Metacognition: The Key to Transforming Students Into Learners

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HOME


CUNY CUE CONFERENCE 2019
Transforming Teaching
Into Learning
May 10, 2019

Paradigm Shift in Higher Education

Teaching Centered Institutions

Learning Centered Institutions

Barr, R.B., and Tagg, J. "From Teaching to Learning - A New Paradigm for Undergraduate Education." Change, Nov-Dec. 1995, pp 13-25

Metacognition

The ability to:

- think about your own thinking
- be consciously aware of yourself as a problem solver
- monitor, plan, and control your mental processing (e.g. “Am I *understanding* this material, or just *memorizing* it?”)
- accurately judge your level of learning
- know what you know and what you don’t know

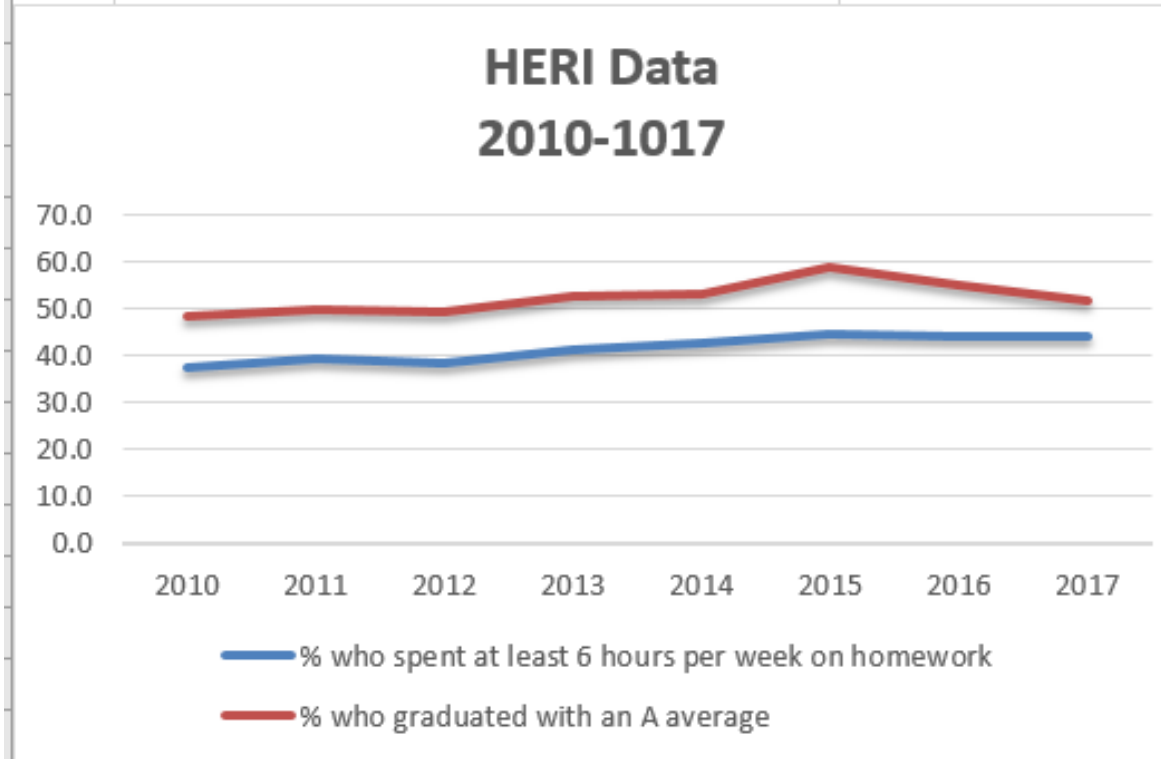
Flavell, J. H. (1976). Metacognitive aspects of problem solving. In L. B. Resnick (Ed.), The nature of intelligence (pp.231-236). Hillsdale, NJ: Erlbaum

Why haven't most students already developed these skills?

It wasn't necessary

Data from UCLA Higher Education Research Institute (HERI)
First Year Student Survey – 2010 - 2017

	% spending > or = 6 hrs/wk on homework	% with an A average
2010	37.3	48.4
2011	39.5	49.7
2012	38.4	49.5
2013	41.4	52.8
2014	42.9	53.1
2015	44.8	58.7
2016	44.0	55.1
2017	44.1	51.5



www.heri.ucla.edu

Report: Skills Gap Increasing in Higher Ed-to-Business Talent Pipelines

Report: Technology Purchases Driving up Back-to-School Shopping Budgets

Research

ACT Alarmed by U.S. Student Test Results

By Dian Schaffhauser | 08/26/15

This year's ACT results show 31 percent of students still unready for college in English, math, reading or science — every subject tested by the assessment organization. That's a figure that has not changed since 2012, when it was slightly higher. Fewer than a fifth of those students can be expected to go on to earn a college degree within six years.

MOST POPULAR ARTICLES

1 Research Uncovers MOOC Cheating Strategy

2 Three-Quarters of Students Say More Tech Would Improve Their Learning

3 Connected Data Unveils Transporter Network Storage Connector

4 E-Texts and the Future of the College Bookstore

How do you think most students would answer the following?

- What did most of your teachers in high school do the *day before the test*?
- What did they *do* during this activity?
- What grade would you have made on the test if you had gone to class *only* on the day before the test?

Faculty Must *Help Students Make the Transition to College*

Help students identify and **close "the gap"**

current *behavior* → ***current grades***

productive *behavior* → ***desired grades***

Data from Psych Prof at Crescent Tech CC

Received on 1/8/2014

Sample of 9 "at risk" students

Exam 1	Exam 2	Exam 3	Exam 4	Final Exam
62.67	77.00	78.20	82.00	82.6

"The final exam was comprehensive. The students were placed in teams and each team was assigned three chapters to review to the class in preparation for the final exam."

The Story of Two Students

- **Travis**, *junior psychology student*

  47, 52, 82, 86 B in course

- **Dana**, *first year physics student*

  80, 54, 91, 97, 90 (final) A in course

Travis, *junior psychology student*
47, 52, 82, 86

Problem: Reading Comprehension

Solution: Preview text before reading*

Develop questions*

Read one paragraph at a time

and paraphrase information

* Developing an anticipatory set

A Reading Strategy that Works: SQ5R

- **Survey** (look at intro, summary, bold print, italicized words, etc.)
- **Question** (devise questions survey that you think the reading will answer)
- **Read** (one paragraph at a time)
- **Recite** (summarize in your own words)
- **Record or wRite** (annotate in margins)
- **Review** (summarize the information in your words)
- **Reflect** (other views, remaining questions)

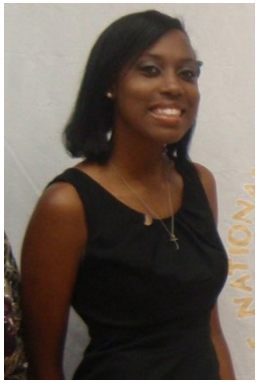
First Voyage of Christopher Columbus

WITH HOCKED GEMS FINANCING HIM/ OUR HERO BRAVELY DEFIED ALL SCORNFUL LAUGHTER/ THAT TRIED TO PREVENT HIS SCHEME/ YOUR EYES DECEIVE/ HE HAD SAID/ AN EGG/ NOT A TABLE/ CORRECTLY TYPIFIES THIS UNEXPLORED PLANET/ NOW THREE STURDY SISTERS SOUGHT PROOF/ FORGING ALONG SOMETIMES THROUGH CALM VASTNESS/ YET MORE OFTEN OVER TURBULENT PEAKS AND VALLEYS/ DAYS BECAME WEEKS/ AS MANY DOUBTERS SPREAD FEARFUL RUMORS ABOUT THE EDGE/ AT LAST/ FROM NOWHERE/ WELCOME WINGED CREATURES APPEARED/ SIGNIFYING MOMENTOUS SUCCESS

Dooling, J.D. and Lachman, R. Effects of Comprehension on Retention of Prose, *Journal of Experimental Psychology,* (1971), Vol. 88, No. 2, 216-222

Dana, *first year physics student*

80, 54, 91, 97, 90 (final)



Problem: Memorizing formulas and using www.cramster.com

Solution: Solve problems with no external aids and test mastery of concepts

Effective Homework Strategy

- **Study material first,** before looking at the problems/questions
- **Work example problems** (without looking at the solutions) until you get to the answer
- **Check** to see if **answer** is correct
- If answer is not correct, **figure out where mistake was made**, without consulting solution
- **Work homework** problems/answer questions **as if taking a test**

Dana Lewis, MS in Medical Physics, 2015

Univ of Texas Graduate School
of Biomedical Sciences at Houston
Thesis research at UT MD Anderson Cancer Center

Practicing Medical Physicist as of 8/28/2016
when she completed her residency!

Learning As Reflective Practice: Reflection Questions for Students

- What's the difference, if any, between *studying* and *learning*?

- For which task would you work harder?

  A. Make an A on the test

  B. Teach the material to the class

When Ty Taught His Betta Fish

- First encounter on September 17, 2018
- Email on October 25, 2018

Bio Exam Grades:	66, 98, 90; Final Grade B
Chem Exam Grades:	62, 83; Final Grade B

Impact of Teaching to Learn

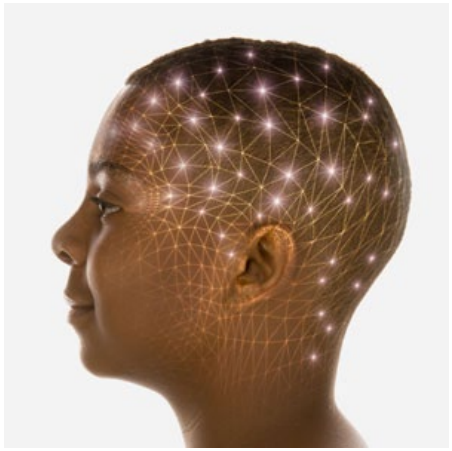
Ty, LSU First Year Student

Email Received on October 26, 2018

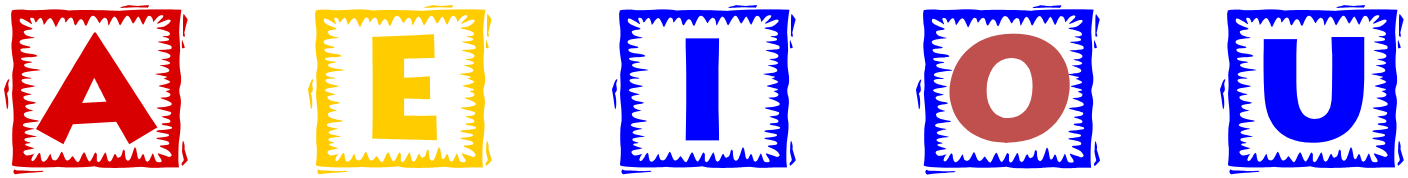
I attended more of the Supplemental Instruction (SI) sessions and the exam reviews. Before the exam reviews and SI Sessions I would try to answer as many of the questions as possible to see about where I was in terms of grasping the information, then at the exam reviews/SI sessions I would know what I needed to understand. Next after the reviews/SI sessions **I would go to my room and "teach" the materials to my betta fish. The material I couldn't explain, I would study more.** ***I would continue that cycle until I could explain everything in my notes....***

Why is Fast and Dramatic Increase Possible?

It's all about the ***strategies***, and getting ***them*** to ***engage their brains***!



Counting Vowels in 45 seconds



How accurate are you?

Count all the vowels
in the words on the next slide.

Dollar Bill
Dice
Tricycle
Four-leaf Clover
Hand
Six-Pack
Seven-Up
Octopus

Cat Lives
Bowling Pins
Football Team
Dozen Eggs
Unlucky Friday
Valentine’s Day
Quarter Hour

How many *words* or *phrases* do you remember?

Let’s look at the words again…

What are they arranged according to?

Dollar Bill
Dice
Tricycle
Four-leaf Clover
Hand
Six-Pack
Seven-Up
Octopus

Cat Lives
Bowling Pins
Football Team
Dozen Eggs
Unlucky Friday
Valentine’s Day
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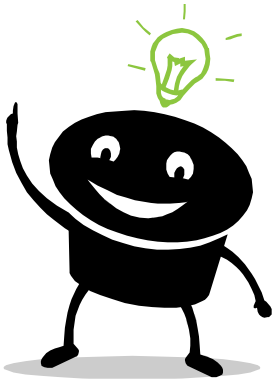
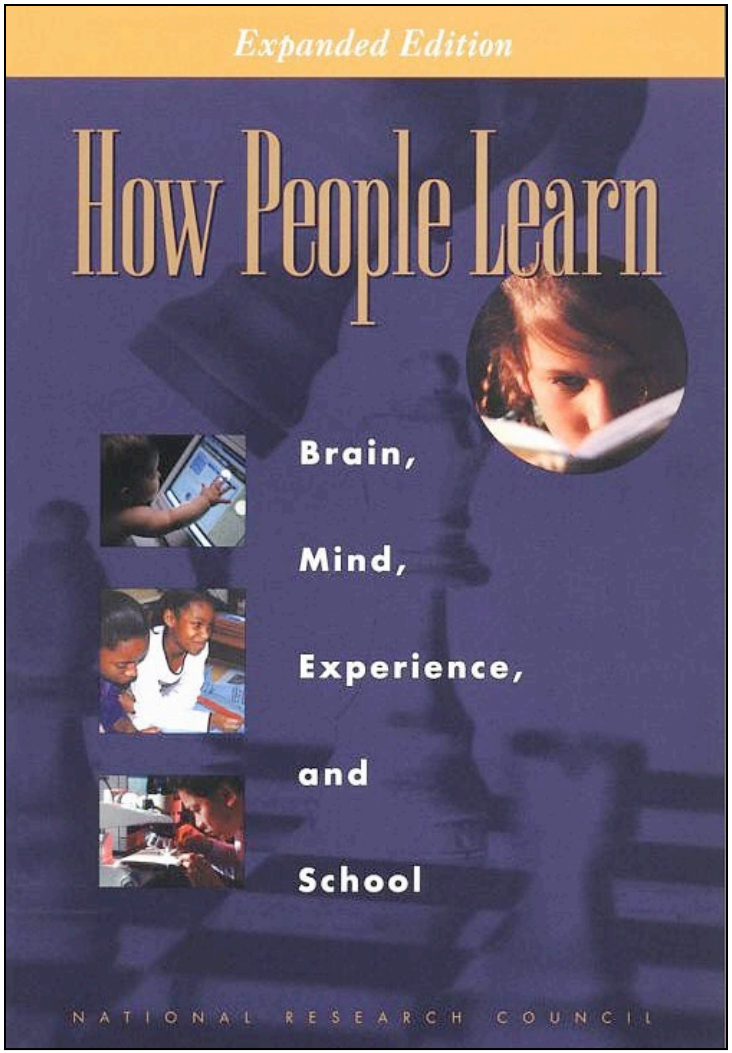
NOW, how many words or phrases do you remember?

What were two major *differences* between the two attempts?

1. We knew what the task was

2. We knew how the information was organized





Bransford, J.D., Brown, A.L., Cocking, R.R. (Eds.), 2000. *How people learn: Brain, Mind, Experience, and School.* Washington, DC: National Academy Press.

What we know about learning

- Active learning is more lasting than passive learning
  -- Passive learning is an oxymoron*

- Thinking about thinking is important
  – Metacognition**

- The level at which learning occurs is important
  – Bloom's Taxonomy***

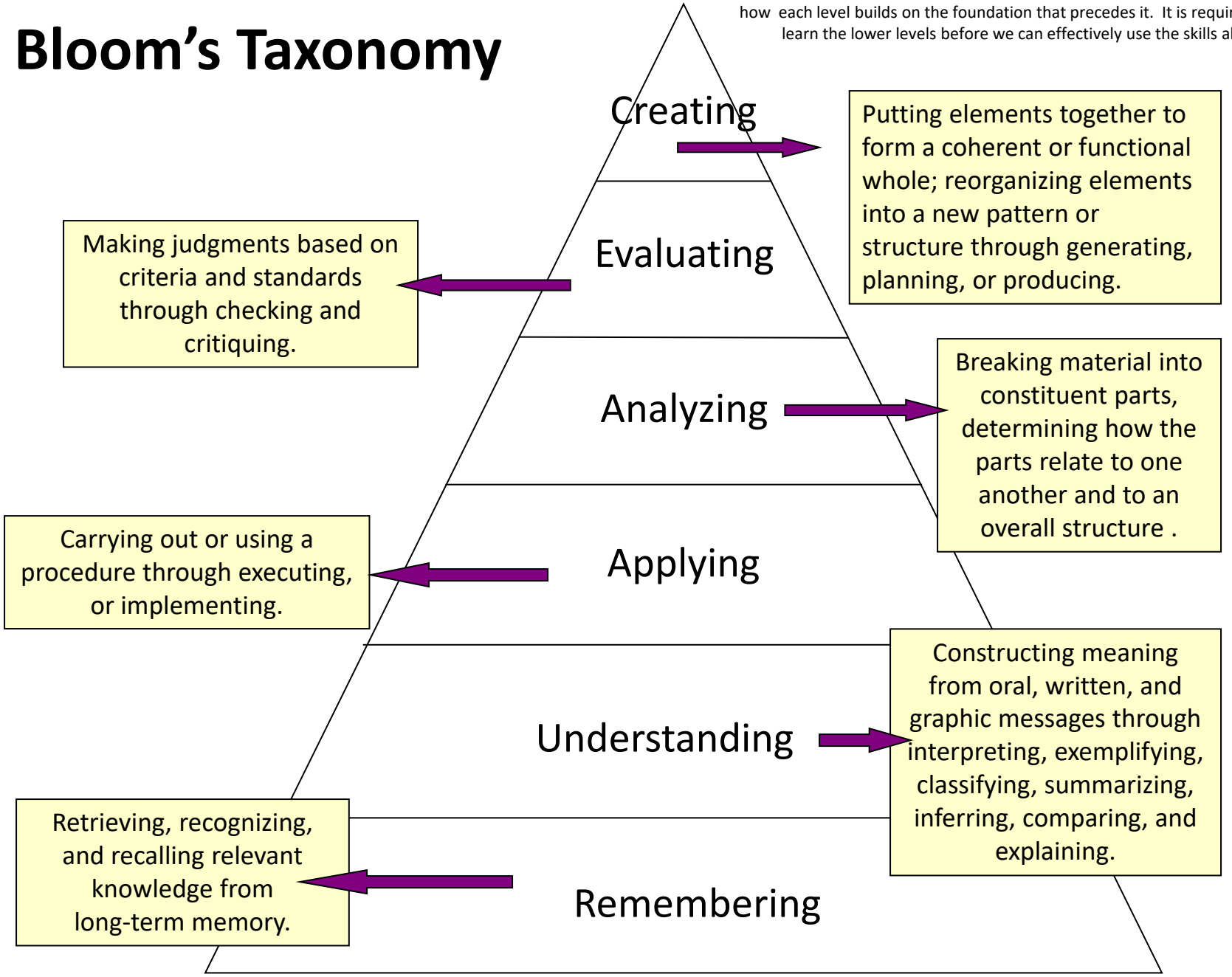
*Cross, Patricia, "Opening Windows on Learning" League for Innovation in the Community College, June 1998, p. 21.

** Flavell, John, "Metacognition and cognitive monitoring: A new area of cognitive–developmental inquiry." *American Psychologist*, Vol 34(10), Oct 1979, 906-911.

*** Bloom Benjamin. S. (1956). *Taxonomy of Educational Objectives, Handbook I: The Cognitive Domain.* New York: David McKay Co Inc.

Bloom's Taxonomy

This pyramid depicts the different levels of thinking we use when learning. Notice how each level builds on the foundation that precedes it. It is required that we learn the lower levels before we can effectively use the skills above.



http://www.odu.edu/educ/llschult/blooms_taxonomy.htm·

When we teach students about Bloom's Taxonomy…

They GET it!

How do you think students answered?

At what level of Bloom's did you have to operate to make A's or B's in high school?

1. Remembering
2. Understanding
3. Applying
4. Analyzing
5. Evaluating
6. Creating

How do you think students answered?

At what level of Bloom's do you think you'll need to operate to make A's in college courses?

1. Remembering
2. Understanding
3. Applying
4. Analyzing
5. Evaluating
6. Creating

How students answered (2013)

At what level of Bloom's did you have to operate to make A's or B's in high school?

1. Remembering
2. Understanding
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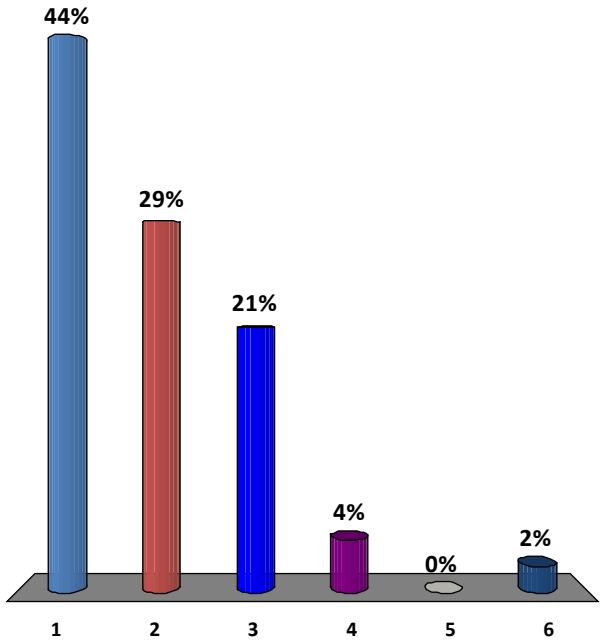
4. Analyzing
5. Evaluating
6. Creating



How students answered (in 2013)

At what level of Bloom's do you think you'll need to operate to make A's in college?

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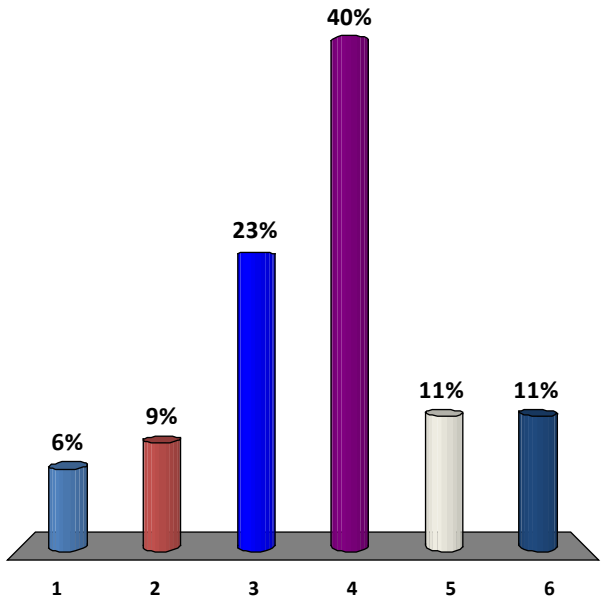
6. Creating



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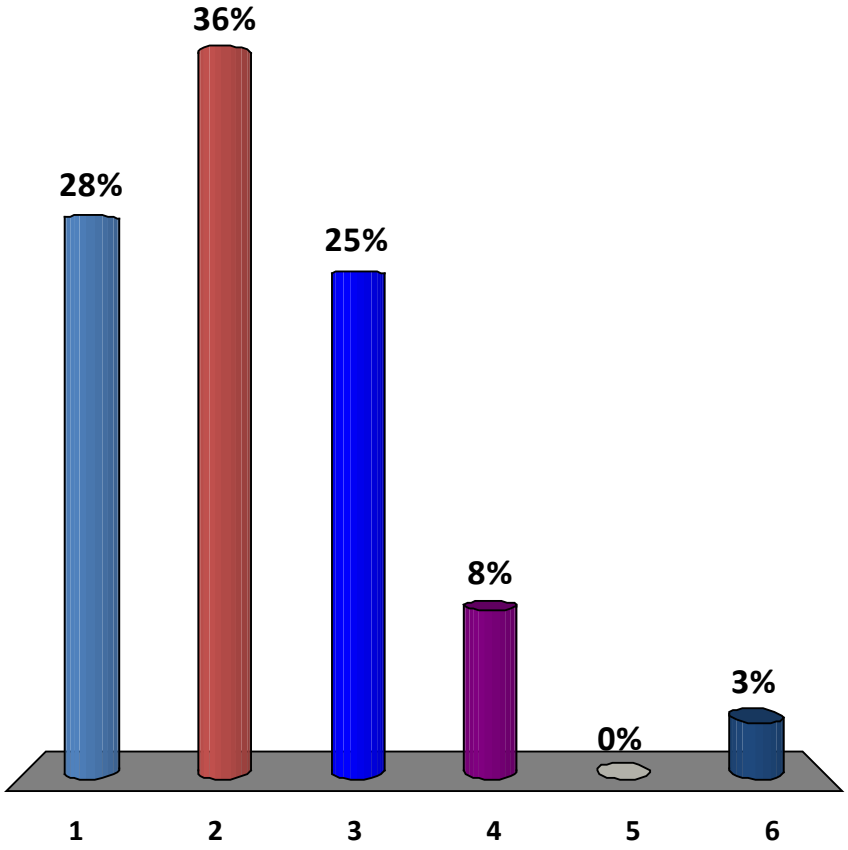

How students answered (in 2014)

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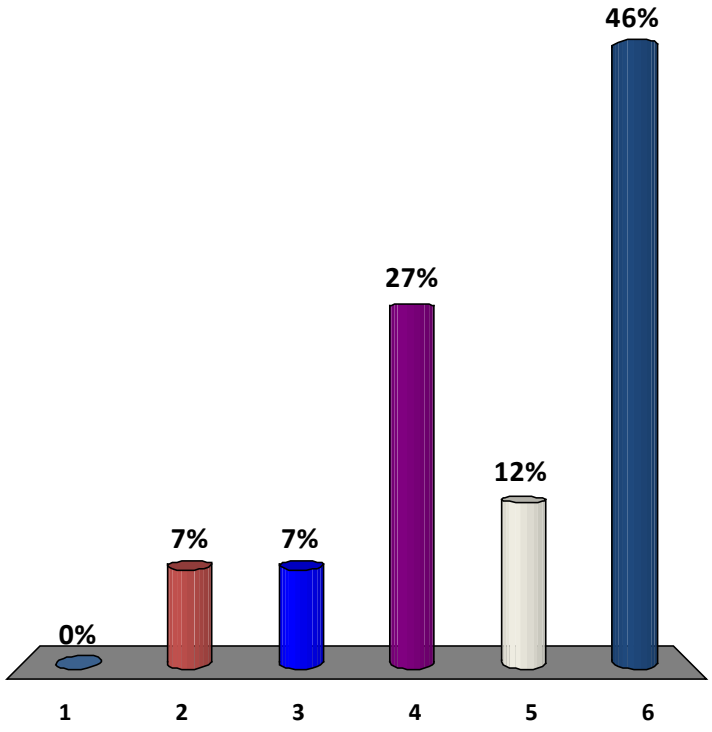
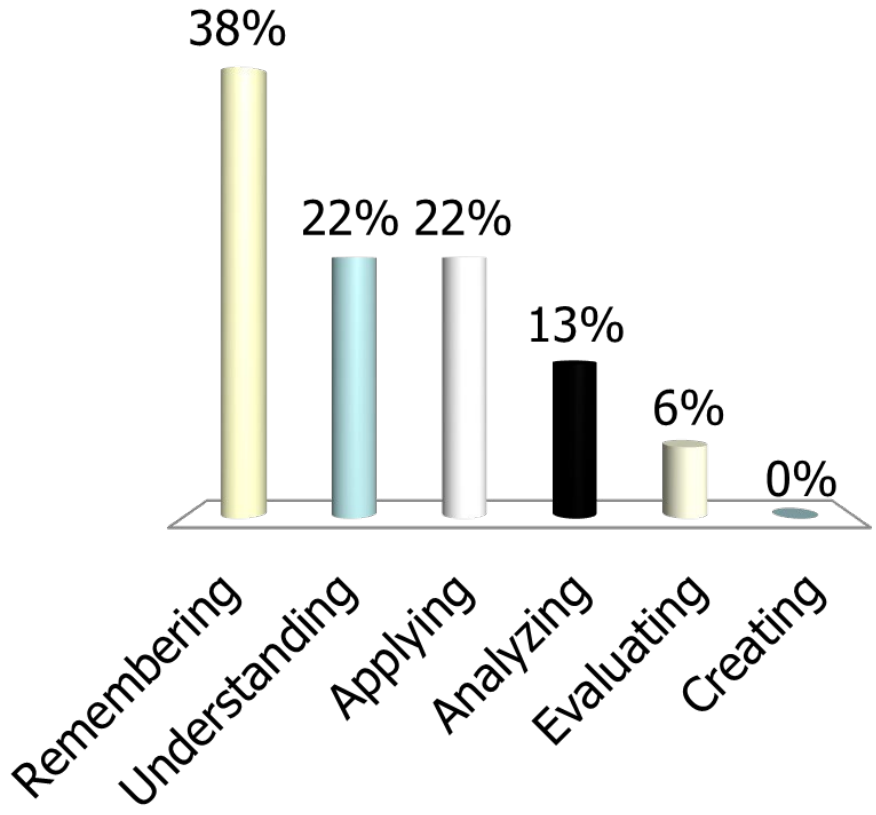


How students answered (2017)

At what level of Bloom's did you have to operate to make A's and B's in high school?

1. Remembering
2. Understanding
3. Applying
4. Analyzing
5. Evaluating
6. Creating



How students answered (in 2017)

At what level of Bloom's do you think you'll need to operate to make A's in college?

1. Remembering
2. Understanding
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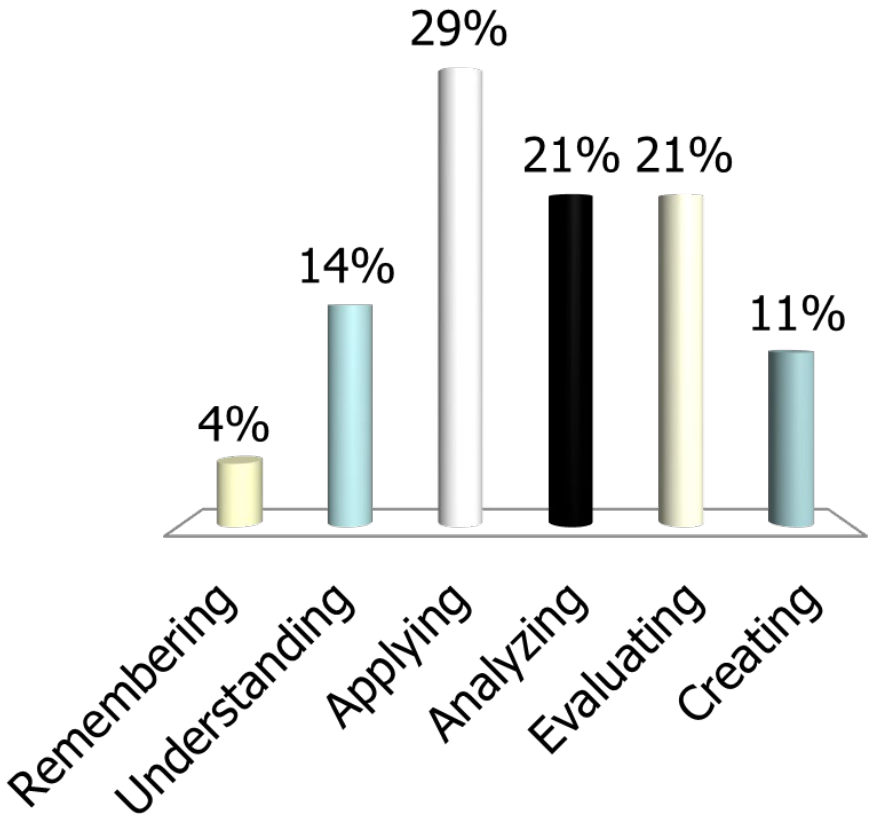

How students answered (in 2018)

At what level of Bloom's do you think you'll need to operate to make A's and B's in high school?

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2. Understanding
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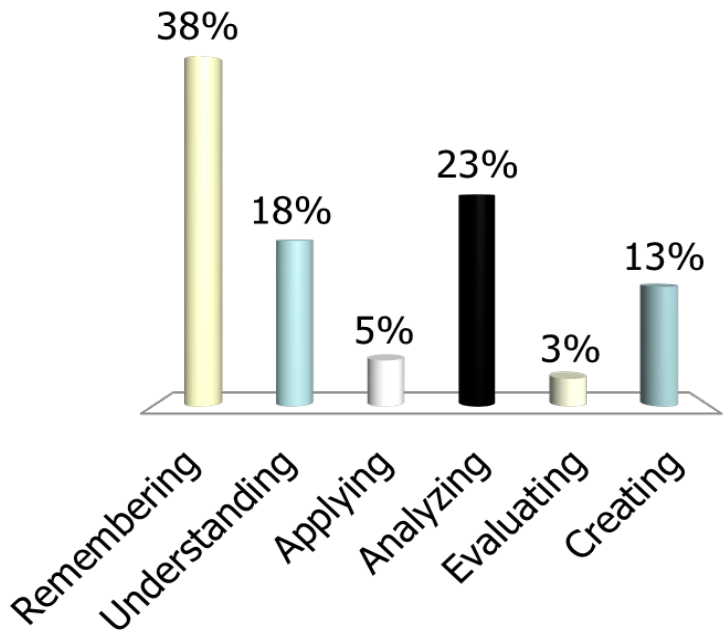

How students answered (in 2018)

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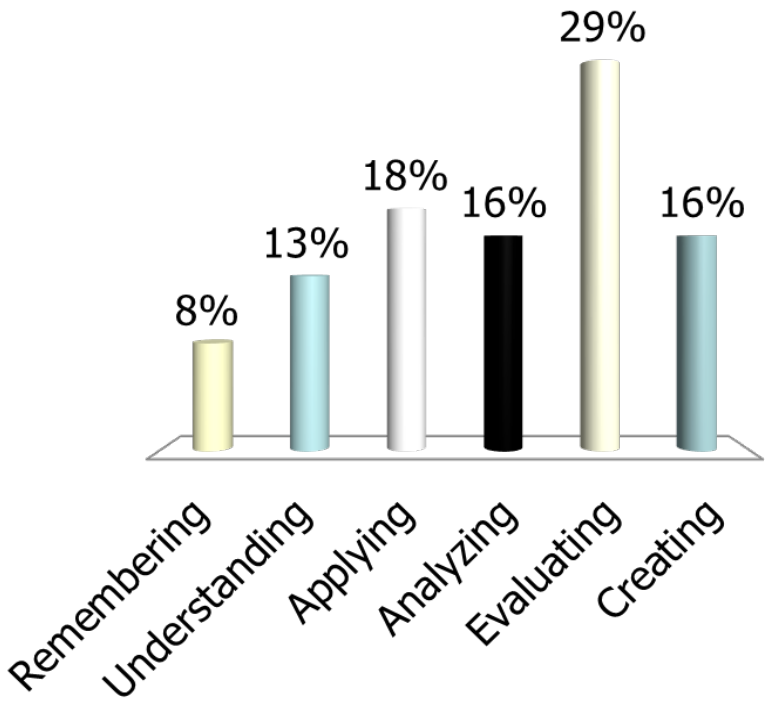
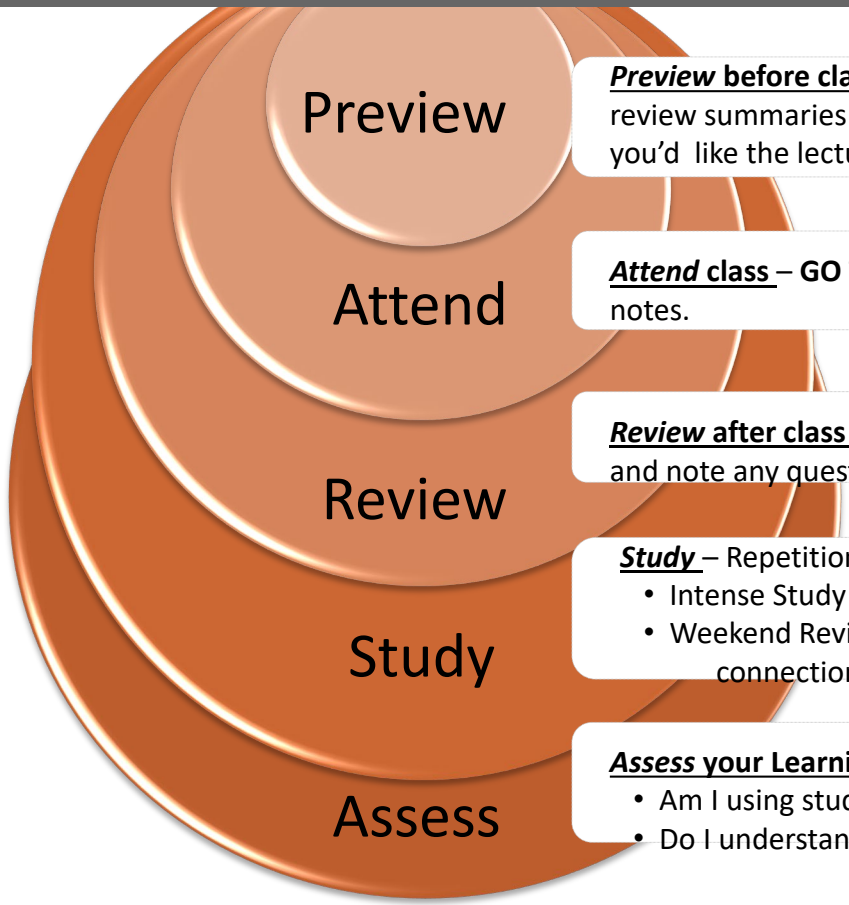


How do we teach students to move *higher* on Bloom's Taxonomy?

Teach them the Study Cycle*

adapted from Frank Christ's PLRS system

The Study Cycle



***Preview* before class** – Skim the chapter, note headings and boldface words, review summaries and chapter objectives, and come up with questions you'd like the lecture to answer for you.

***Attend* class** – **GO TO CLASS!** Answer and ask questions and take meaningful notes.

***Review* after class** – As soon after class as possible, read notes, fill in gaps and note any questions.

Study – Repetition is the key. Ask questions such as 'why', 'how', and 'what if'.

- Intense Study Sessions* - 3-5 short study sessions per day
- Weekend Review – Read notes and material from the week to make connections

***Assess* your Learning** – Periodically perform reality checks

- Am I using study methods that are effective?
- Do I understand the material enough to teach it to others?

*Intense Study Sessions

1	**Set a Goal**	(1-2 min)	**Decide what you want to accomplish in your study session**
2	**Study with Focus**	(30-50 min)	**Interact with material**- organize, concept map, summarize, process, re-read, fill-in notes, reflect, etc.
3	**Reward Yourself**	(10-15 min)	**Take a break**– call a friend, play a short game, get a snack
4	**Review**	(5 min)	**Go over what you just studied**

What happens when we **teach metacognitive learning strategies**, Bloom's Taxonomy, and the Study Cycle **to an entire class**, not just individuals?

Performance in Gen Chem I in 2011 Based on One Learning Strategies Session*

	Attended	Absent
Exam 1 Avg:	71.65%	70.45%
Exam 2 Avg:	77.18%	68.90%
Final course Avg*:	81.60%	70.43%
Final Course Grade:	**B**	**C**

The one 50-min presentation on study and learning strategies was followed by an improvement of one full letter grade

***Cook, E.; Kennedy, E.; McGuire, S. Y. *J. Chem. Educ.*, 2013, 90 (8), 961–967**

Performance in Gen Chem 1202 Sp 2013 Based on One Learning Strategies Session

	Attended	Absent
Exam 1 Avg:	71.33%	69.27%
Homework Total:	169.8	119.1
Final course Avg*:	82.36%	67.71%
Final Course Grade:	**B**	**D**

The 50-min presentation on study and learning strategies was followed by an improvement of two letter grades

Performance in Gen Chem 1202 Sp 2015 Based on One Learning Strategies Session

	Attended	Absent
Exam 1, 2, 3 Avg:	68.14%	69.67%
Exam 4 Avg:	83.45%	75.91%
Final Exam Avg:	80.98%	75.24%
Final course Avg*:	84.90%	78.83%
Final Course Grade:	**B**	**C**

The 50-min presentation on study and learning strategies *after exam 3* was followed by an improvement of one letter grade

LSU Analytical Chemistry Graduate Student's Cumulative Exam Record

2004 – 2005	
9/04	Failed
10/04	Failed
11/04	Failed
12/04	Failed
1/05	Passed
2/05	Failed
3/05	Failed
4/05	Failed

Began work with CAS and the Writing Center in October 2005

2005 – 2006	
10/05	Passed
11/05	Failed
12/05	Passed best in group
1/06	Passed
2/06	Passed
3/06	Failed
4/06	Passed last one!
5/06	N/A

Dr. Algernon Kelley, December 2009

From a Xavier University student to Dr. Kelley in Fall 2011

Oct. 17, 2011

Hello Dr. Kelley. **… I am struggling at Xavier and I REALLY want to succeed, but everything I've tried seems to end with a "decent" grade. I'm not the type of person that settles for decent. What you preached during the time you were in Dr. Privett's class last week is still ringing in my head. I really want to know how you were able to do really well even despite your circumstances growing up. I was hoping you could mentor me and guide me down the path that will help me realize my true potential while here at Xavier. Honestly I want to do what you did, but I seriously can't find a way how to. Can I please set up a meeting with you as soon as you're available so I can learn how to get a handle grades and classes?**

Oct. 24, 2011

Hey Dr. Kelley, **I made an 84 on my chemistry exam (compared to the 56 on my first one) using your method for 2 days (without prior intense studying). Thanks for pointing me in the right direction. I'll come by your office Friday and talk to you about the test.**

Nov 3, 2011

Hey Dr. Kelley! **I have increased my Bio exam grade from a 76% to a 91.5% using your system. Ever since I started your study cycle program, my grades have significantly improved. I have honestly gained a sense of hope and confidence here at Xavier. My family and I are really grateful that you have taken time to get me back on track.**

Conclusion

We *can* significantly increase learning by

- teaching students *how* to learn
- making learning *visible*
- *not judging* student potential on initial performance
- encouraging students to *persist in the face of initial failure*
- encouraging the *use of metacognitive tools for deep and integrative learning*

Useful Websites

- www.lsu.edu/students/cas/
- www.howtostudy.org
- www.vark-learn.com
- www.drearlbloch.com

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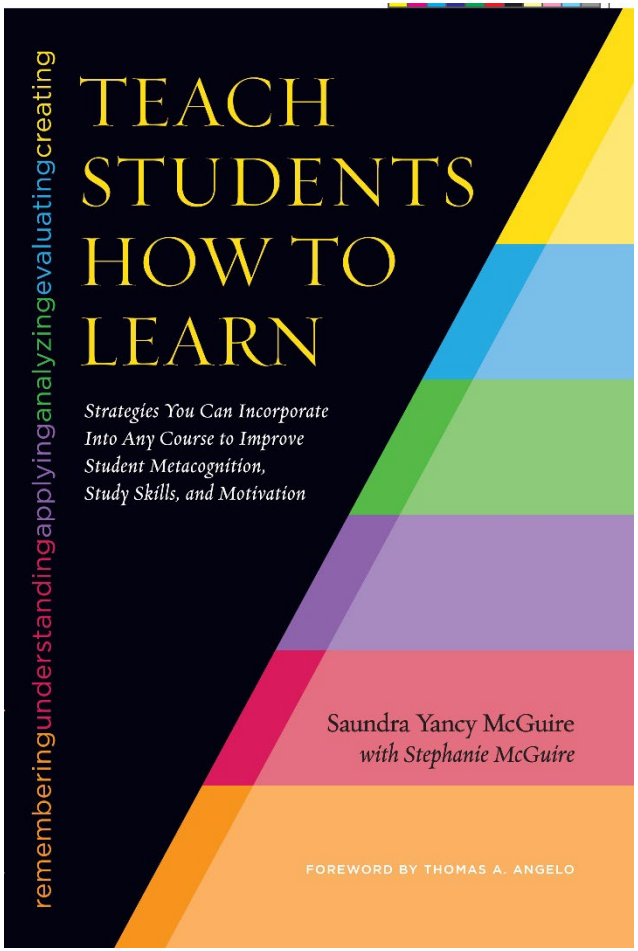
  http://academic.pg.cc.md.us/~wpeirce/MCCCTR/metacognition.htm

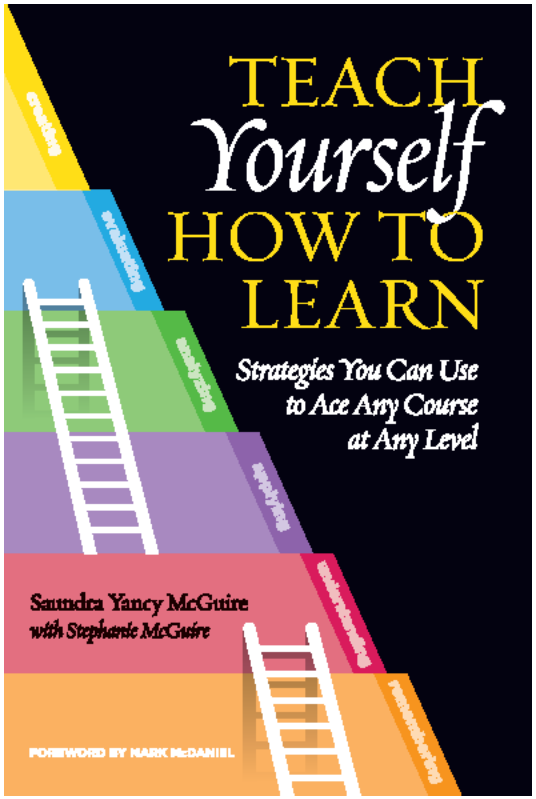
*Excellent student reference

A FacultyReference



***McGuire, S.Y. (2015). Teach Students How to Learn: Strategies You Can Incorporate into Any Course to Improve Student Metacognition, Study Skills, and Motivation*. Sterling, VA: Stylus**

A Book for Students



McGuire, S.Y. (2018). Teach Yourself How to Learn: Strategies You Can Use to Ace Any Course at Any Level. Sterling, VA: Stylus