

Teach Health Professions and Natural Sciences Students *How* to Learn: Metacognition is the Key!



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Director Emerita, Center for Academic Success
Louisiana State University

School of Health & Natural Sciences

[Health Professions](#)[Natural Sciences](#)

Mission

The School of Health and Natural Sciences is committed to providing *motivated* students the opportunity to transform their lives by **preparing them to achieve or enhance a rewarding career** in the health and science professions. The School is dedicated to providing a **high quality learning environment** that fosters a spirit of scientific inquiry, life-long learning, and ethical behavior for all students..

Goals

The School goals establish the shared vision, mission, philosophy and guiding principles agreed to by members of the faculty and other stakeholders in the learning community. The School goals are as follows:

Students are expected to **achieve entry-level proficiency and standards of excellence for their field**, including:

Adequate knowledge of content

Essential competencies

Sound math skills & quantitative reasoning

Professional written & verbal communication skills

Integration of theory with practice

Application of innovative/cutting edge technology to practice

The School's Goals Reflect the Paradigm Shift in Health Science Education

Training Students to

- Acquire Knowledge
- Implement textbook approaches
- Rely on information previously learned to inform actions



Preparing Experts to

- Acquire competencies
- Adapt to new circumstances
- Think critically to develop new approaches

ADEA Commission on Change and Innovation in Dental Education (2006), *Journal of Dental Education*, 70(9), 925-936.

How much do you know about metacognition?

- A. Nothing or just a little
- B. A moderate amount
- C. Quite a lot
- D. More than I want to know!

Have You Ever Attended a Session Presented by Sandra McGuire?

- A. Yes, within the last 3 years
- B. Yes, but over three years ago
- C. No, but I've read *Teach Students How to Learn*
- D. Have never attended a session or read the book

Desired outcomes

- We will understand why many students do not know **how** to learn
- We will have **concrete learning strategies** that faculty can teach students to increase learning
- We will have **more resources** for our students
- We will **view our students differently**, and we will **help them to view themselves differently**
- We will see **positive changes in our students' performance** and self-perception
- We will **reverse the huge dip in 2020 of the % of students passing the NAPLEX**

Metacognition: The Key to Helping Students Make the Paradigm Shift

The ability to:

- think about your own thinking
- be consciously aware of yourself as a problem solver
- plan, monitor, 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 developed these skills?



**It may not have been
necessary before now**

Data from UCLA Higher Education Research Institute (HERI) First Year Student Survey – 2010 - 2019

	% 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
2019	43.3	59.3

What is “Metacognitive Equity”?

- **Educational Equity***

reducing the discrepancy in educational outcomes between low-income versus high-income students and minority versus majority students (closing the gap)

- ***Metacognitive Equity***

reducing the discrepancy in metacognition (*thinking strategies*) between low-income versus high-income, minority versus majority, and well prepared versus underprepared students

*<https://www.kaganonline.com/grants/Excellence&Equity.pdf>

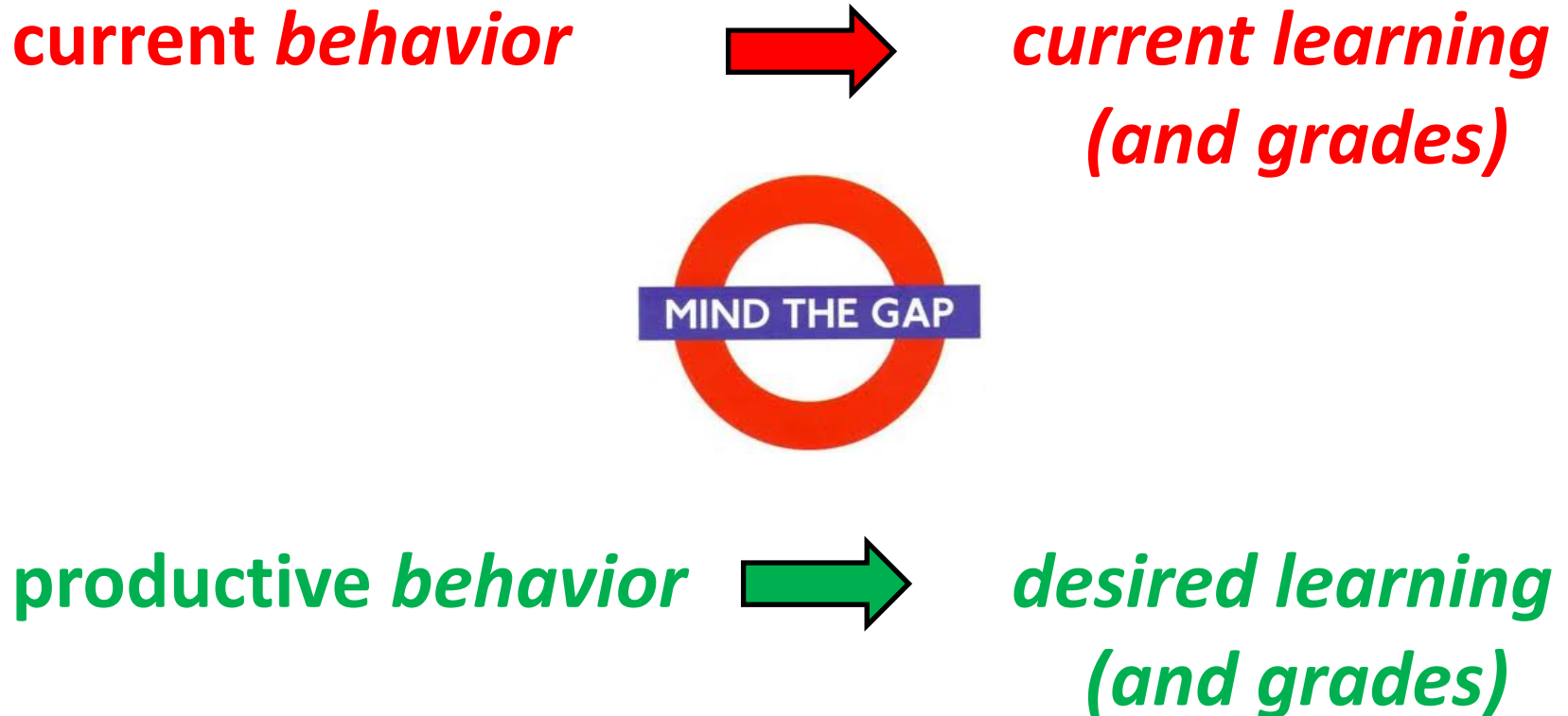
What are the biggest barriers to success for health professions and natural sciences students?

- Poor reading skills
- Relying too much on memorization*
- Poorly developed critical thinking and problem-solving skills
- Keeping struggles a secret*

* Dr. Sharon Silverman, developer of award-winning retention program at the Strith School of Medicine at Loyola University of Chicago (personal communication, June 5, 2015)

Faculty Must Help Students Make the Transition

Help students identify and close “the gap”



An Extremely Valuable Resource

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Center for Academic Excellence & Innovation (CAEI)

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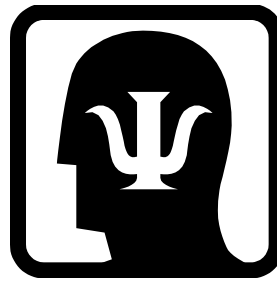
Overview

Academic tutoring — offered at the Vitale Center for Academic Excellence and Innovation in Dobbs Ferry, and Learning Centers on the Mercy campuses — is a valuable resource to help you get ahead, whether you are a B student looking to get an A, a student in need of extra support to succeed in a difficult course, or a graduate student working on your thesis. CAEI provides a friendly learning environment in



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
-



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

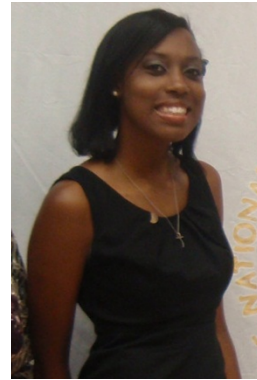
- **Survey** (look at intro, summary, bold print, italicized words, etc.)
- **Question** (devise questions survey that you think the reading will answer)
- **Read** (one paragraph at a time)
- **Recite** (summarize in your own words)
- **Record or wRite** (annotate in margins)
- **Review** (summarize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

Problem Solving is Essential to Health Professionals' Success

Homework system that can be taught

- Study information 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

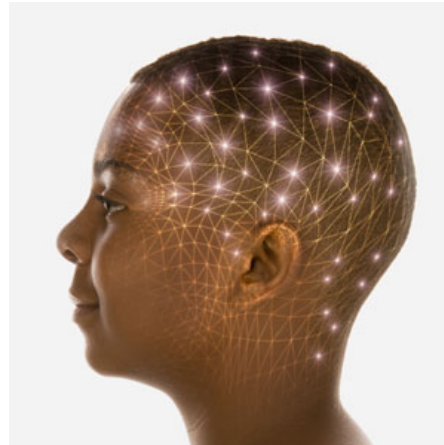
Dana Lewis, MS in Medical Physics, 2015
Univ of Texas Graduate School
of Biomedical Sciences at Houston
Thesis research at UT MD Anderson Cancer Center



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

Why the Fast and Dramatic Increase?

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



Finding Numbers in Sequential Order

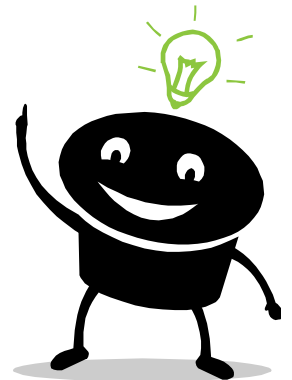


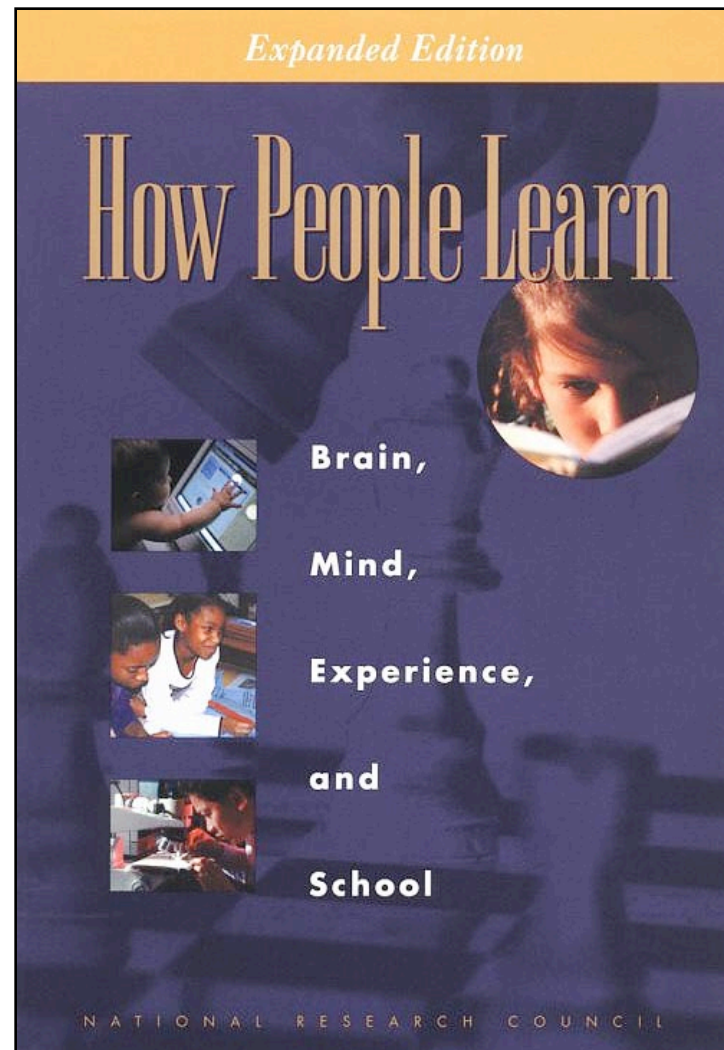
**How many can you find in
15 seconds?**

76	4	48	28	64	5	77	33	53	45
56	32	16	44	72	17	37	69	29	1
20	36	8	24	52	21	61	13	57	49
68	60	12	80	40	9	41	65	25	73
3	67	47	79	23	70	22	38	14	54
19	31	55	51	71	6	62	2	46	50
59	7	63	27	39	74	10	42	66	26
35	75	15	43	11	78	18	34	30	58

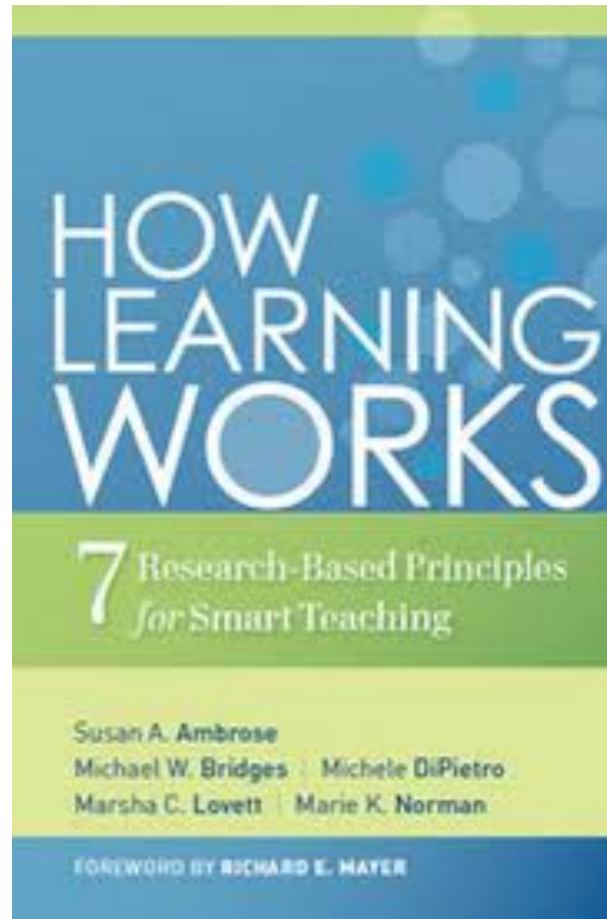
**What was the major difference
between the first attempt
and the second attempt?**

**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.



Ambrose, S.A., Bridges, M.W., DiPietro, M., Lovett, M.C., Norman, M.K. (2010) *How Learning Works: Seven Research-Based Principles for Smart Teaching*. San Francisco, CA: Jossey Bass.

What we know about learning

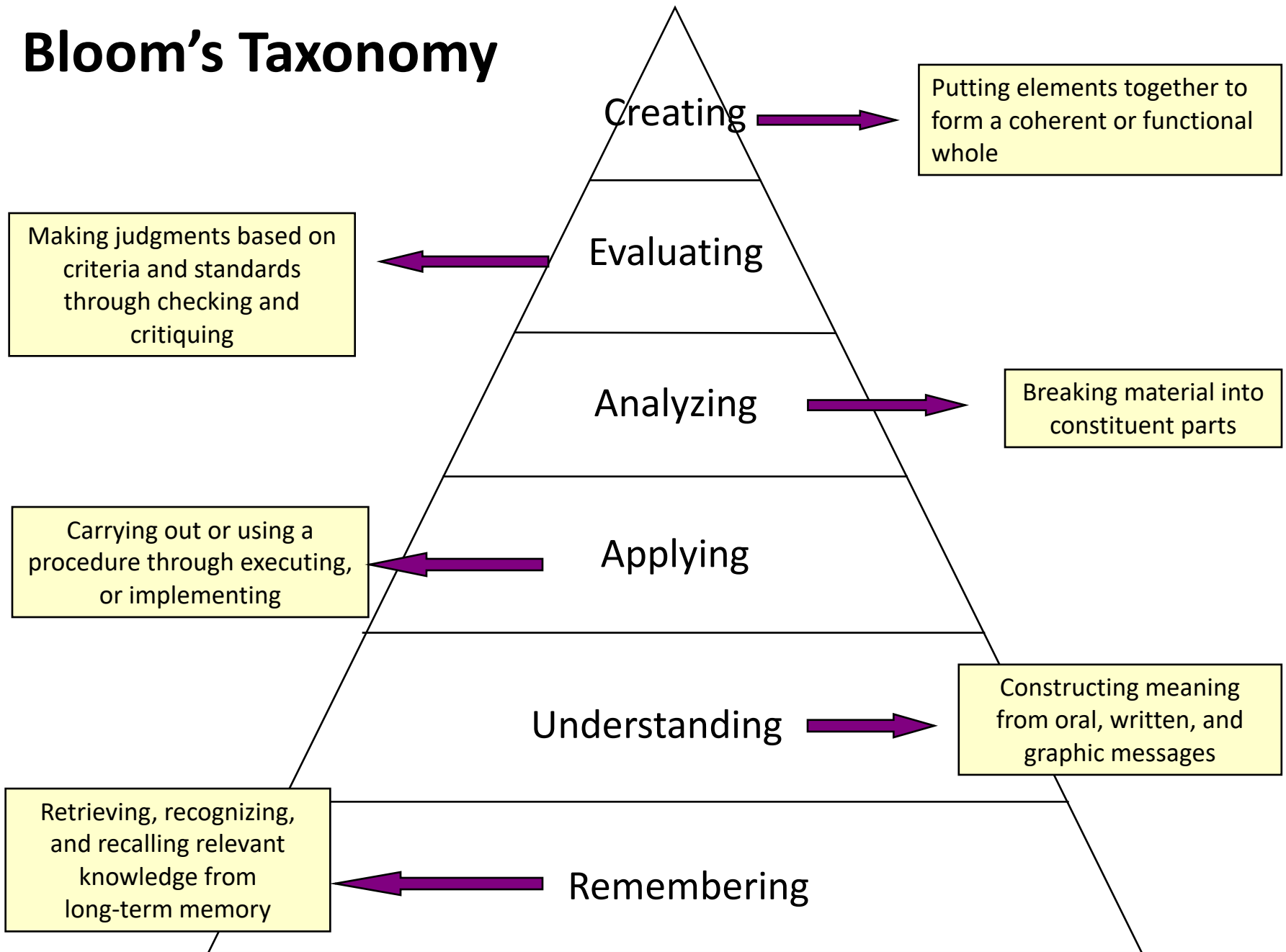
- Active learning is more lasting than passive learning
 - Passive learning is an oxymoron*
- Thinking about thinking is important
 - Metacognition**
- The level at which learning occurs is important
 - Bloom's Taxonomy***

*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



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 before now?

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 master your courses now?

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

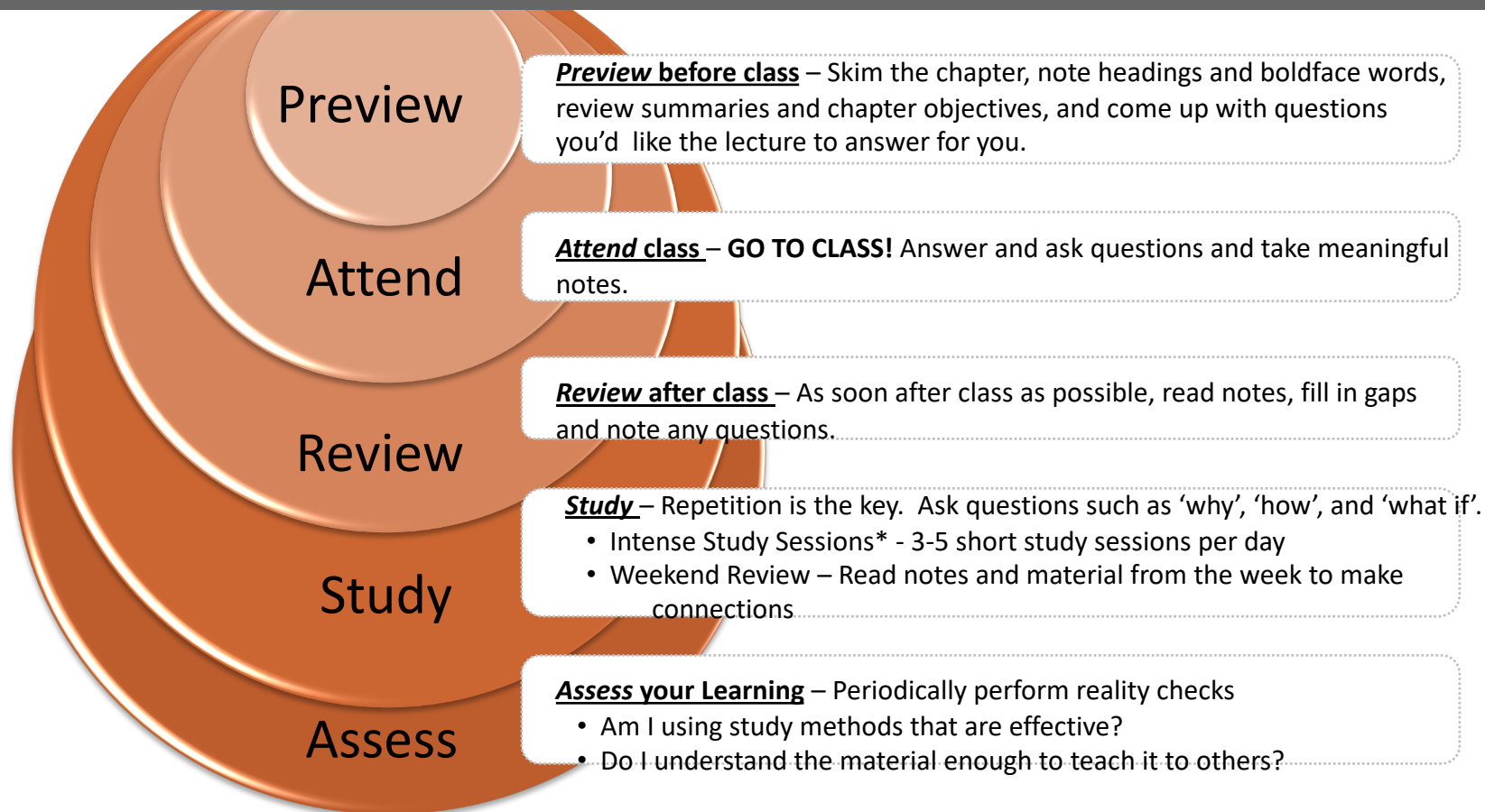
How do we teach students to move *higher* on Bloom's Taxonomy?



Teach them the Study Cycle*

**adapted from Frank Christ's PLRS system*

The Study Cycle



*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

Brea Manuel*, BS in Chemistry, 2018
Entered PhD Program at
Emory University on Full Fellowship in Fall 2018
Became a PhD Candidate Spring 2020!



The intense (focused) 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.

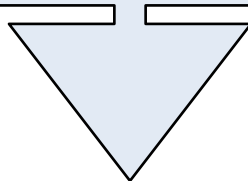
*Manuel, B.A., Karloff, D.B. Recruit and retain a diverse workforce. Nat Rev Chem (2020). <https://doi.org/10.1038/s41570-020-0214-z>

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

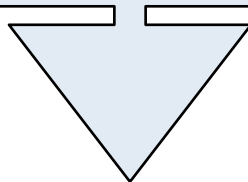


The one 50-min presentation on study and learning strategies was followed by an improvement of one full letter grade

***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

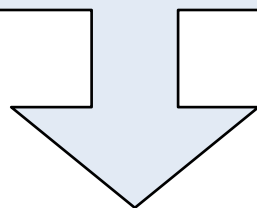
	Attended	Absent
Exam 1 Avg:	71.33%	69.27%
Homework Total:	169.8	119.1
Final course Avg*:	82.36%	67.71%
Final Course Grade:	B	D



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**

“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.

Turning Students into Efficient, Expert Learners

- Have them do “think aloud” exercises, involving actual cases
- Constantly ask them “why” how and “what if” questions in think-pair-share exercises in class
- Show them how to test their understanding by verbalizing or writing about concepts; practice retrieval of information
- Show them how to move their activities higher on the *Bloom's taxonomy* scale by comparing and contrasting, thinking of analogies, thinking of new pathways, treatments, etc.

The Transparency in Learning and Teaching project aims to advance equitable teaching and learning practices that reduce systemic inequities in higher education through two main activities:

1

Promoting students' conscious understanding of how they learn

2

Enabling faculty to gather, share and promptly benefit from current data about students' learning by coordinating their efforts across disciplines, institutions and countries



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PARTICIPATE



ABOUT TILT



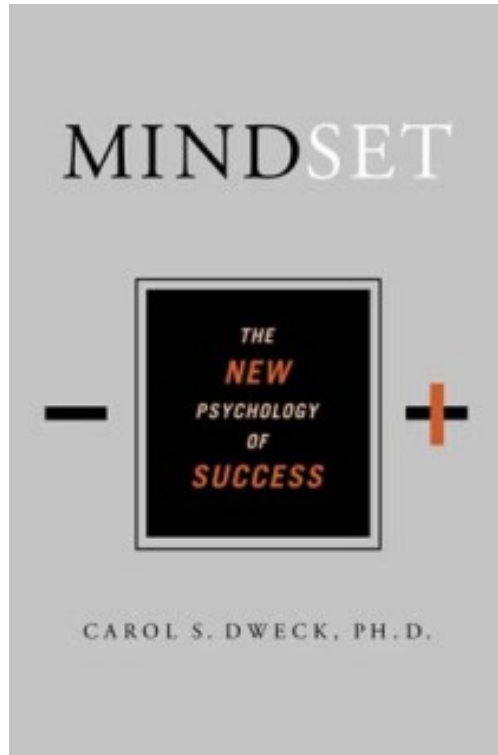
TILT EXAMPLES &
RESOURCES

Transparent Methods

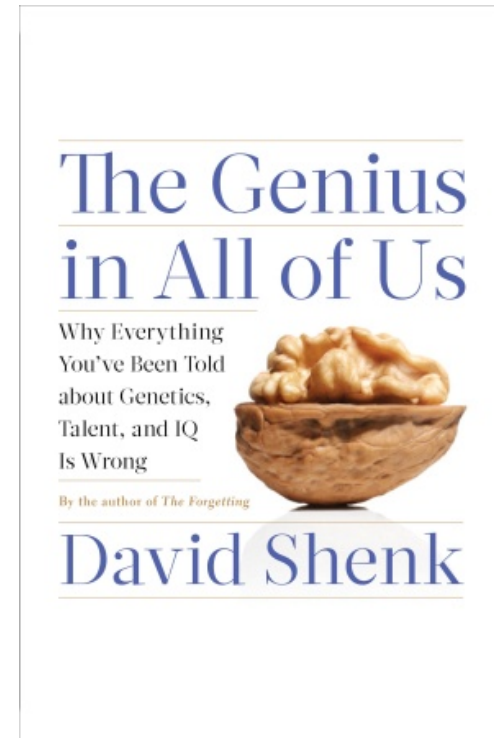
Transparent teaching methods help students understand *how and why* they are learning course content in particular ways. This list of options is adapted frequently as faculty participants identify further ways to provide explicit information to students about learning and teaching practices. **Faculty participants usually employ one option** from the list and students indicate the impact of this small change when they complete an online survey (taking about four to five minutes) at the end of the course. Please email wink@brandeis.edu to add your suggestions to the list.

- ▶ Discuss assignments' learning goals and design rationale before students begin each assignment
- ▶ Invite students to participate in class planning, agenda construction
- ▶ Gauge students' understanding during class via peer work on questions that require students to apply concepts you've taught
- ▶ Explicitly connect "how people learn" data with course activities when students struggle at difficult transition points
- ▶ Engage students in applying the grading criteria that you'll use on their work
- ▶ Debrief graded tests and assignments in class
- ▶ Offer running commentary on class discussions, to indicate what modes of thought or disciplinary methods are in use

Mindset Matters!



Dweck, Carol, 2006.
Mindset: The New Psychology of Success. New York: Random House Publishing



Shenk, David, 2010. *The Genius in All of Us: Why Everything You've Been Told About Genetics, Talent, and IQ Is Wrong.* New York: Doubleday

Two Different Mindsets About Intelligence

- **Fixed Mindset**

Intelligence is static

You have a certain amount of it

- **Growth Mindset**

Intelligence can be developed

You can grow it with actions

Responses to *Many* Situations are Based on Mindset

	Fixed Mindset Response	Growth Mindset Response
Challenges	<i>Avoid</i>	<i>Embrace</i>
Obstacles	<i>Give up easily</i>	<i>Persist</i>
Tasks requiring effort	<i>Fruitless to try</i>	<i>Path to mastery</i>
Criticism	<i>Ignore it</i>	<i>Learn from it</i>
Success of Others	<i>Threatening</i>	<i>Inspirational</i>

Which mindset about intelligence do you think *most students* have?

1. Fixed
2. Growth

**Which mindset about student intelligence
do you think *most faculty* have?**

1. Fixed
2. Growth

Study links faculty attitudes on intelligence to student success in STEM, with large impact on minority student success

Submitted by Scott Jaschik on February 18, 2019 - 3:00am

A new study suggests that faculty members' attitudes about intelligence can have a major impact on the success of students in science, mathematics and technology courses. Students see more achievement when their instructors believe in a "growth mind-set" about intelligence than they do learning from those who believe intelligence is fixed. The impact was found across all student groups but was most pronounced among minority students.

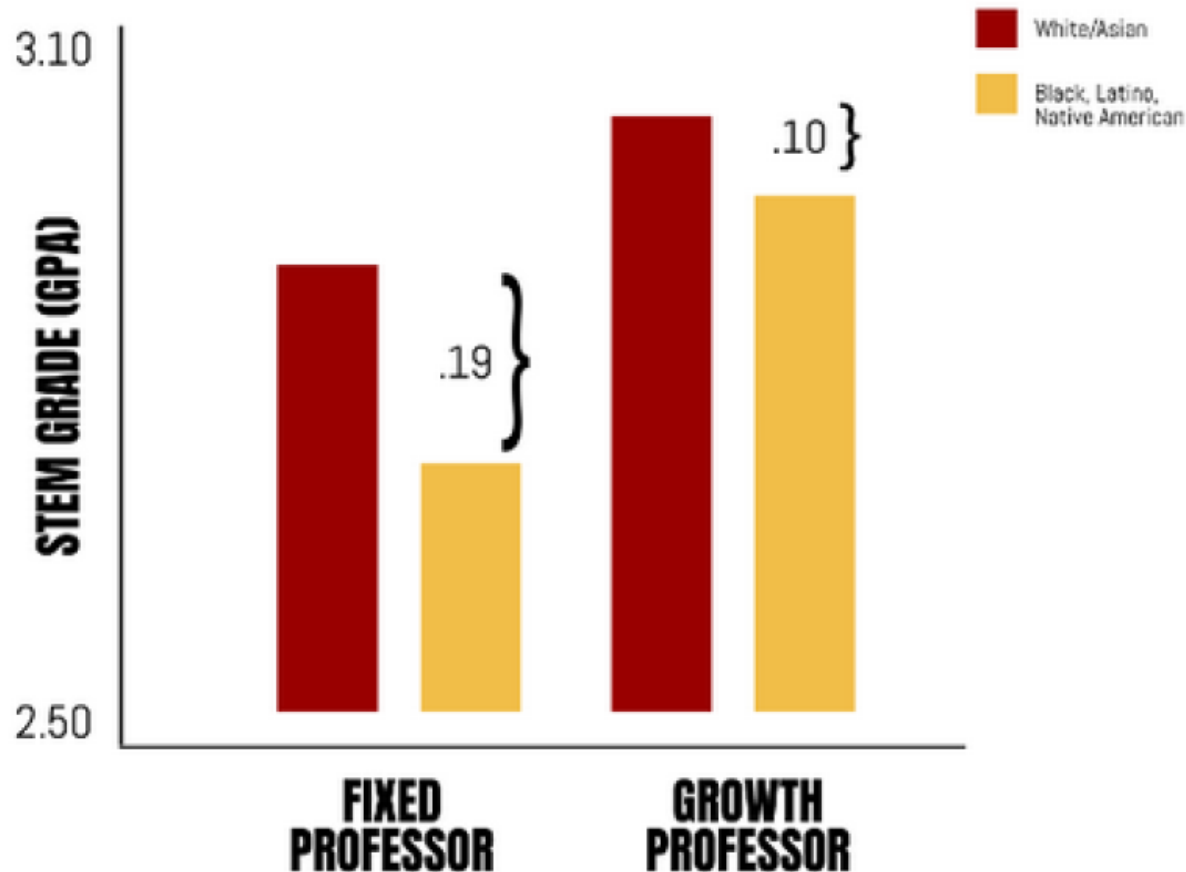
The study -- by brain science scholars at [Indiana University at Bloomington](#) ^[1] -- was published in the journal [Science Advances](#) ^[2] and presented last week at the annual meeting of the American Association for the Advancement of Science.

The researchers collected data on 150 faculty members in a range of STEM disciplines and 15,000 students over two years at a large public research university that is not identified. Faculty members were asked to respond to a general statement about intelligence along the lines of "To be honest, students have a certain amount of intelligence, and they really can't do much to change it."

The study then looked at student performance in courses taught by those who agreed with that perspective and those who did not.

The findings:

While all students perform better when STEM professors endorse a growth mindset belief, the racial achievement gap is almost halved when professors endorse a growth-mindset belief.



Email from a General Chemistry Student

“...Personally, I am not so good at chemistry and unfortunately, at this point my grade for that class is reflecting exactly that. I am emailing you inquiring about a possibility of you tutoring me.”

April 6, 2011

“I made a 68, 50, (50), **87, 87, and a 97 on my final.** I **ended up earning a 90 (A) in the course, but I started with a 60 (D).** I think what I did different was make sidenotes in each chapter and as I progressed onto the next chapter I was able to refer to these notes. ***I would say that in chemistry everything builds from the previous topic.***

May 13, 2011

Semester GPA: 3.8

January 4, 2020

Emails from Fredrick

I ... am a current nursing student at Brenau University... I wanted to ask you if you can help me with implementing metacognitive strategies. As a first-year student in a nursing program, **I am struggling to learn contents for all my classes. I have sought tutoring and still struggling. I have failed one course due to my inability to apply contents.** I have used several studying methods and none at this helps to learn important concepts and contents.... I am begging if you have anything that can help me this upcoming year, I would greatly appreciate it...

Sent: Wednesday, January 8, 2020 12:05 PM

To: Sandra McGuire <smcgui1@lsu.edu>

Subject: Enlightened

Hello Dr. McGuire

...Enlightenment is the word for today. Your book is fantastic. I have told all my brothers and sisters to read it...I have told several of my classmates to buy the book and honestly read it.


Thank you again. Feedback coming soon after first nursing exams of the semester.


February 6, 2020

Thank you for checking on me about the test. I got my results. I got 90 on the test. Completed it within 20 minutes (75 minutes). I would've gotten higher if I had slow down and reread the questions several times. I saw the all answer and reviewed them, especially the wrong ones.

I got overly excited by the time I got to 5 question (50 questions). I knew so much content for almost every right and wrong answer, I was shocked by how much knowledge I possessed. The content from the reading was easy recall.

Fredrick, First Year Nursing Student

Fall 2019	Test grades	Final Course Grade
Comprehensive Health assessment 	89.33, 78.00, 85.67, 63.83, HESI - 55	78.52
Professional Nursing		98.92
Foundations of Professional Nursing Practice		84.95
Pharmacology		87.88

Spring 2020		final
Comprehensive Health assessment 	90, 86, 90, 87, 90 HESI Scores 96, 90	91.75
Basic Nursing Concepts		100
Evidence-Based Practice		98.83

For some of the course we completed small assignments (quizzes, articles, case studies, group activities, presentations, lab checkoffs, and clinical assessments). Most of theses I received 100 and successful completions.

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*



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!

Saundra 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!

Additional References

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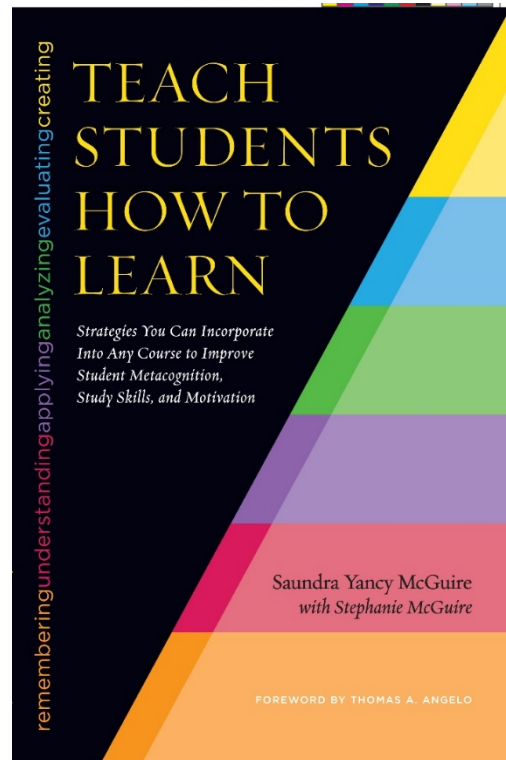
<http://academic.pg.cc.md.us/~wpeirce/MCCCTR/metacognition.htm>

*Excellent student reference

Reflection Activity

- Choose 2 to 3 strategies that you would like to teach your students
- Share with a colleague or two how you plan to present it to the students.

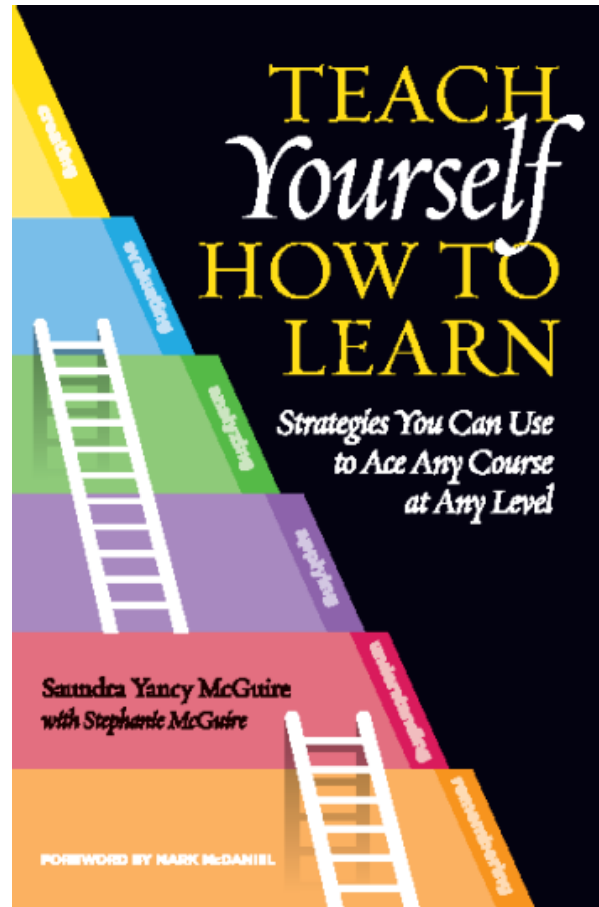
A Faculty Resource



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