Teach Students *How* to Learn:
A Small Change that Can Make A Big Impact!

Saundra Yancy McGuire, Ph.D.
Retired Asst. Vice Chancellor & Professor of Chemistry
Director Emerita, Center for Academic Success
Louisiana State University

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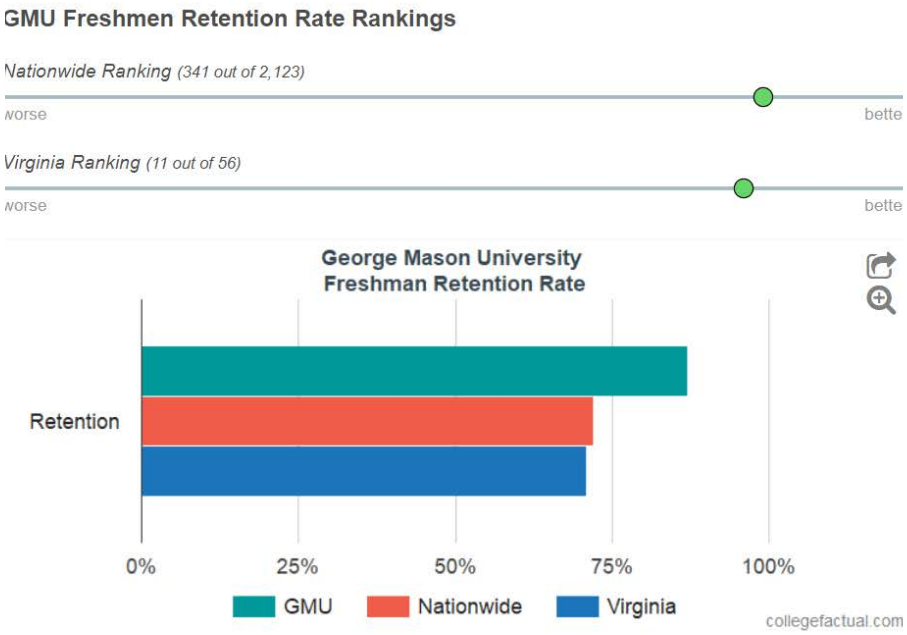
CELEBRATING 2008 10 2018 YEARS ANNIVERSARY

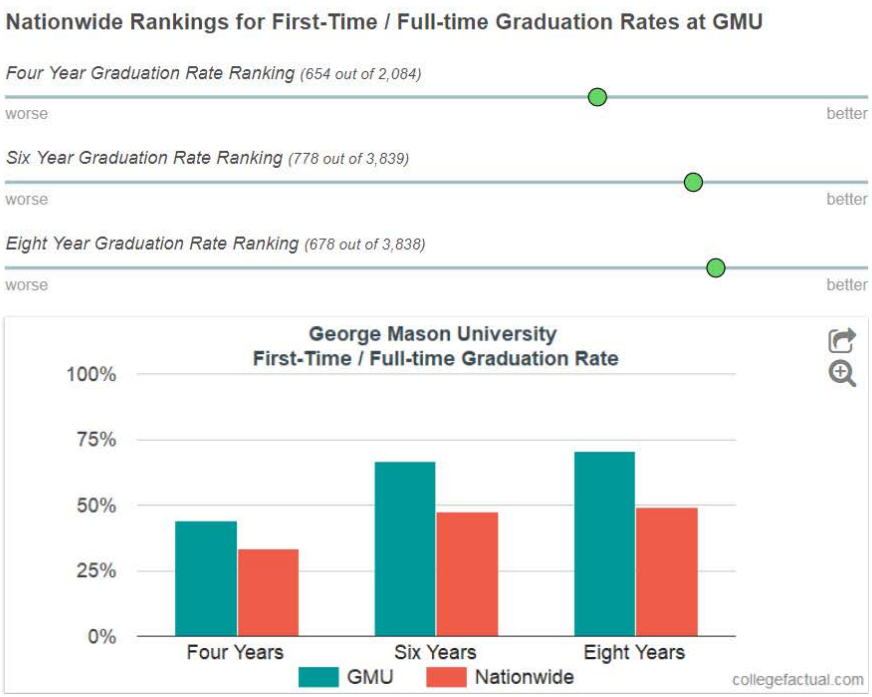
INNOVATIONS in Teaching & Learning

10th Annual Conference Theme:
"Small Changes, Big Impact: 10 Years of ITL"

George Mason University
Retention and Graduation Rates



GMU Retention Rate is **87.0%!**
National Average is 72.0%
Virginia Average is 71.0%



GMU Six-Year Graduation Rate is 69.4%
National Average is 47.6%

Expected GMU Grad Rate is 70.4%

www.collegefactual.com/colleges/george-mason-university/academic-life/graduation-and-retention

How Can GMU Improve These Rates?

- Teach Students Metacognitive Learning Strategies
- Help Students Develop the Right Mindset
- Motivate Students to Implement Effective Metacognitive Learning Strategies

Metacognition: The Key to Teaching Students How to Learn

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

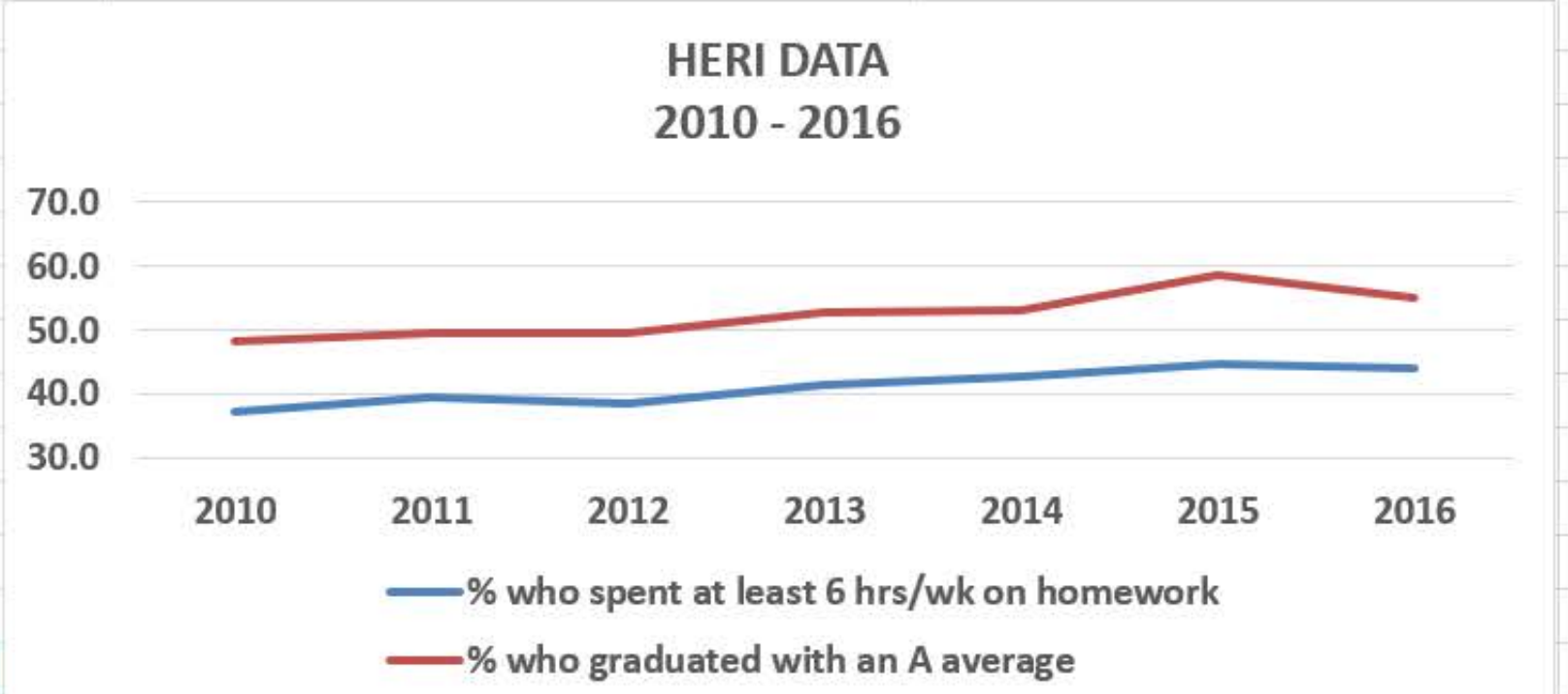
Flavell, J. H. (1976). Metacognitive aspects of problem solving. In L. B. Resnick (Ed.), The nature of intelligence (pp.231-236). Hillsdale, NJ: Erlbaum

Why haven't many students *already* developed these skills?

It wasn't necessary

Data from UCLA Higher Education Research Institute (HERI)
First Year Student Survey – 2010 - 2016

	% who spent at least 6 hrs/wk on homework	% who graduated 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



http://www.heri.ucla.edu

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***

Power of Metacognitive Learning Strategies

Sydnie's Story: Intro and emails

- First encounter on September 23, 2013
- Email on October 14, 2013
- Email on January 9, 2014
- Email on January 20, 2014
- Email on May 7, 2014
- Update on July 26, 2016 Cum GPA 3.5
- Email on February 7, 2017 Cum GPA 3.6

Fall Sem GPA 4.18

Sydnie Landry, BS in Biology, May 2017

Louisiana State University

Final Semester GPA: 3.77

Currently Applying to Medical School

Intended Specialty: Dermatology

Teaching an Effective Homework Strategy

A Small Change that Makes a Big Impact

- **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**

Impact of Using Homework Strategy

Sydnie L.

First Year Biology Pre-Med Honors College Student

Email on January 20, 2014

I started to use the "Get more out of your homework" method. **I reviewed my notes right before attempting my homework problems, and tried to work the problems *without help from the solutions manual or tutors*. If I still could not get the right answer, I'd look at my notes again to get a hint, but *not to study the problem and mimic it step by step*…**

Asking Reflection Questions
A Small Change that Makes a Big Impact

- 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

Power of Teaching to Master Learning

Clint's Story: Baby Groot and the Licensure Exam

Guardians of the Galaxy

- First encounter on October 29, 2015 at EKU
- Email on January 18, 2016
- Msg on April 14, 2016
- Msg on June 11, 2016

https://www.youtube.com/watch?v=BEPbXYzE5_Y

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

Teaching the SQ5R Reading Strategy

A Small Change that Makes a Big Impact

- **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)

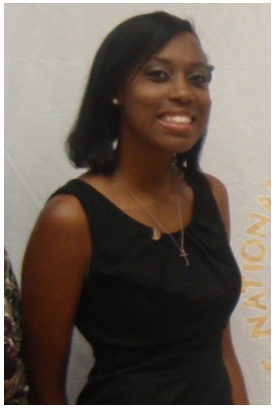
First Voyage of Christopher Columbus

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

Dana Lewis, MS in Medical Physics, 2015

Univ of Texas Graduate School

of Biomedical Sciences at Houston

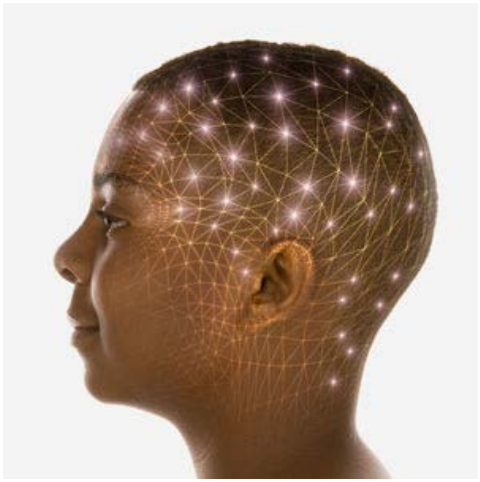
Thesis research at UT MD Anderson Cancer Center

Practicing Medical Physicist as of 8/28/2016

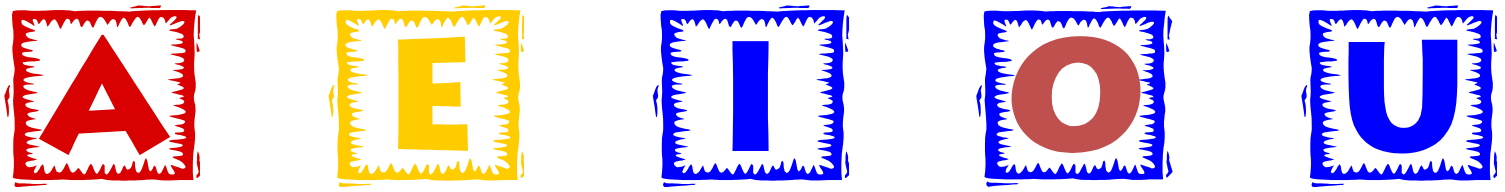
when she completed her residency!

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

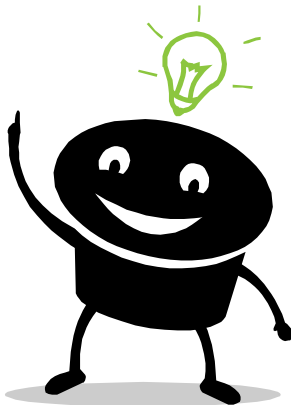
Cat Lives
Bowling Pins
Football Team
Dozen Eggs
Unlucky Friday
Valentine’s Day
Quarter Hour

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

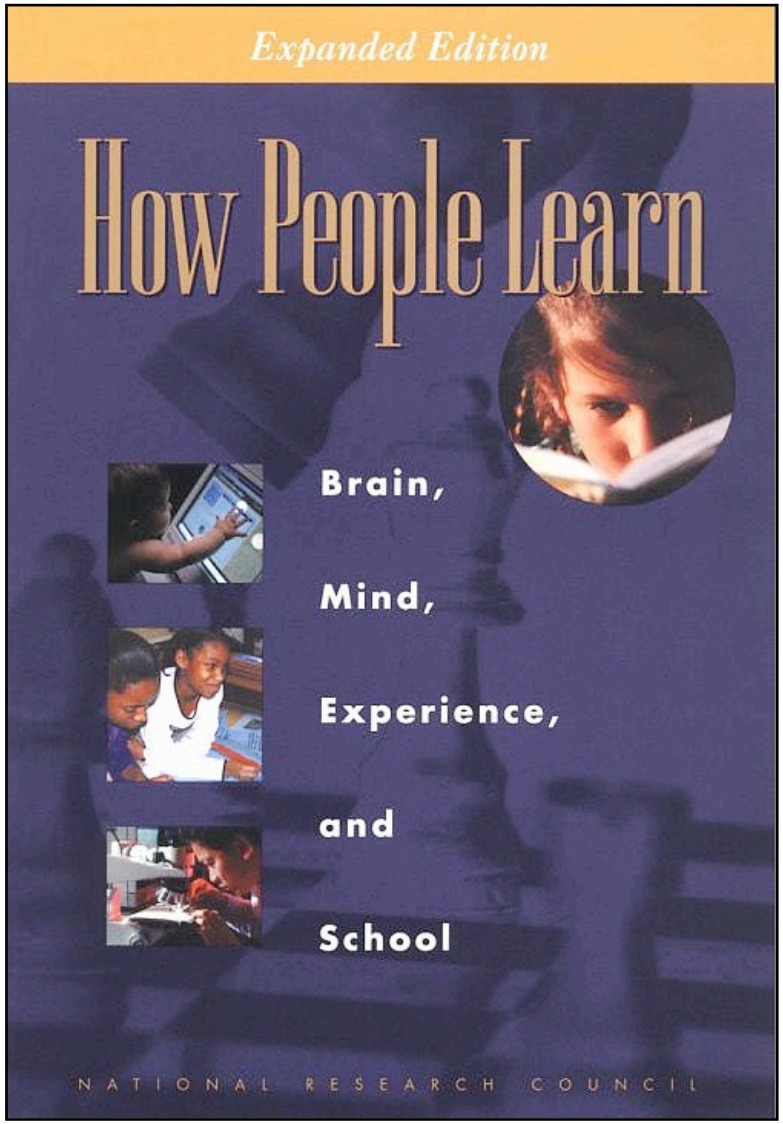
2. We knew how the information was organized



Two Small Changes
That Make a Big Impact

1. Make Sure Students Know the Goal

2. Help Students Discover the Structure



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***

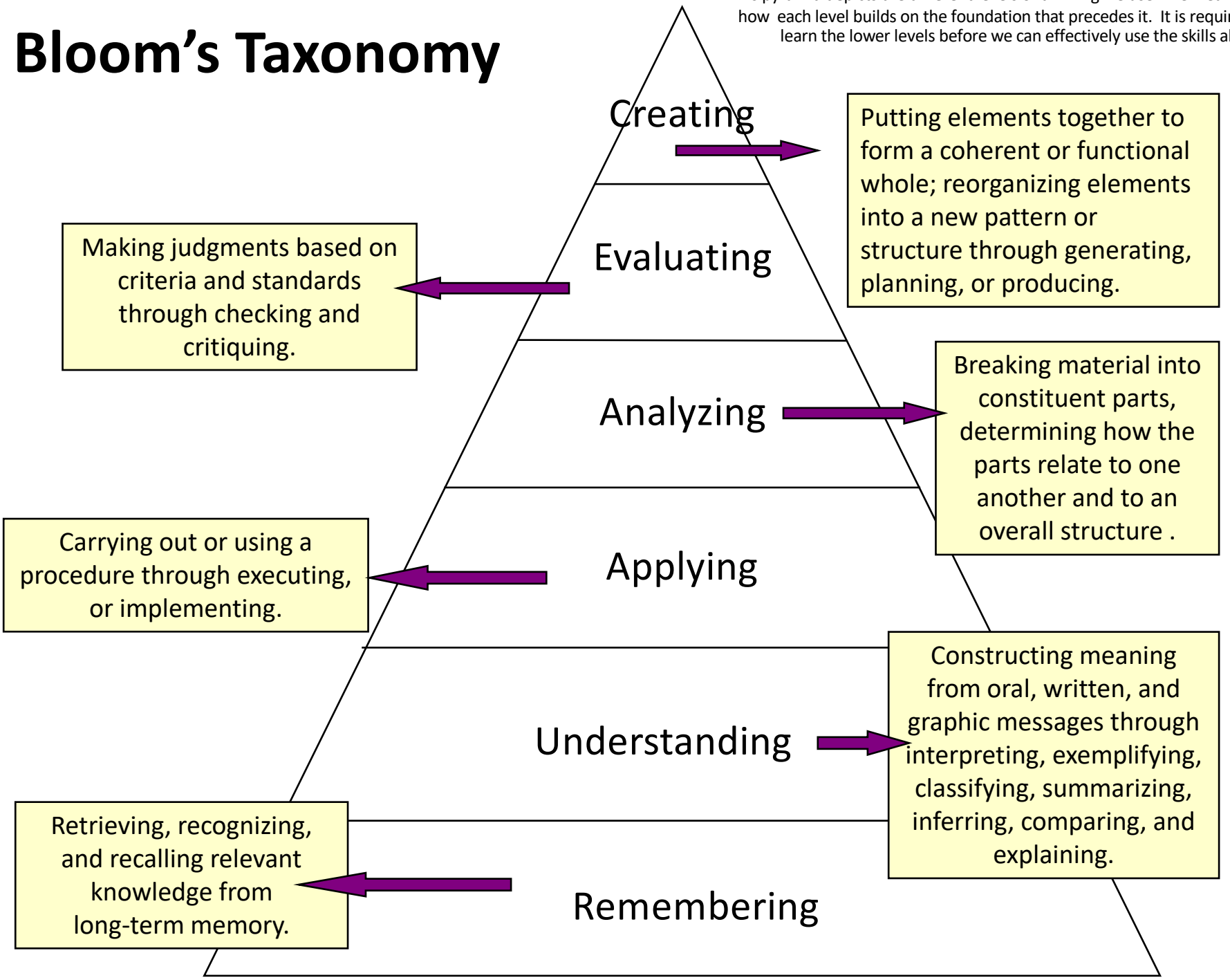
*Cross, Patricia, "Opening Windows on Learning" League for Innovation in the Community College, June 1998, p. 21.

** 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?

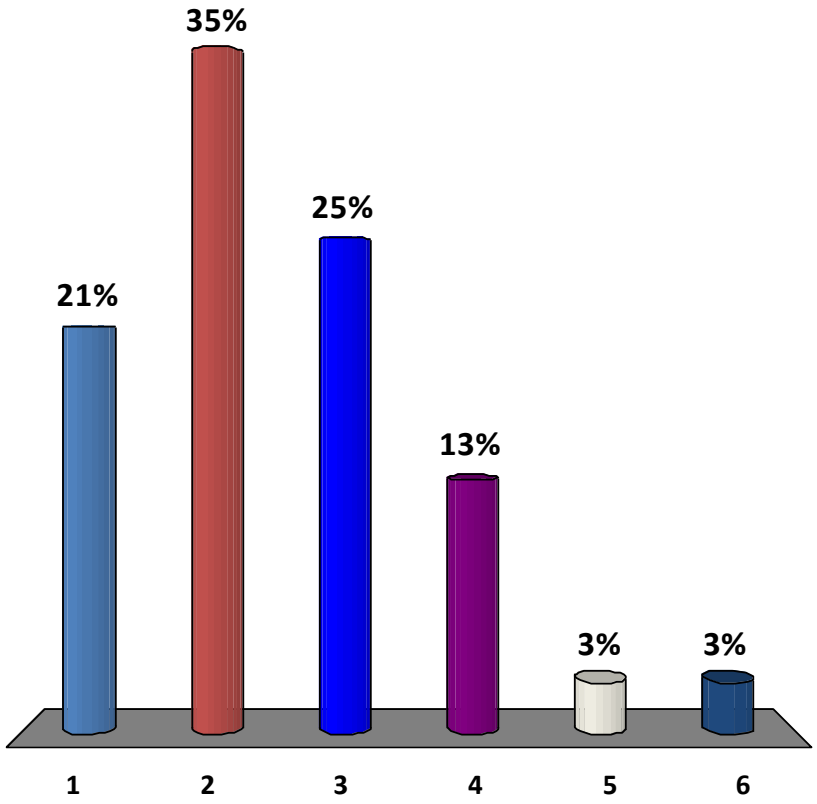
At what level of Bloom's do you think you'll need to operate to make A's in college courses?

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

How students answered (2008)

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

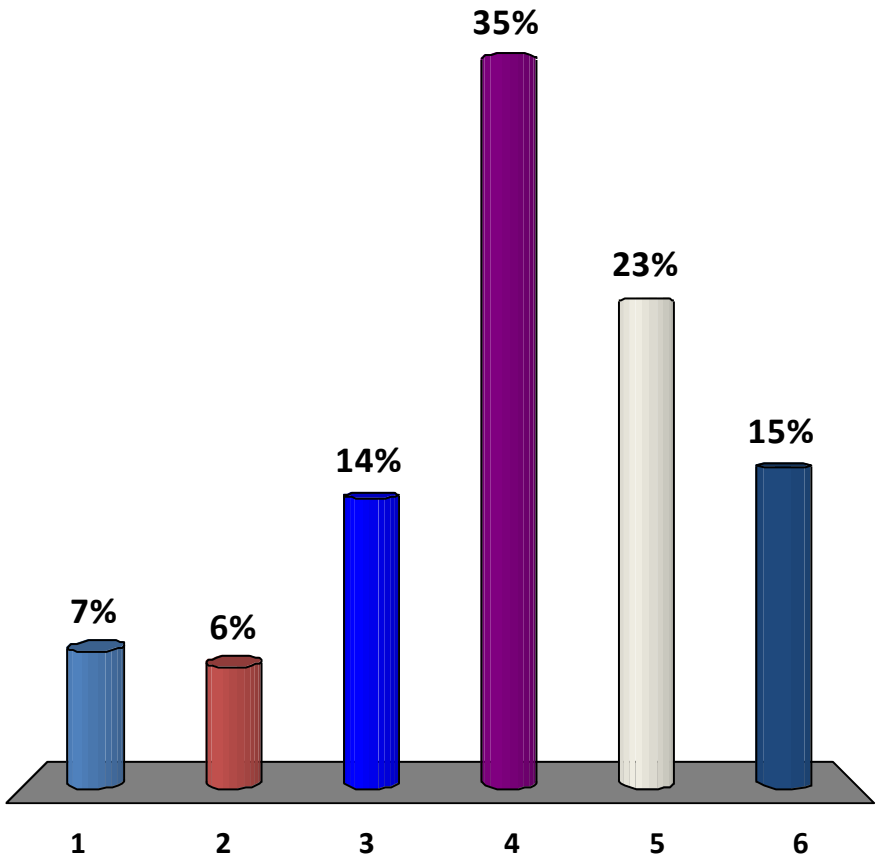
1. Remembering
2. Understanding
3. Applying
4. Analyzing
5. Evaluating
6. Creating



How students answered (in 2008)

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

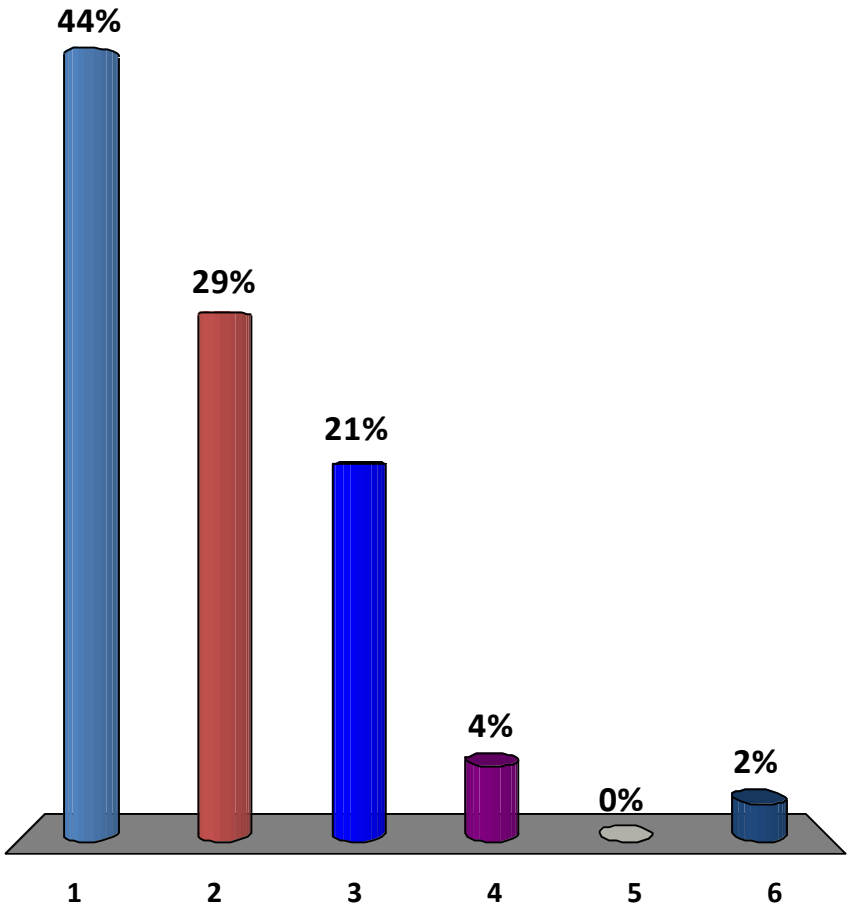
1. Remembering
2. Understanding
3. Applying
4. Analyzing
5. Evaluating
6. Creating



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
3. Applying
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?

1. Remembering
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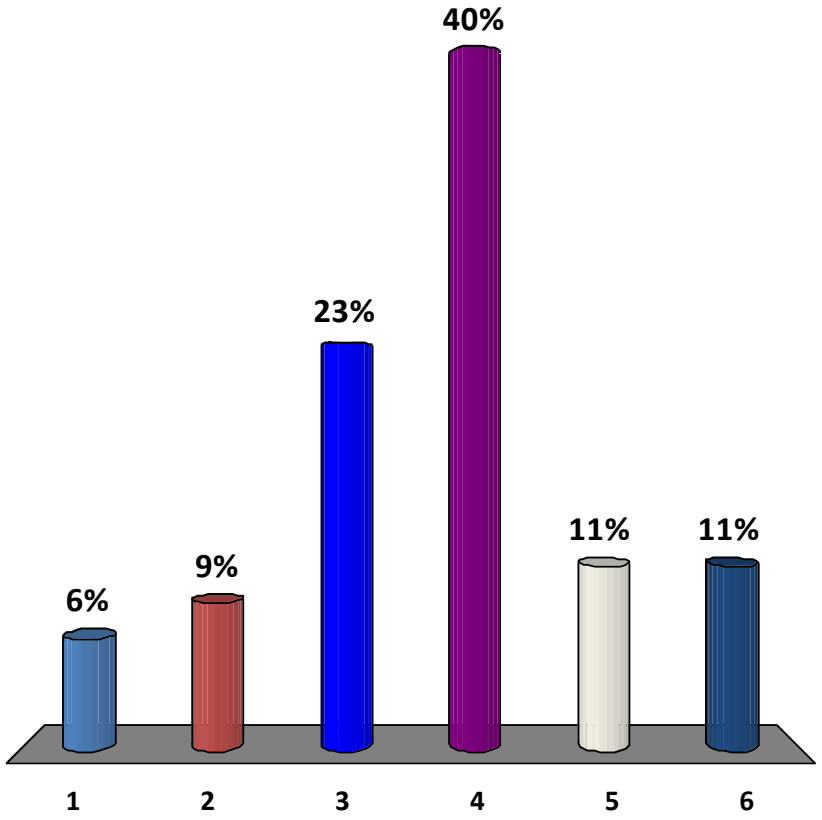
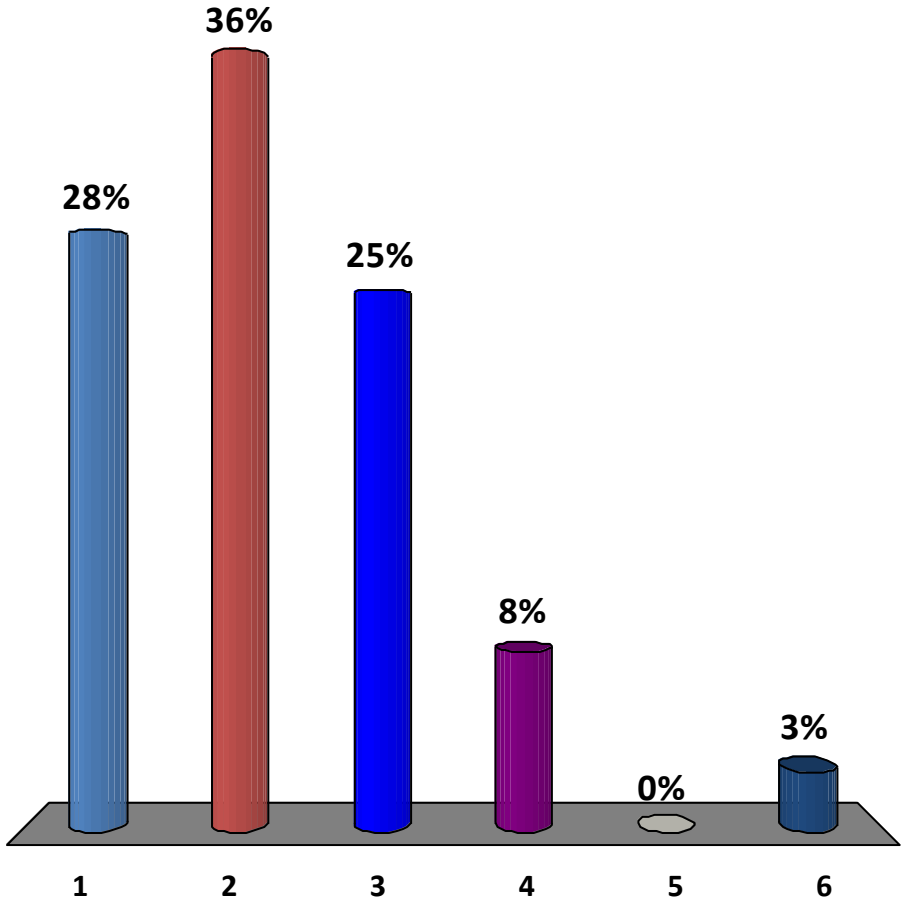


How students answered (2014)

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 2014)

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

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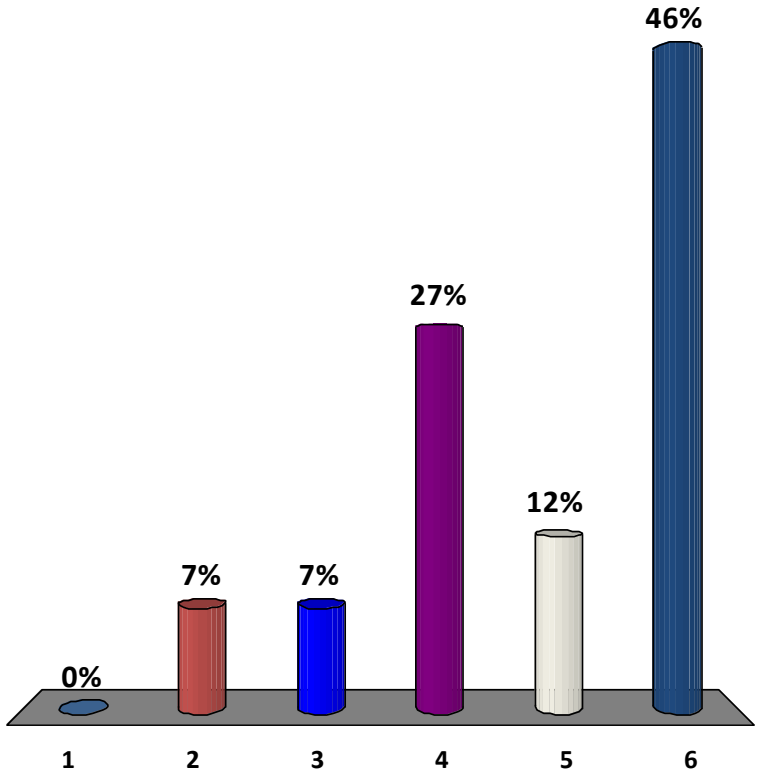
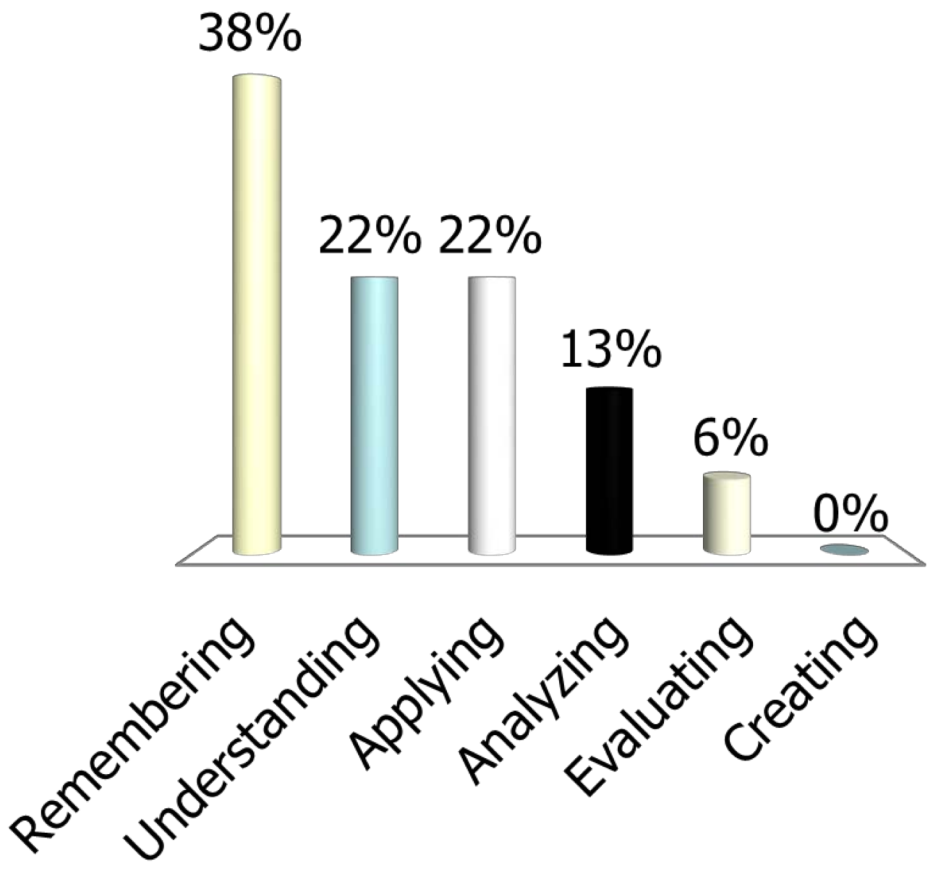


How students answered (2017)

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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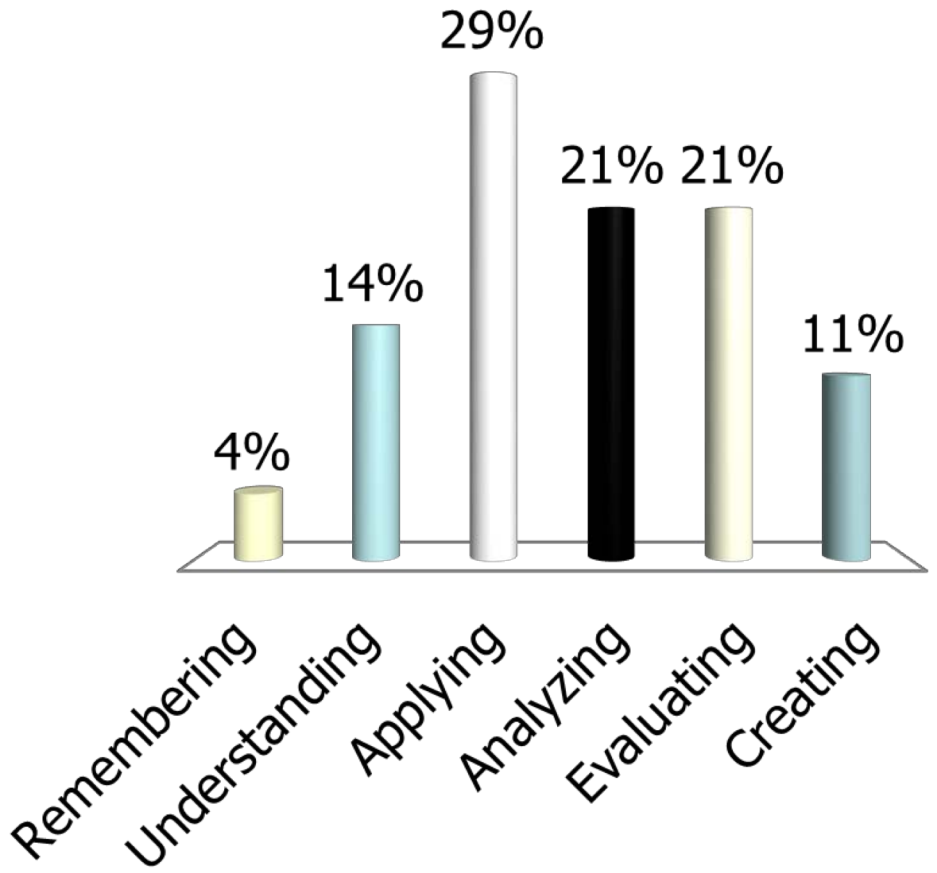

How students answered (in 2018)

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

1. Remembering
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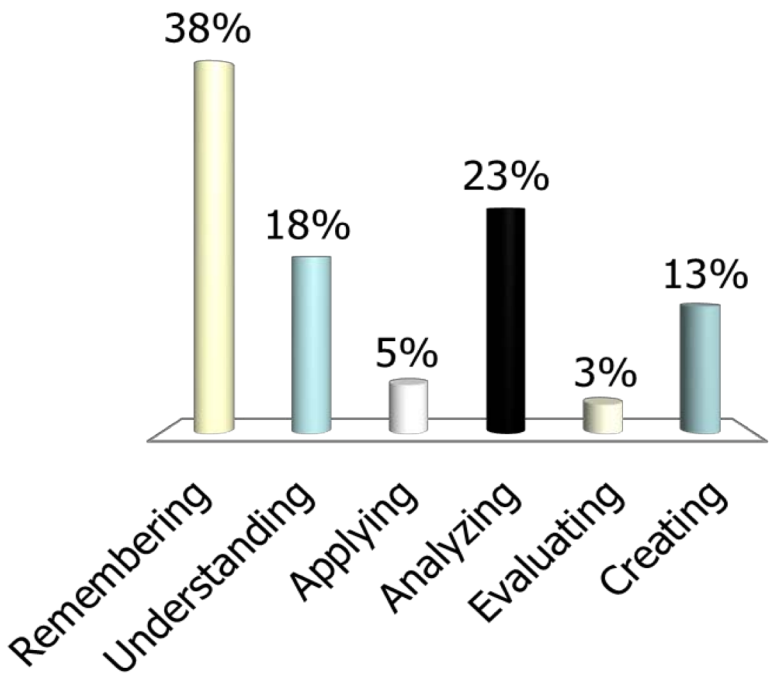
5. Evaluating
6. Creating



How students answered (in 2018)

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

1. Remembering
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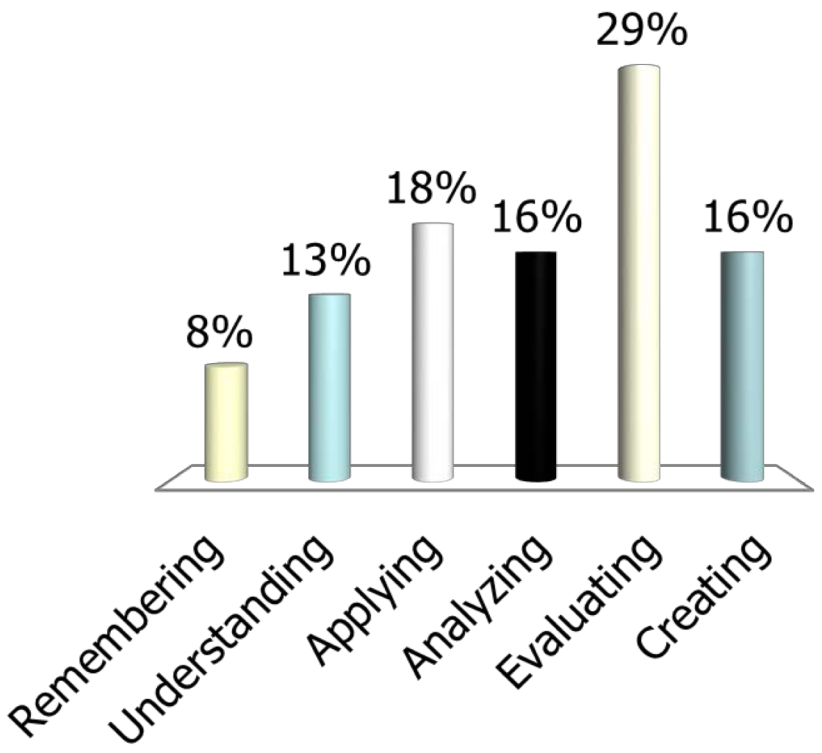


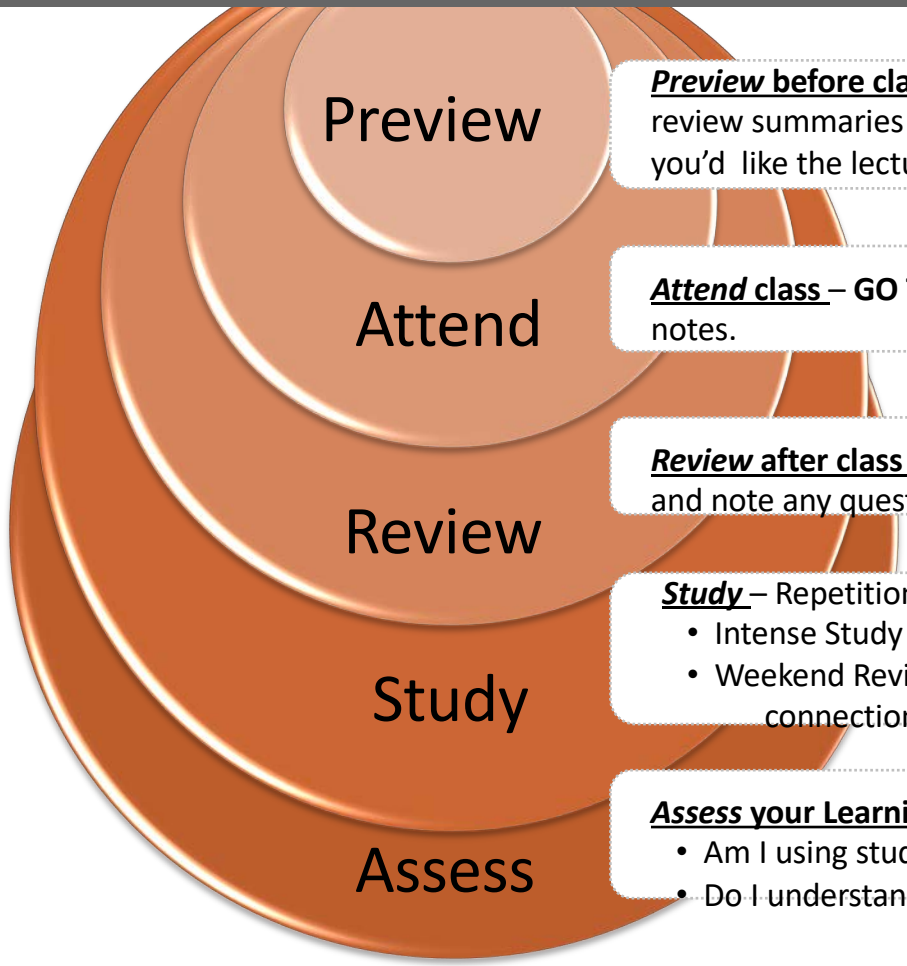
How do we teach students to move *higher* on Bloom's Taxonomy?

Teach them the Study Cycle*

A Small Change That Makes a HUGE Impact

**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**

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Brea Manuel, BS in Chemistry, 2018
Entered PhD Program at
Emory University on Full Fellowship in Fall 2018

The intense study sessions helped me most. I actually got A+ on 3 out of 4 of my finals using that method of studying. It's important to use it everyday before finals week, and I think it would really benefit students during finals week.

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

A Small Change that Made a Big Impact

***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

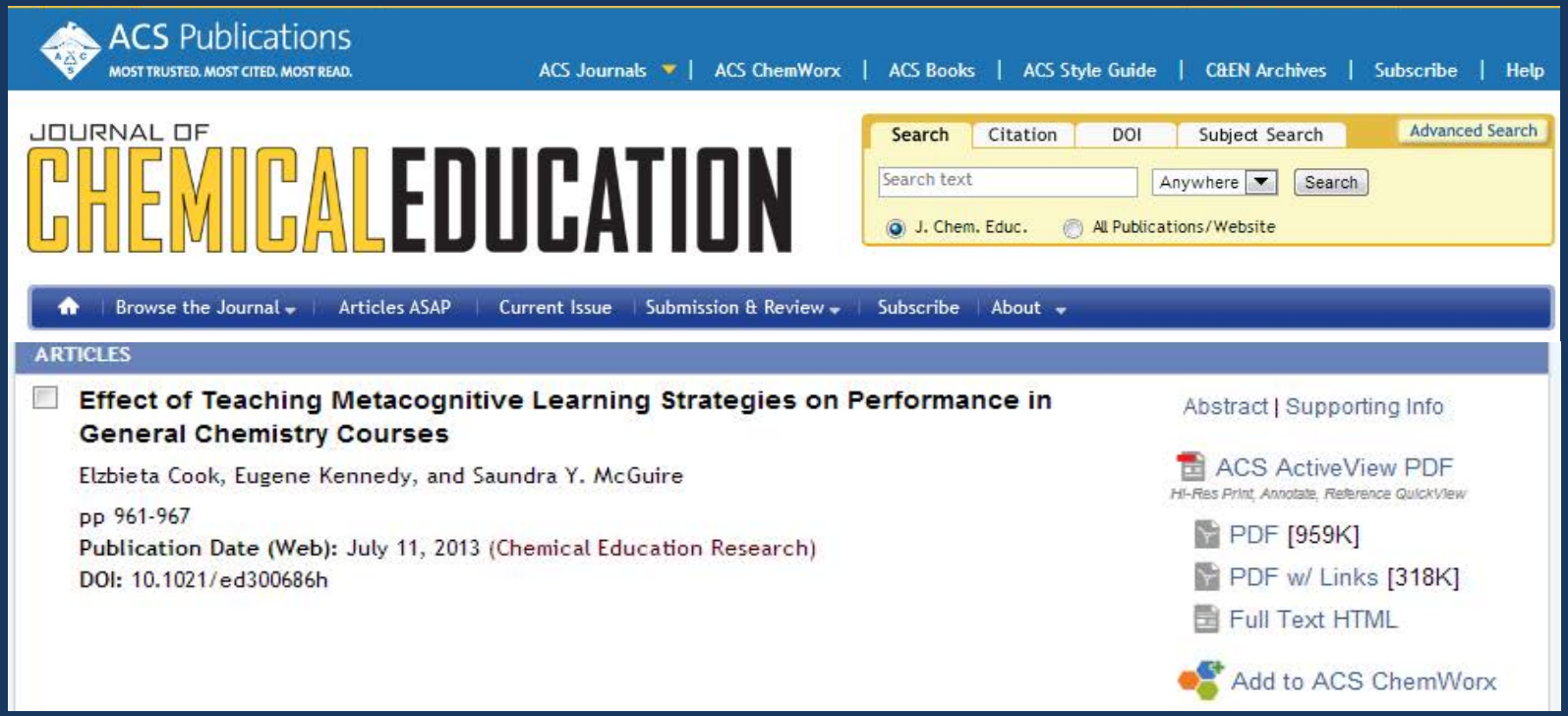
	Attended	Absent
Exam 1 Avg:	71.33%	69.27%
Homework Total:	169.8	119.1
Final course Avg*:	82.36%	67.71%
Final Course Grade:	**B**	**D**

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



Journal of College Science Teaching

Metacognition: An Effective Tool to Promote Success in College Science Learning*

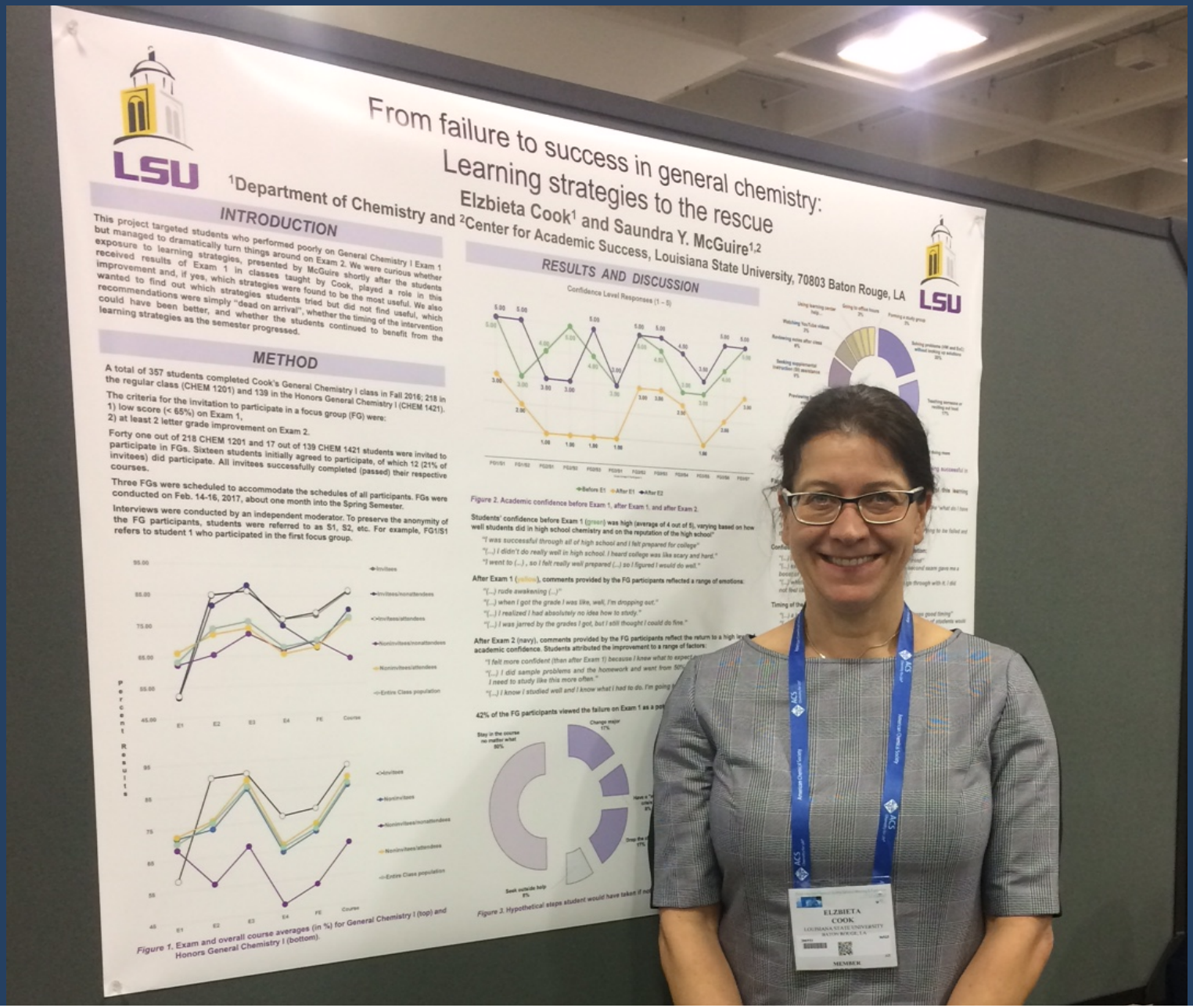
Ningfeng Zhao[1], Jeffrey Wardeska[1], Saundra McGuire[2], Elzbieta Cook[2]

[1]Department of Chemistry, East Tennessee State University

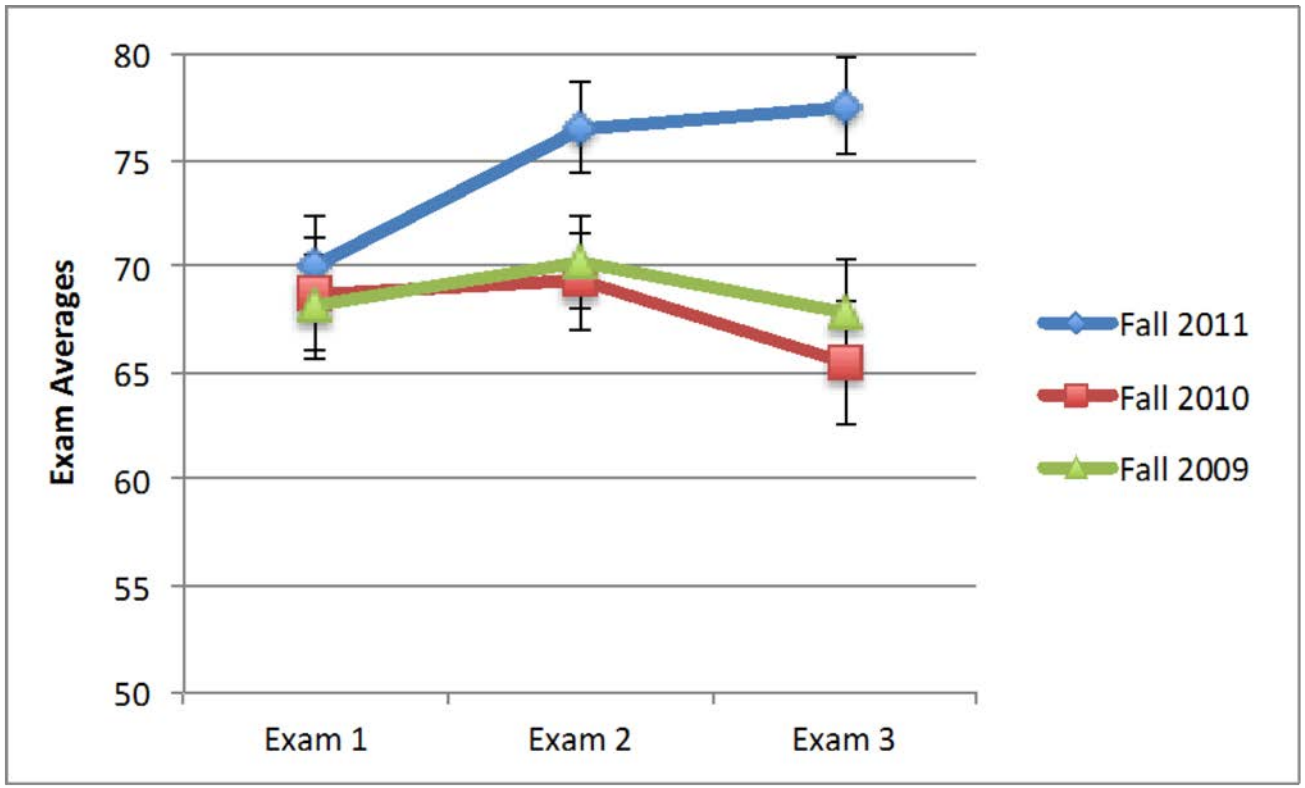
[2]Department of Chemistry, Louisiana State University

*March/April 2014 issue of JCST, Vol. 43, No. 4, pages 48-54

Dr. Elzbieta Cook
My General Chemistry Collaborator



Professor Ningfeng Zhao's Exam Averages



Intervention:
One fifty minute learning strategies session after Exam 1

Zhao, N., Wardeska, J. G., McGuire, S. Y., & Cook, E. (2014). Metacognition: An effective tool to promote success in college science learning. *Journal of College Science Teaching, 43*(4), 48–54.

Professor Nina Stein's Exam Averages in Organic Chemistry

EXAM	AVERAGE	AVERAGE	AVERAGE*
	Fall 2012	Fall 2013	Fall 2014
1	69.25	70.06	77.42
2	79.40	73.33	86.17
3	70.35	73.38	85.12
final	**66.00**	**63.06**	**82.17**
			***The semester I did the study skills workshop**

Intervention: One twenty minute learning strategies session ***after*** Exam 1

Nina Stein, University of Connecticut, personal communication, April 4, 2015

Three Common Demands from Students in Large Lecture Classes*

- **Provide Presentation Slides Before Lecture**
  - *Helps with notetaking and cuing prior knowledge*
- **Make Practice Tests Available**
  - *Helps students "train their brains to make the kinds of mental maneuvers we expect of them*
  - *Helps with notetaking and cuing prior knowledge*
  - *Having them write a question engages them in higher order thinking and promotes their metacognitive abilities*
- **Implement More Active Learning or More Teaching**
  - *Research supports the value of active learning, but some students don't like it. Explaining its value helps.*

Hodges, Linda C, *National Teaching and Learning Forum*, Volume 25, Number 5, September 2016, as reprinted in February 26, 2017 "Tomorrow's Professor℠ eNewsletter, sponsored by the Stanford Center for Teaching and Learning and provided by Rick Reis.

Email from a Professor Who Made Small Changes

After the ND-Gateway workshop this August, I have shared Dr. McGuire's presentation with several of my colleagues and students in the ABEN department.

One ABEN student was struggling on his classes. I asked how he studied, and found he didn't have a good study habit. I shared the PPT with him on August 21, 2018, and also emphasized the contents in slide 32 (Bloom's Taxonomy) and slide 45 (Study Cycle). He wrote me an email today (September 7, 2018) and said:

"I actually am applying myself and changed my study and planning habits and it seems to be paying off already. I scored 114% on the first and only graded homework assignment so far and took the first exam on Wednesday and got 100%."

I also applied the suggestion in Slide 14 to my class, and invited students to co-teach some lectures with me. They did a fantastic job by adding much more contents and real world experience to the class. This is truly a wonderful experience for me because I saw students poured their passion and talent into the lecture.

Please extend my appreciation to Dr. McGuire.

Thanks,

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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

Demonstrating the Impact of Small Changes

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 impact student learning by making small changes

- teach students *how* to learn
- make learning *visible*
- *Can't judge* student potential on initial performance
- encourage students to *persist in the face of initial failure*
- Encourage the *use of metacognitive tools for deep and integrative learning*

Final Reflection Questions

Who is ***primarily*** responsible for student learning?

a) the student
b) the instructor
c) the institution

Who do you think ***students*** say is ***primarily*** responsible for student learning?

a) the student
b) the instructor
c) the institution

The reality is that…

when ***all three*** of these entities take ***full responsibility*** for student learning,

we will experience an **increase** in academic capability, confidence, retention, and graduation rates!

Useful Websites

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

Acknowledgements

- Colleagues at LSU, especially the Center for Academic Success and the Department of Chemistry
- Dr. Elzbieta Cook
- Sarah Baird, former CAS learning strategist
- National College Learning Center Association (NCLCA)
- The many students who have proven to us that metacognitive strategies really do work!

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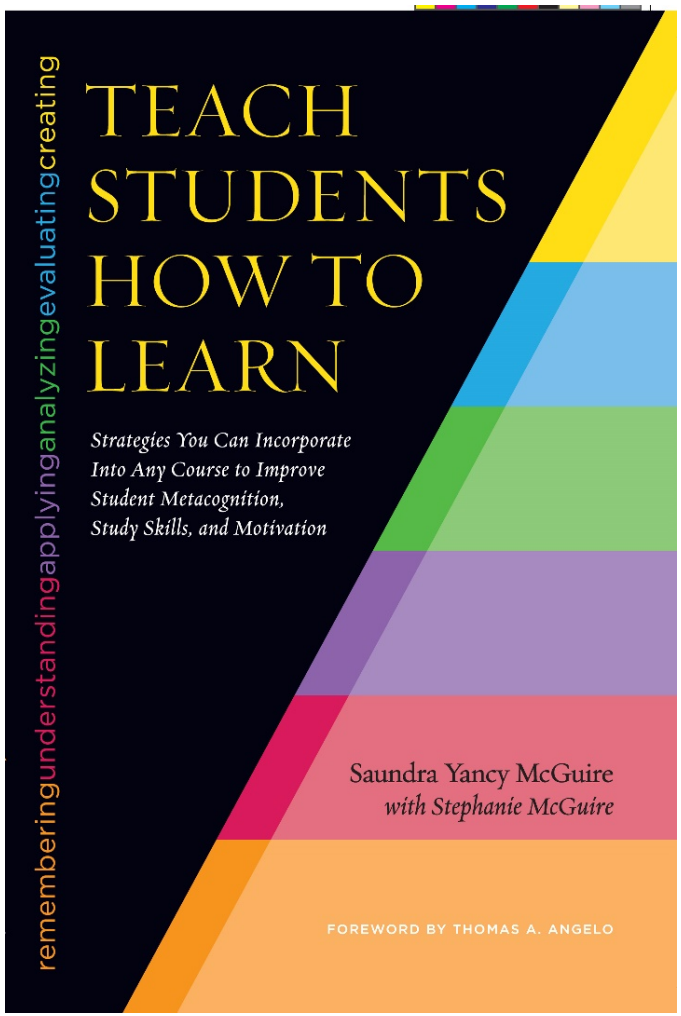
  http://academic.pg.cc.md.us/~wpeirce/MCCCTR/metacognition.htm

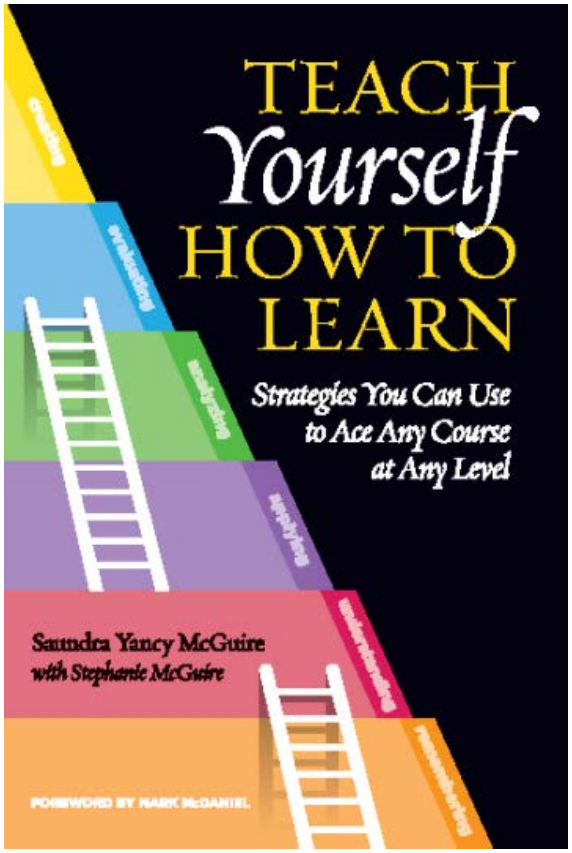
*Excellent student reference

A Recent Reference



***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**

Just out in January 2018
A Book for Students



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