# The Challenge of Translating Learning Research into Effective Pedagogical Practice

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# Goals of this Presentation

- Describe contributions from Learning Science and the Scholarship of Teaching and Learning (SoTL) for improving teaching effectiveness and student learning
- Describe the limitations of each, and the challenges of translating one into the other
- Describe how collaboration between the two approaches, through translational research, is critical for progress

# Teacher Beliefs about How People Learn

- Teaching requires a  mental model of how people learn.
- Determines which teaching methods are selected, how they are implemented and assessed, and how to adjust if there are problems.

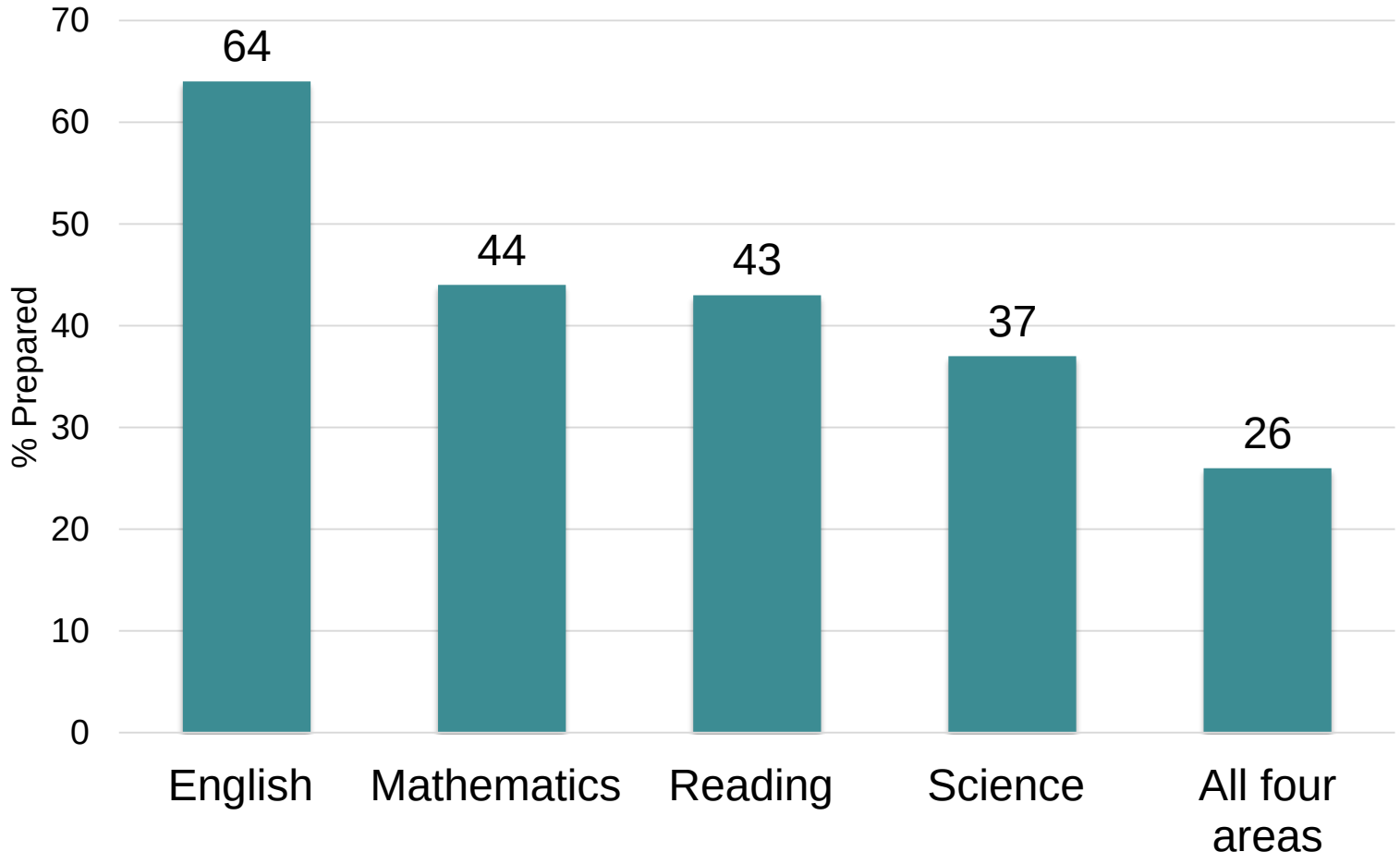
# Student Beliefs about How People Learn

- Students also base their study behavior based on their models of how people (specifically themselves) learn.
- It determines their learning effectiveness, achievement, and success

# A typical incoming college student…

- Has graduated from high school with an average GPA of 3.00 (NAEP, 2009)
- Has probably passed a high school exit or graduation exam
- Has been tested for scholastic achievement or aptitude many times
- Probably taken an entrance exam and was admitted to college

# % of Students Deemed Ready for College by ACT (2014)



# Problematic Student Beliefs and Expectations about Learning

- Inadequately prepared, unaware, and overconfident
  - Poor metacognitive awareness
- Preference for the least effective learning strategies (Dunlosky, et al., 2013)
- Many misconceptions that undermine learning

# Problematic State of Teaching

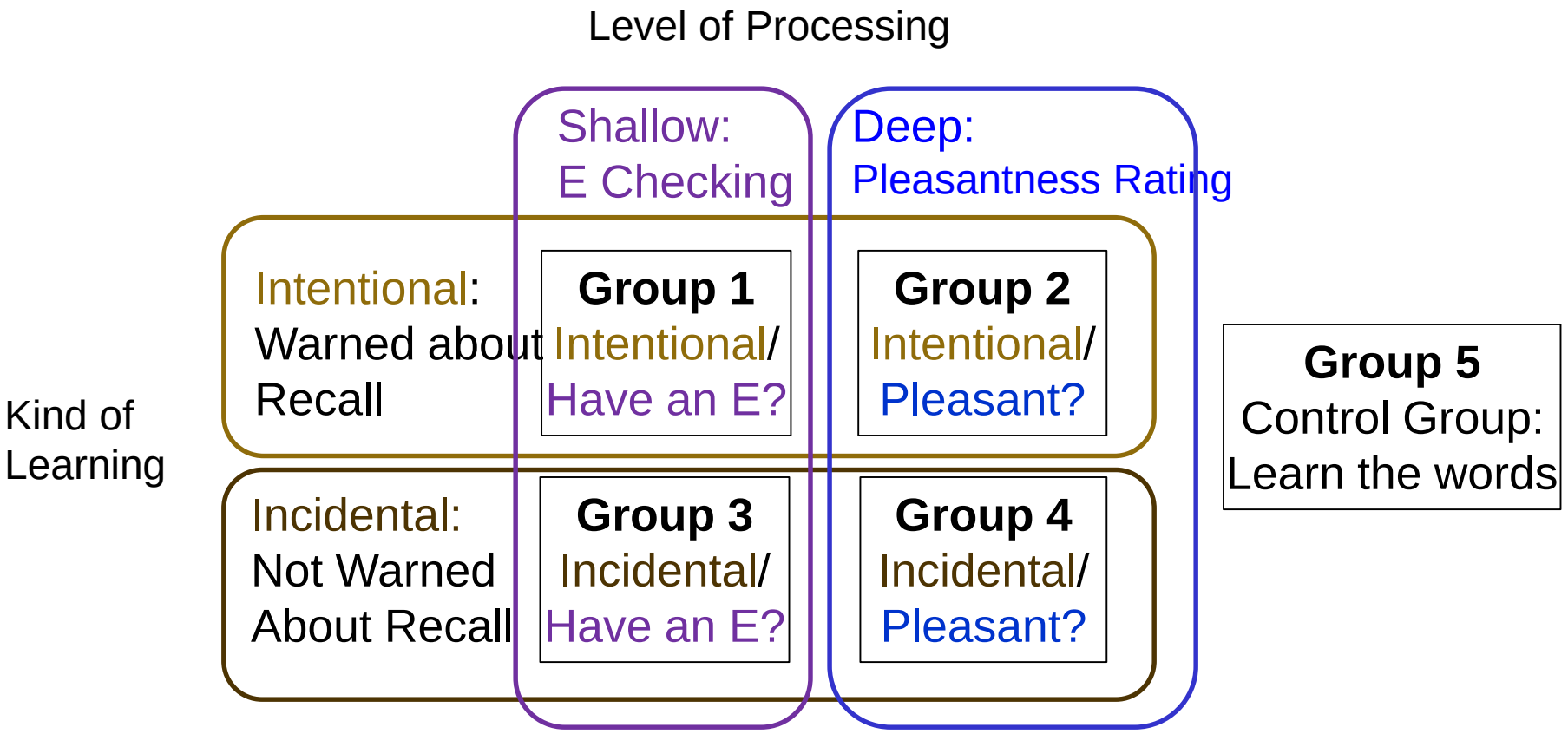
- Most teaching is uninformed by research, and based on intuition, biases, and untested assumptions
  - Particularly embarrassing for psychology
- Teaching is fad driven

# Which of the following is the MOST important ingredient for successful learning?

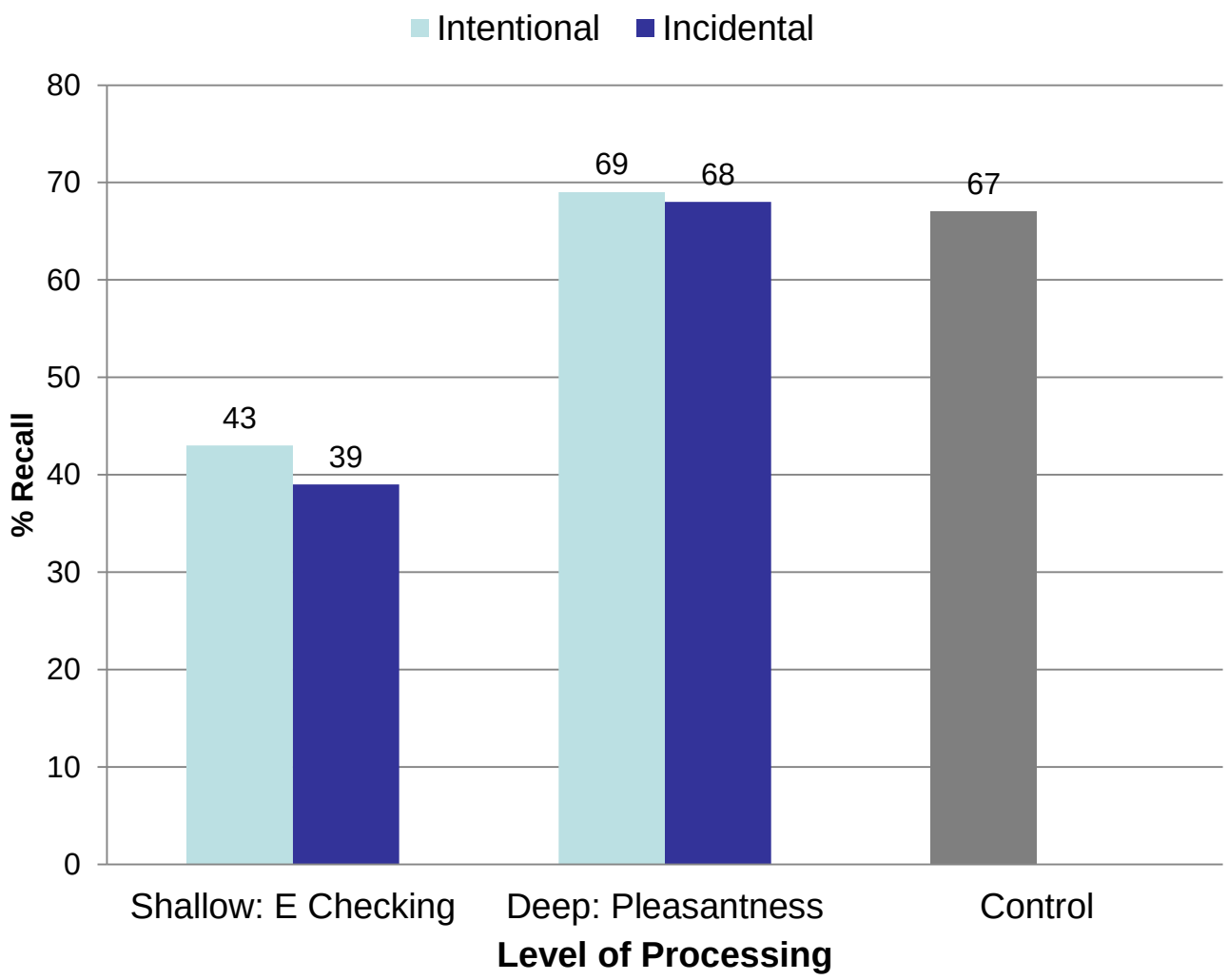
1. The intention and desire to learn
2. Paying close attention to the material as you study
3. Learning in a way that matches your personal Learning Style?
4. The time you spend studying
5. What you think about while studying

# Hyde & Jenkins (1969)

Five groups of subjects were presented with 25 words, one at a time.
Later they had to recall as many words as they could.



# Intention vs. Level of Processing



Which of the following is the MOST important ingredient for successful learning?

1. The intention and desire to learn
2. Paying close attention to the material as you study
3. Learning in a way that matches your personal Learning Style?
4. The time you spend studying
5. What you think about while studying

# The Primary Goal of Teaching

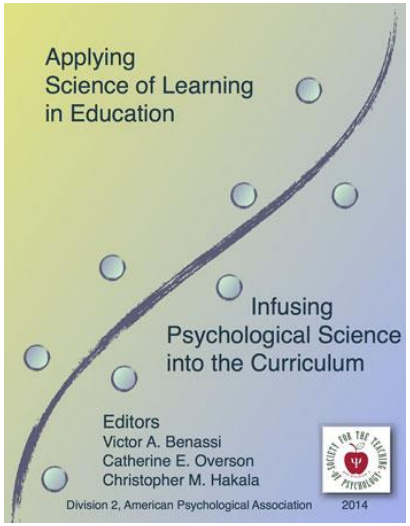
Either

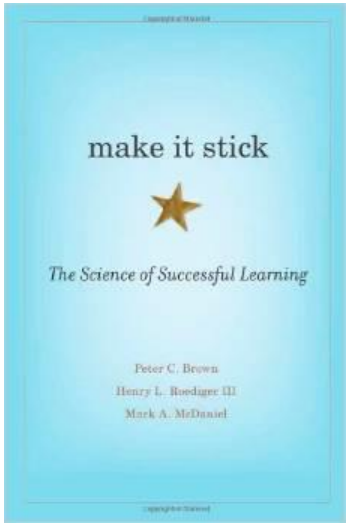
- To present information that students are solely responsible for learning

Or

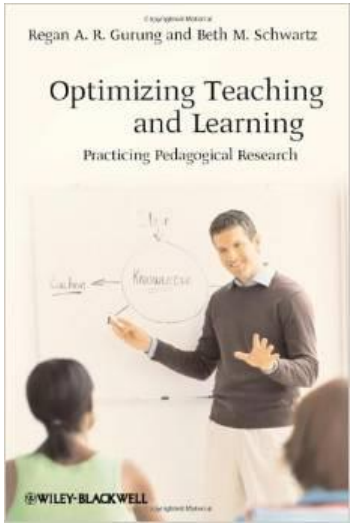
- To develop a sophisticated, useful, and generative level of understanding on the part of the students
  - Teachers strongly influence, for better or worse, what and how well students learn

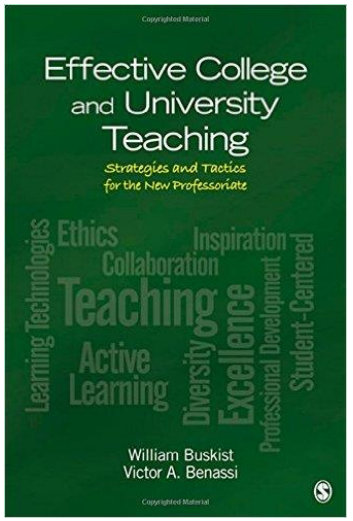
# Rapid Growth in Research on Teaching and Learning




Learning Science



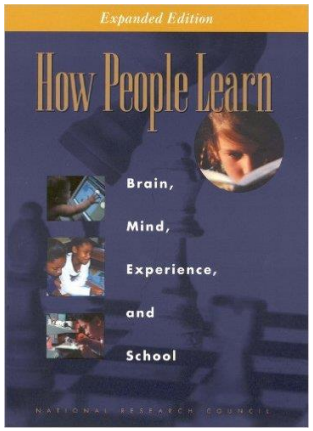




Scholarship of Teaching and Learning (SoTL)
Pedagogical Research

# A Story of Two Tribes

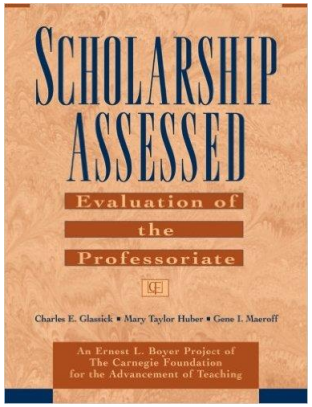
## Learning Science

- Mostly lab centered
- Methodical, systematic
- Focus on control
- Theoretically and empirically driven
- From psychology




## SoTL

- Classroom research
- Pragmatic, intuitive
- Contextually valid
- Practice Driven
- From education



# Ways Learning Science and SoTL are Similar

- Move beyond notion of teaching as simply presenting information
- Focus on learning as the critical indicator of teaching effectiveness
- Replace untested assumptions and intuitions with research-based principles as the basis of teaching and learning

# Why SoTL needs Learning Science

Without learning science, teaching is…

- often based on misconceptions
- lacks a framework to help teachers develop and improve

- Teaching practice is a buffet of unrelated teaching tips, procedures, and technology
  - Awash in an ocean of fads, buzzwords, and gimmicks

# I recommend pedagogies that are…

high impact, student-centered, just-in-time, technology-enhanced, flipped, blended, hybrid, experiential, disruptive, adaptive, hands-on, situated, guided, integrative, supplemental, reciprocal, transformational, cooperative, collaborative, reflective, engaging, gameified, and active; and that are brain-based, peer-based, team-based, project-based, case-based, group-based, discovery-based, community-based, competency-based, mastery-based, research-based, service-based, inquiry-based, evidence-based, problem-based, and data-driven.

Oh, and it should be massive, open, and online.

# Why SoTL needs Learning Science

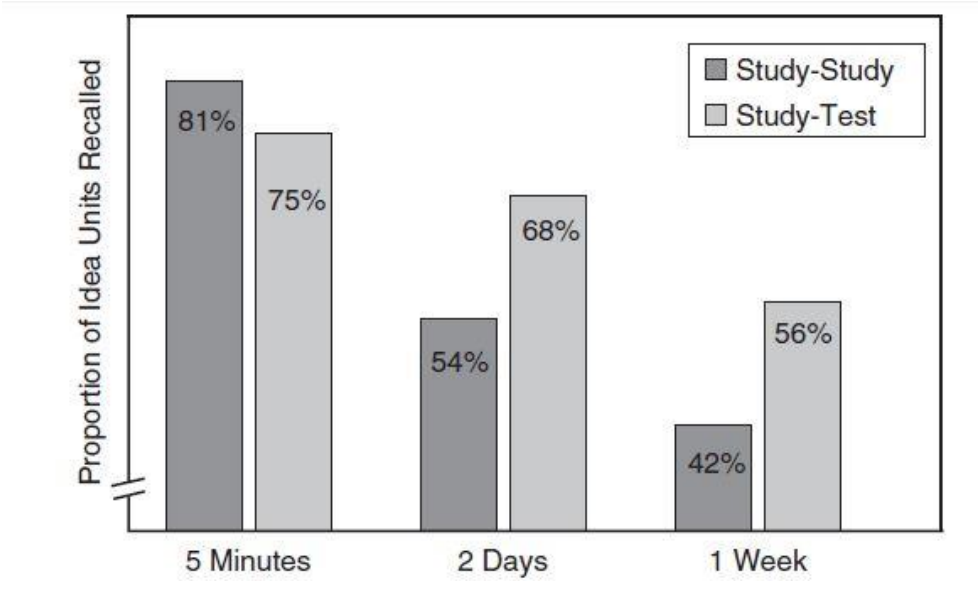
- Learning Science can help discriminate between theoretically and empirically sound pedagogy and  empty buzzwords
- To be effective, any teaching method must be grounded in the cognitive architecture of the human mind.

# Why Learning Science needs SoTL

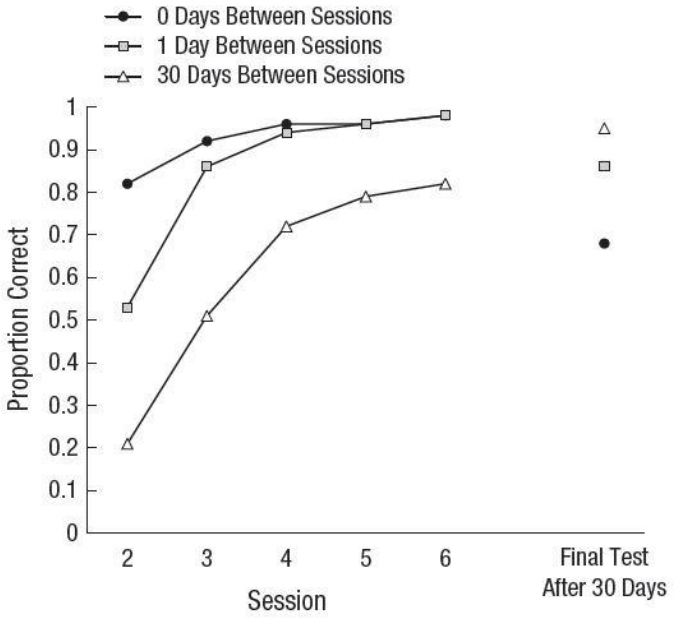
Without SoTL, Learning science…

- Conducts research on isolated phenomena under controlled conditions
- Grossly misjudges the complexity of the teaching and learning context
- Rarely tackles the challenge of trying to translate the concepts into general teaching and learning practice

# Translating Learning Research into Teaching Practice




Testing Effect
Roediger & Karpicke, 2006




Distributed Practice
Bahrick, 1979

# Gurung, Daniel, & Landrum (2012)

- Multi-site study of introductory psychology (N=454)
- Compared contributions of a wide range of factors such as the instructor, textbook, student attitude toward learning, and student study behavior on learning and achievement
- 23 variables to predict quiz score and self-rated learning
- Predictor variables accounted for 26% of quiz score variance and 36% of self-reported learning

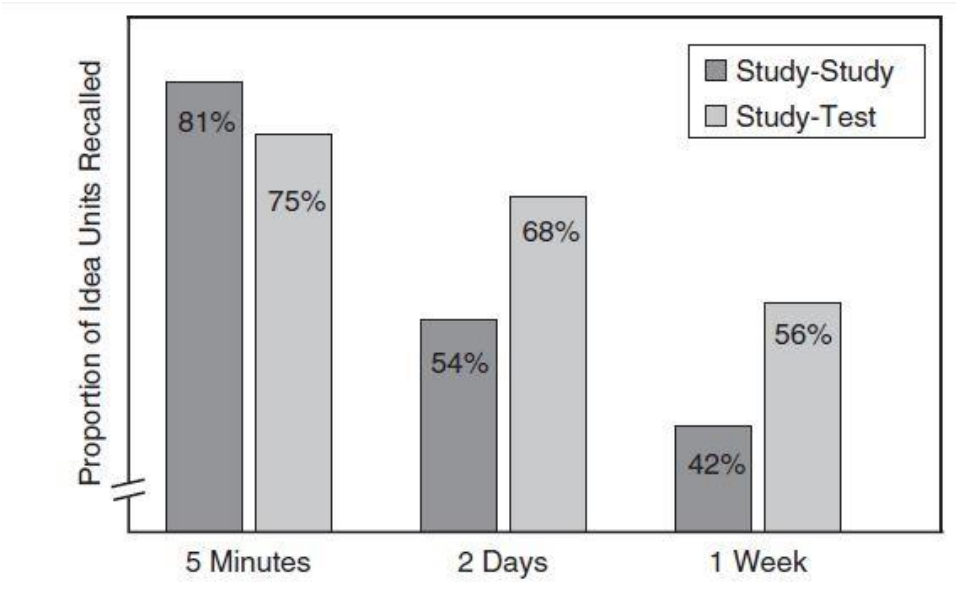
# Bartoszewski and Gurung (2015)

- Students use constellations of techniques without necessarily favoring one over the other
  - Practice testing x Exam score: r = 0.25**
  - Distributed practice x Exam score: r = 0.10
  - Professor x Exam score: r = 0.54**
- Student perceptions of the instructor and their sense of self-efficacy may be stronger predictors of exam scores than how the student studied.
- “Our results show that when research is conducted in the classroom, findings are not as neat and tidy as the lab suggests.”

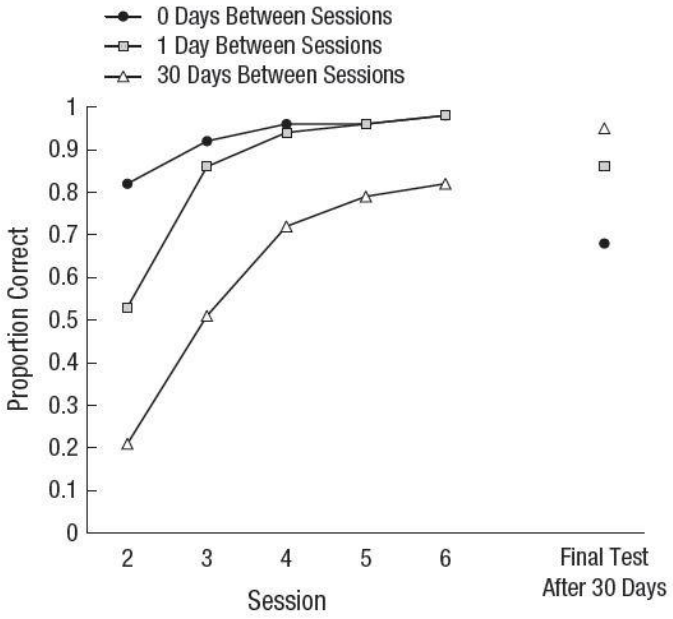
# Problematic Student Mindset

I realize it is the night before our second test. I'm writing now because if I don't than I will somehow convince myself everything is okay and then I won't ask for any help. Statistics is an ocean in which I am drowning. I have tried studying with friends and it has not been any help, first of all they are way ahead of me and when I say I don't understand they don't really get that I truly have no idea what is happening. I would love to stop by your office and ask a question, but I do not know the question to ask. I need help from someone who actually has the time, and energy to help me from the ground up. …Do you know of somehow I can get tutoring…

# Translating Learning Research into Teaching Practice




Roediger & Karpicke, 2006




Bahrick, 1979

# About Master Teachers

"[T]he people we analyzed have generally cobbled together from their own experiences working with students, conceptions of human learning that are remarkably similar to some ideas that have emerged in the research and theoretical literature on cognition, motivation, and human development."

Ken Bain,
*What the Best College Teachers Do* (2004, p. 25)

# Relevant Cognitive Research

- Mental Mindset
- Testing Effect
- Generation Effect
- Elaborative rehearsal
- Deep processing
- Interleaved practice
- Intrinsic Motivation
- Transfer appropriate processing
- Schema
- Self-referent processing
- Spaced practice
- Chunking
- Selective attention
- Mnemonics
- Encoding specificity
- Desirable Difficulty
- Cognitive load
- Automaticity
- Working Memory
- Examples
- Analogical reasoning
- Narrative processing
- Deliberate practice
- Expertise
- Interference

# If we know so much, why don't we use it to improve teaching and learning?

- Because we think teaching is presenting information
- Because the information from learning science isn't in a form that teachers and students can use
- To be useful, cognitive research has to be translated into the classroom context

# Useful teaching principles
## (Nilson, 2010)

- Meet students where they are
- Hold students to high expectations
- Make material relevant and valuable
- Demonstrate enthusiasm and passion
- Make learning multimodal
- Teach students how to learn and think about material
- Teachers create a classroom context in which learning can occur
- Cognitive principles can be translated to help create an optimal context for learning

# The Cognitive Challenges to Teaching
(that we know about thus far)

1) Student Mental Mindset
2) Metacognition and Self-regulation
3) Student Fear and Mistrust
4) Prior Knowledge
5) Misconceptions
6) Ineffective Learning Strategies
7) Transfer of Learning
8) Constraints of Selective Attention
9) Constraints of Mental Effort and Working Memory

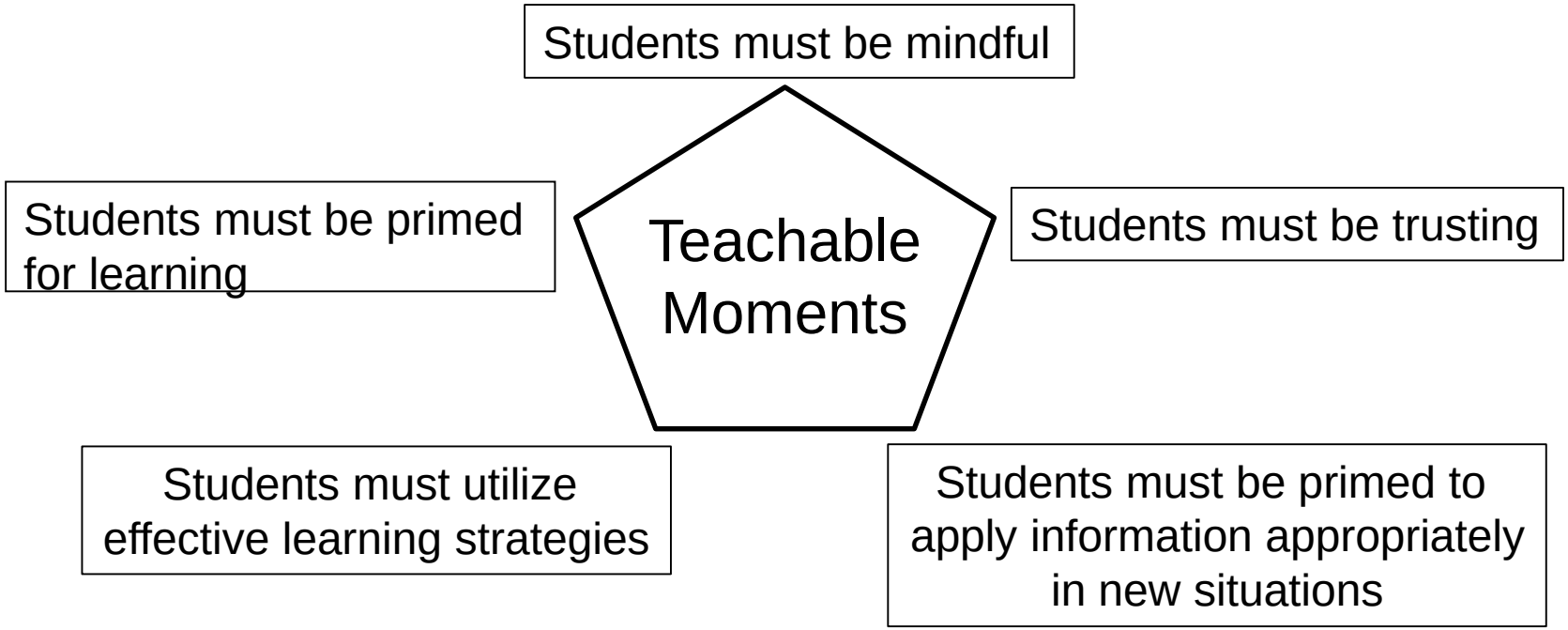
And they all interact with each other

# A good theory of teaching and learning…

- Addresses as many of these factors as possible
- Addresses them not as separate factors, but as a contextual framework that captures the dynamic, complex interaction among them
- Is in a form that can be used by both teachers and students.

# Teachable Moments

## The point at which learning becomes possible for a student



# Students must be mindful

- Sufficiently focused  attention
- Have and devote sufficient mental effort
  - Cognitive Load Theory
- Proper learning mindset
  - Beliefs about intelligence (Growth Mindset), self-efficacy, and time requirements

# Students must be trusting

- Accurate information; compelling evidence
- Believe the teacher is supportive of their learning
- Share the learning goal of the teacher
- Believe they are capable of the work
- Believe the work is worthwhile

# Students must utilize effective learning strategies

- Effective teaching involves more than presenting content, it involves showing students how to think about and remember that content
- Whole host of memory strategies; the best combine deep processing with how to think critically about a concept

# Students must be primed to apply information appropriately in new situations

- New knowledge is fragile and highly context specific
- Students often do not think beyond grades and the immediate class when thinking about information
- Inert knowledge

# Students must be primed for learning

- Appropriate knowledge activated
- Must be aware of a gap or shortcoming in knowledge
  - Metacognitive awareness
- Must believe that the missing knowledge is desirable to know
- Must recognize when they have better understanding
- Must realize the limitations of the new knowledge

# Clicker Questions vs. Formative Assessment






Brief, low stakes assessments that give students (and teachers) feedback BEFORE exams/high stake grades

Angelo, T. A. and K. P. Cross (1993). *Classroom Assessment Techniques: A Handbook for College Teachers,* Jossey-Bass.

# When does a clicker question become a formative assessment?

- When it is designed using cognitive principles to achieve a desired learning goal

# Goals of Formative Assessments

- Improve metacognition for students and teachers
- Address tenacious student misconceptions
- Illustrate desired level of understanding of knowledge for students
- Promote student learning and understanding
- Model thinking for understanding
- Promote rapport and trust

# A Test of Critical Thinking

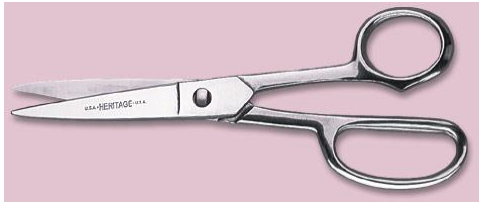
In the box, draw a picture of what the dressmaker used to cut the fabric

# Obviously Wrong Answers









# And the Correct Answer is:



The dressmaker used the scissors
to cut the cloth for the dress.

# How did critical thinking fail?

- Content was not enough
- Just telling students to “think critically” was not enough
- What could you do to ensure critical thinking?

# Formative Assessment

Which of the following would most likely be used by a dressmaker?

A.



B.



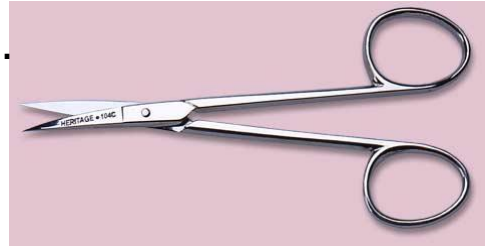

C.




D.



E.



If students don’t know what critical thinking looks like, they can’t accomplish it, even if they are capable of it

# A Teachable Moment Occurs When We…

- Become aware of gap or error in our knowledge
- See the value of correcting it
- Have a trusted source of accurate information
- Believe we can master new understanding given sufficient effort
- Have sufficient resources to attend to that source
- Have sufficient prior knowledge to comprehend information
- Recognize when we have mastered the new understanding
- Process new information for long-term recall
- Prime new information to be recalled appropriately and be preferred over prior knowledge

# Addressing Teacher Mindset:
## Cognitive Principles of Effective Teaching
Playlist: http://bit.ly/1LDovLp



# A Final Word

"In order to navigate the complexity in which a teacher works, it is not possible just to follow a recipe. As a teacher, you make adaptations. You must. The important question is: What adaptations do you make? You can do it by blind trial and error, but it would be much better if you knew what kinds of adaptations were needed, and why."

Nuthall (2007), p. 15
*The Hidden Lives of Learners*

# Take Home Message

- Psychology is in a unique position to advance teaching effectiveness
- To be effective, any teaching or study method must be grounded in the cognitive architecture of the mind.
- We must translate cognitive research into a form that is usable by teachers and students

# Thank you! Questions?

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