Thinking... Like your Prof

- Problem Manipulation and Test Taking



GENE 101:

Thinking About Your Thinking = Higher-Order Problem Solving

Step 1: Identify 5 different concepts from one of your courses

Step 2: Choose an example problem from each of the different areas.

Step 3: Manipulate your problems so that you are solving for a different variable

Step 4: Solve your problems

Step 5: Trade with a peer and critique / solve the peers problems

Step 6: Create 20 questions for a 'practice final'

Step 7: Submit the problems for review by course instructors

Step 8: Write your DIY practice final
→ Mark your own work!

Step 9: Write your Final Exam
→ May include specific questions you created

ECE 682 - Assignments

- In 2012, incorporated group work on assignments, with the requirement to come up with some exam questions
- There are professor assigned assignment questions that the students do ... and then use as examples of appropriate questions
- These exam questions have to be of the appropriate level
- 40% of the final exam was drawn from these questions

Student Engagement

In both GENE 101 and ECE 682:

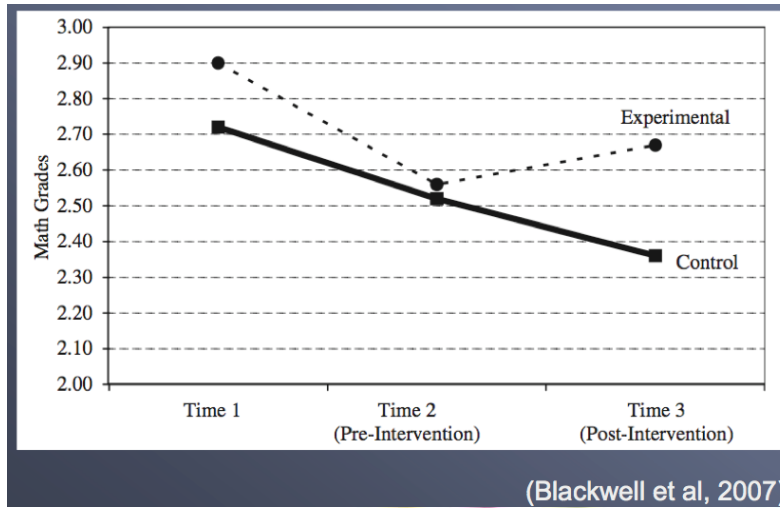
- “the best way to learn is to teach”
- Students were more engaged and some interesting questions were created
- Comments indicated the majority enjoyed the ability to create these questions
- Instructors noticed they were more comfortable working with the course concepts

Outcomes and Retention Comments / Anecdotal evidence

- ECE 682: The average of all the Critique numbers went from 79->78->74->85 even with material added back into the course
- MATH 115: Final exam made harder to challenge them ... success rates still high
- CHE 102: Comprehension levels improved, sample questions needed editing

Monitor Your Beliefs

First year Engineering beliefs about their math abilities



D.I.Y. Test Questions as a Tool for Deeper Learning

UNIV 101 / GENE 101 – Andrea Prier & Bill Owen
(Strategies and Skills for Academic Success)

WATERLOO
STUDENT SUCCESS
OFFICE &
FACULTY OF ENGINEERING

ECE 682 – David Wang
(Multivariable Control Systems)

CHE 102 – Mary Robinson
(Chemistry for Engineers)

MATH 115 -Paula Smith
(Linear Algebra for Engineers)