

Teach Students *How* to Learn: Metacognition is the Key!



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



TRI-INSTITUTIONAL FACULTY FORUM

Metropolitan State University of Denver
Community College of Denver
University of Colorado Denver

The Tri-Institutional Faculty Forum is a cooperative effort of



The Teaching Learning Center at
Community College of Denver
Jennifer Fergusn, Director



The Center for Teaching, Learning and Design at
Metropolitan State University of Denver
Jeff Loats, Director



University of Colorado
Denver

The Center for Faculty Development at
University of Colorado Denver
Margaret Wood, Director

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 in high school

Data from UCLA Higher Education Research Institute (HERI) First Year Student Survey – 2010 - 2018

	% spending at least 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
2018	42.3	57.6

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?
-

Education

Can you skip 47 days of English class and still graduate from high school?



Albert Einstein High School in Kensington, Md. (Bonnie Jo Mount/The Washington Post)

By **Donna St. George** and **Justin Wm. Moyer**

May 25 at 6:35 PM

As graduation approached last year, the list of often-absent students at Albert Einstein High School in suburban Maryland was long. More than 175 seniors repeatedly missed classes, many in courses required for their diplomas.

How Do Students Feel About Active Learning?



[News & Views](#) [Careers](#) [Events](#) [Reports & Data](#)

INSIDE
HIGHER ED

[Admissions](#) [Digital Learning](#) [Fund-Raising](#) [Diversity](#)

Trending: [State Cuts](#) [Copyright Dispute](#)

[Subscribe Free](#) [Advertise](#) [Hire Faculty & Staff](#) [Find a Job](#)

'The Dangers of Fluent Lectures'

A study says smooth-talking professors can lull students into thinking they've learned more than they actually have -- potentially at the expense of active learning.

By [Colleen Flaherty](#) // September 9, 2019

57 COMMENTS



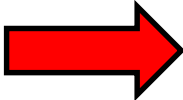
KRIS SNIBBE / HARVARD UNIVERSITY

Sean Finamore (left) and Xaviera Zime study during a lecture in the Science Center at Harvard University

Students who engage in active learning learn more -- but feel like they learn less -- than peers in more lecture-oriented classrooms. That's in part because active learning is harder than more passive learning, according to a new [study](#) in *Proceedings of the National Academy of Sciences*.

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

Sydney'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**

Sydney Landry, BS in Biology, May 2017

Louisiana State University

Final Semester GPA: 3.77



Applying to Medical School in Fall 2017

Intended Specialty: Dermatology

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

Impact of Using Homework Strategy

Sydney 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...*

Impact of Metacognitive Learning Strategies at a Two Year College

As described **Lynn Futral***, Psychology Professor,
Southern Crescent Technical, Griffin, GA
College

It just hit me that **since I have incorporated the presentation *Metacognition: success through understanding learning styles, learning strategies, and study skills*, these post-tests are remarkably showing that students are actually retaining this information.** When I compare the data from two years ago, I can clearly remember how distressed I was that students weren't retaining this information, but **the test scores I am receiving today?-- I am just blown away.**

*email received on 5/9/2015

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.”

Reflection Questions

- 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
-

Impact of Teaching The Material to His Betta Fish on Ty's Learning in Biology and Chemistry



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

Bio Exam Grades:	66, 98, 90	B in course
Chem Exam Grades:	62, 83	B in course

Impact of Teaching to Learn Ty, First Year LSU Student

Email Received on October 26, 2018

I attended more of the 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....**

Betta fish purchased on September 21, 2019 by Howard University Bison STEM Scholars

Sat, Sep 21, 12:34 PM



Look what you inspired!!

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

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

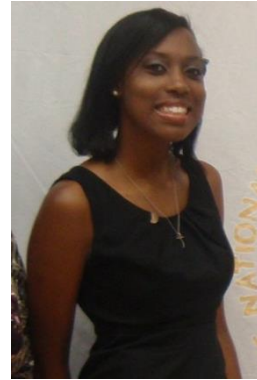
Dooling, J.D. and Lachman, R. Effects of Comprehension on Retention of Prose,
Journal of Experimental Psychology, (1971), Vol. 88, No. 2, 216-222

An Effective Reading Strategy: 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)

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

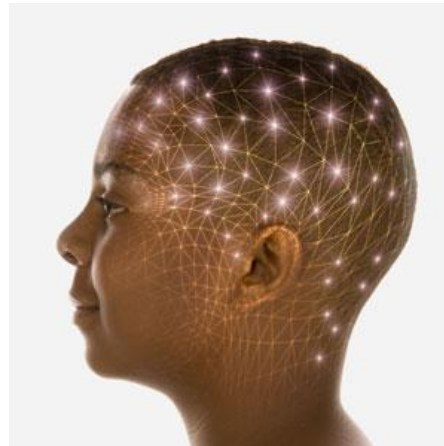
Dana Lewis, MS in Medical Physics, 2015
Univ of Texas Graduate School
of Biomedical Sciences at Houston
Thesis research at UT MD Anderson Cancer Center



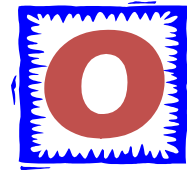
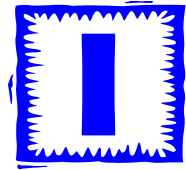
Practicing Medical Physicist as of 8/28/2016
when she completed her residency!

Why the Fast and Dramatic Increase?

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

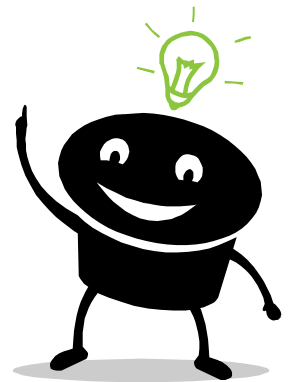
Valentine's Day

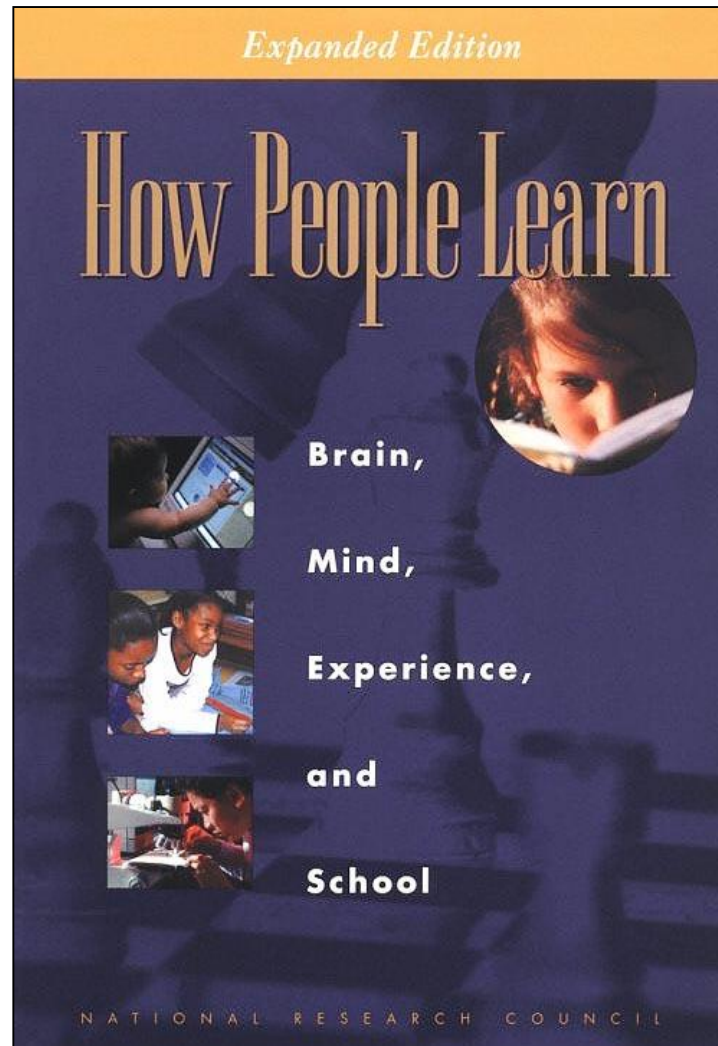
Quarter Hour

**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





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

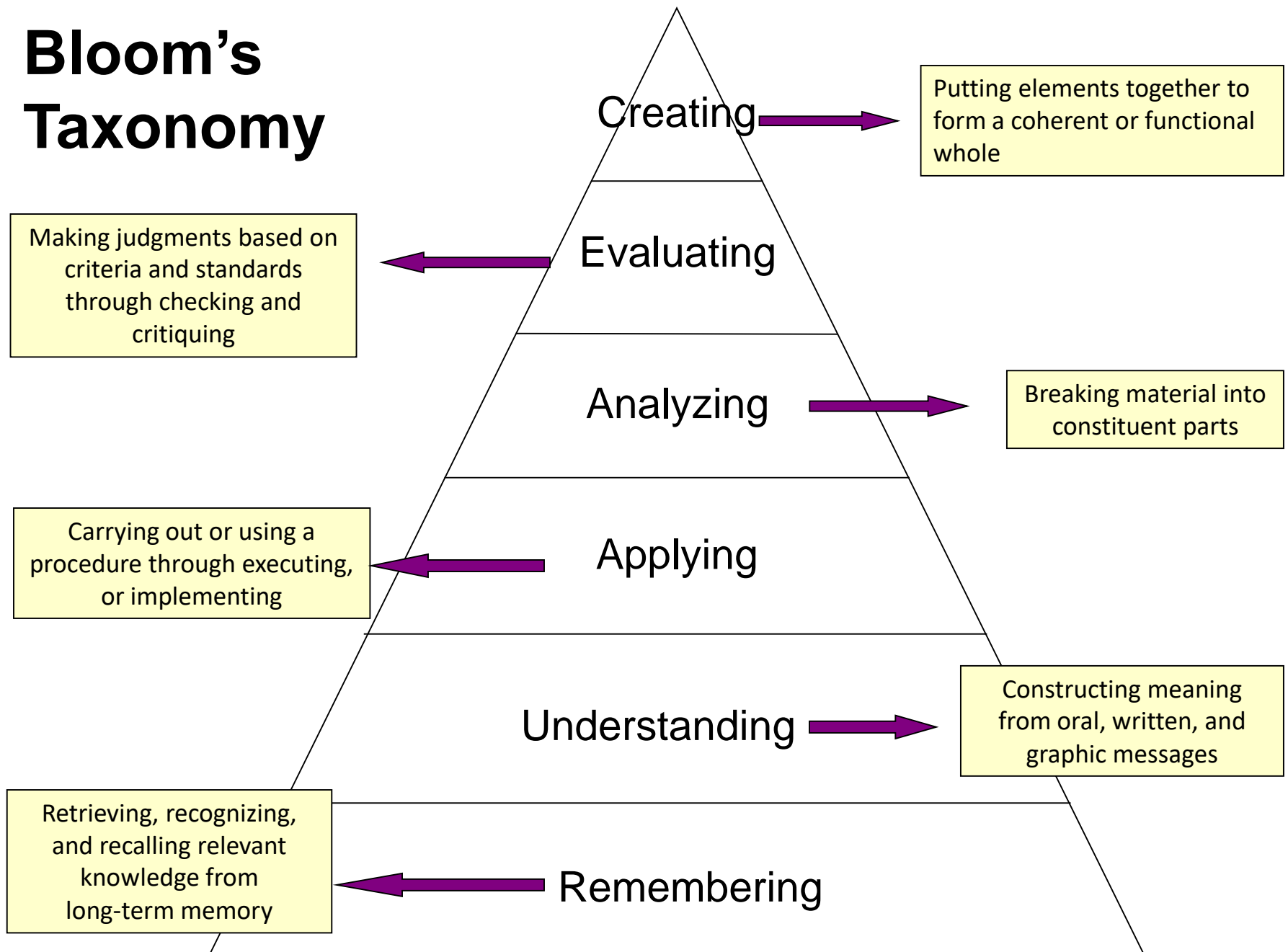
- Active learning is more lasting than passive learning
-- Passive learning is an oxymoron*
- Thinking about thinking is important
– Metacognition**
- The level at which learning occurs is important
– Bloom's Taxonomy***

*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



Bloom's Taxonomy



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



Teach them the Study Cycle*

**adapted from Frank Christ's PLRS system*

Preview

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

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

Review

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

Study

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

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

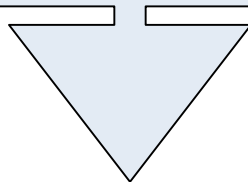
1	Set a Goal	1-2 min	Decide what you want to accomplish in your study session
2	Study with Focus	30-50 min	Interact with material- organize, concept map, summarize, process, re-read, fill-in notes, reflect, etc.
3	Reward Yourself	10-15 min	Take a break– call a friend, play a short game, get a snack
4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

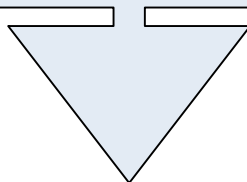


The one 50-min presentation on study and learning strategies resulted in an improvement of one full letter grade!

***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

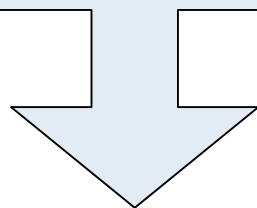
	Attended	Absent
Exam 1 Avg.:	71.33%	69.27%
Homework Total	169.8	119.1
Final course Avg*	82.36%	67.71%
Final Course Grade:	B	D



**The 50-min presentation on study and learning strategies
resulted in 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**

“Strategies to prevent cognitive overload: A team-based approach to improving student success and persistence in a gateway introductory chemistry course”*

Marguerite H. Benko*, Keith M. Vogelsang, Kristin C. Johnson, and Allison R. Babij
Department of Science, Ivy Tech Community College, Central Indiana, Indianapolis, Indiana



Until Fall 2013, the student success rate of a large introductory chemistry class...was **50%**. ...We then **implemented a face-to-face class format based on The Study Cycle concepts** presented by Dr. Sandra McGuire in her book “Teach Students How to Learn”. Curriculum revisions enabled faculty to deliver well-focused lectures, with access to supporting practice problems and labs that connected clearly with each week’s learning objective... Starting in Fall 2016, some sections introduced active and cooperative learning, which led to a steady improvement in the overall success rate, ending at **75%** in Fall of 2018.

*Manuscript accepted for publication. Personal communication April 19, 2019

What happens when we **offer metacognitive learning strategies, Bloom's Taxonomy, and the Study Cycle to an entire university,** not just individuals or specific classes?



Quantitative Results from Feb 2017 AYC Challenge

- **979 students** in eight sections of STEM gateway courses
(3 disciplines; 6 courses)
- **Ordinary Least Squares Regression (OLS) performed** to generate a statistically significant model ($p < 0.001$)
- Controlling for exam 1 score and high school GPA, we estimate that **attending Dr. McGuire's workshop** was associated with **final grades that were 3.22 points higher (100 pt scale)**. **Completing the challenge** was associated with a final grade **5.61 points higher**.
- **Final course grades:**

Course only:	C+
Attended metacognition workshop session:	B
Attended workshop <i>and</i> completed AYC Challenge:	B+

THINK BIG  WE DO™

A Campus-wide Strategy to Develop Metacognition in Gateway Courses

by Eric Kaldor and Holly Swanson, University of Rhode Island

**2018 Robert J. Menges Award for Outstanding Research
in Educational Development**
Professional and Organizational Development (POD)



Univ of Louisville AYC Challenge

Currently in Progress



ACE YOUR COURSE CHALLENGE

**Thursday, February 6
4-5:30 p.m.
Strickler Hall - Rm 101**

Join visiting expert **Dr. Sandra McGulre** for a transformative presentation on learning strategies proven to increase course grades!



95%

of students who incorporated her strategies after attending a similar presentation at the University of Rhode Island noted increased confidence when learning material in a challenging course!

WHAT PREVIOUS ATTENDEES SAY:

"I was a confused freshman before ... but now I am confident I can succeed in college!"

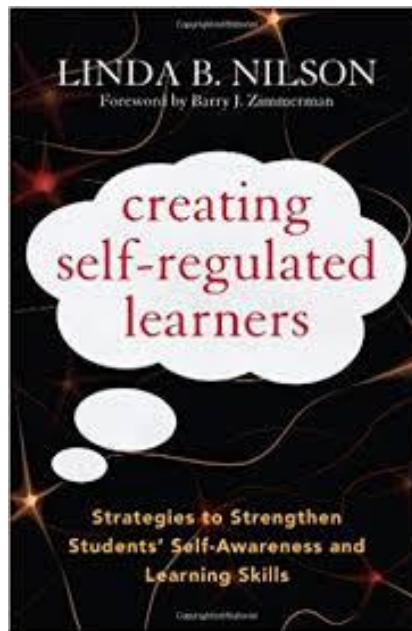
"I was really nervous that my 52 on my first exam was for sure going to 'ruin my life;' however, I came to this presentation and started applying these techniques to my daily routine....I just got my second exam today and I received a 91!"

Register at uoflayc2020.eventbrite.com

Knowledge of Metacognition and Mindset Can Greatly Increase the Success of Minority and First Generation Students

- They are less likely to have been academically challenged in high school
- They are less likely to be encouraged to stick with it
- They are more likely to experience the impact of a paradigm shift

Linda Nilson's Top Ten Best Teaching Practices for Creating Self-Regulated Learners



Nilson, Linda Burzotta. *Creating Self-regulated Learners: Strategies to Strengthen Students' Self-awareness and Learning Skills*. First edition. Sterling, Virginia: Stylus Publishing, 2013.

10. Setting clear, assessable learning outcomes and assess on them
9. Giving students practice, practice, practice
8. **Teaching students how to learn/study in your course**
7. Giving students prompt feedback and many varied grading opportunities, including “authentic” ones
6. Communicating high expectations
5. Integrating “desirable difficulties” into student learning
4. Giving “student-active” breaks every 12 – 20 min
3. Holding students accountable for reading assignments when due
2. Using the “best tool(s) for the job”
1. Getting mid-semester student feedback—on your own or with help of a colleague or instructional consultant

LSU Analytical Chemistry Graduate Student's Cumulative Exam Record

<u>2004 – 2005</u>			<u>2005 – 2006</u>	
9/04	Failed		10/05	Passed
10/04	Failed		11/05	Failed
11/04	Failed	Began work with CAS and the Writing Center in October 2005	12/05	Passed best in group
12/04	Failed		1/06	Passed
1/05	Passed		2/06	Passed
2/05	Failed		3/06	Failed
3/05	Failed		4/06	Passed last one!
4/05	Failed		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
- helping students develop the right mindset
- making the implicit *explicit*
- *not judging* student potential on initial performance
- encouraging students to *persist in the face of initial failure*
- *Motivating students to use metacognitive learning strategies*



Special Note

Please visit the CAS website at www.cas.lsu.edu. We have on-line workshops that will introduce you and your students to effective metacognitive strategies.

Have fun teaching your students powerful metacognitive strategies that will lead to increased academic success!

Sandra McGuire

Acknowledgments

- Sarah Baird, Learning Strategist
- LSU Center for Academic Success
- Dr. Elzbieta Cook, LSU General Chem Instructor
- National College Learning Center Association
- All of the faculty who implemented these strategies and provided feedback
- All of the students who changed their attitudes and behaviors and showed me what was possible!

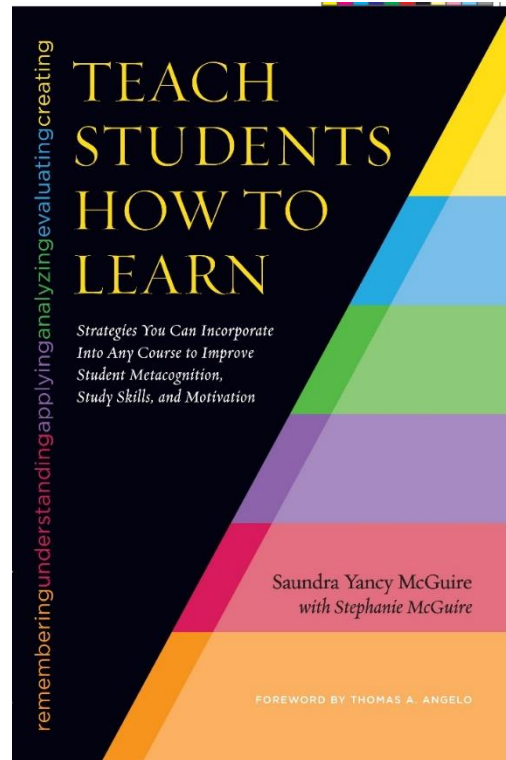
Useful Websites

- reach.louisville.edu/
- www.cas.lsu.edu
- www.howtostudy.org
- www.vark-learn.com
- Searches on www.google.com

Additional References

- Bokser, J.A., Brown, S., Chaden, C., Moore, M., Cleary, M. N., Reed, S., Seifert, E., & Zecker, L.B. (2016), Finding common ground: Identifying and Eliciting Metacognition in ePortfolios Across Contexts. *International Journal of ePortfolio*, 6(1), 33-44. Retrieved from <http://www.theijep.com/pdf/IJEP211.pdf>
- Bruer, John T. , 2000. *Schools For Thought: A Science of Learning in the Classroom*. MIT Press.
- Bransford, J.D., Brown, A.L., Cocking, R.R. (Eds.), 2000. *How people learn: Brain, Mind, Experience, and School*. Washington, DC: National Academy Press.
- Christ, F. L., 1997. *Seven Steps to Better Management of Your Study Time*. Clearwater, FL: H & H Publishing
- Cromley, Jennifer, 2000. *Learning to Think, Learning to Learn: What the Science of Thinking and Learning Has to Offer Adult Education*. Washington, DC: National Institute for Literacy.
- Hoffman, Roald and Sandra Y. McGuire. (2010). Learning and Teaching Strategies. *American Scientist* , vol. 98, pp. 378-382.
- Nilson, Linda, 2004. *Teaching at It's Best: A Research-Based Resource for College Instructors*. Bolton, MA: Anker Publishing Company.
- Pierce, William, 2004. *Metacognition: Study Strategies, Monitoring, and Motivation*.
<http://academic.pg.cc.md.us/~wpeirce/MCCCTR/metacognition.htm>

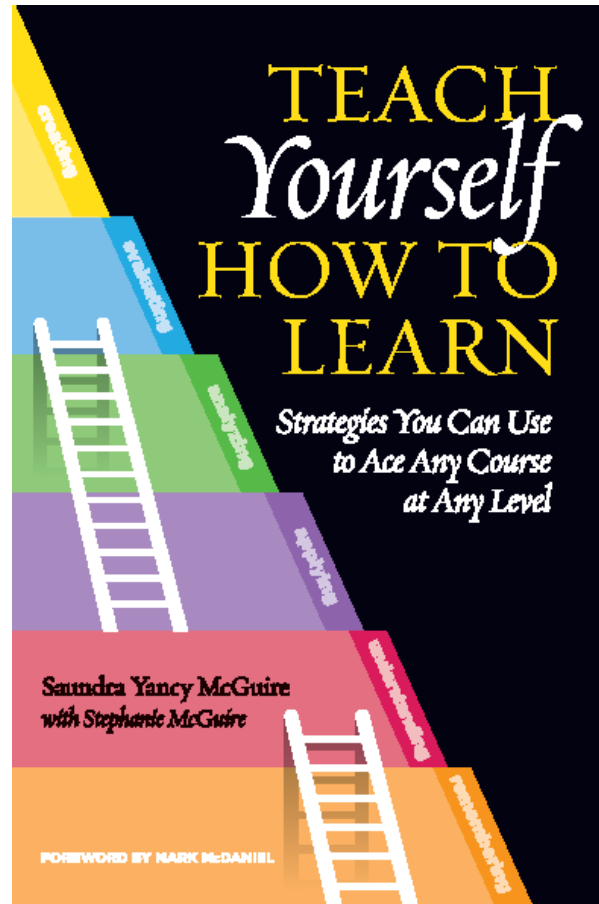
A Faculty Resource



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

**New Online Course on *Teach Students How to Learn* (<https://tinyurl.com/TSLcourse>)
Offered by Dr. Bridget Arend**

The 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