



The Science of Learning: An overview for GSIs

Professor Silvia A. Bunge
Department of Psychology &
Helen Wills Neuroscience Institute
UC Berkeley

Outline



Role of the GSI

Factors that
influence learning

Recommendations

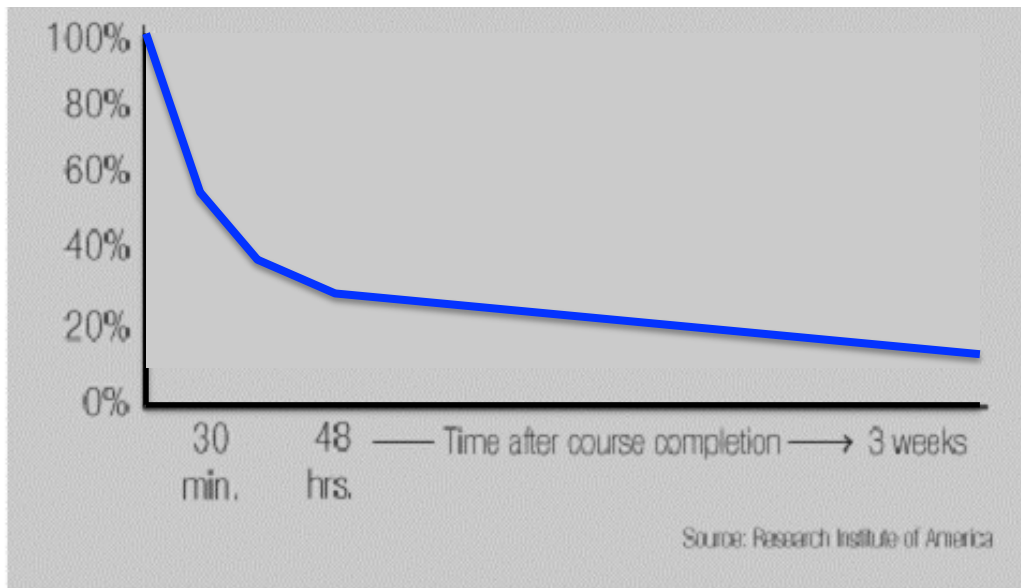
Undergrads' perceptions of GSIs vs. faculty: The good, the bad, & the ugly

GSI's role in student learning

- Faculty-like lectures/behavior are not what students *need* or necessarily *want* from you (Kendall & Schussler, 2012)
 - Professors and GSIs fulfill different roles
 - Students have clear expectations for each type of instructor

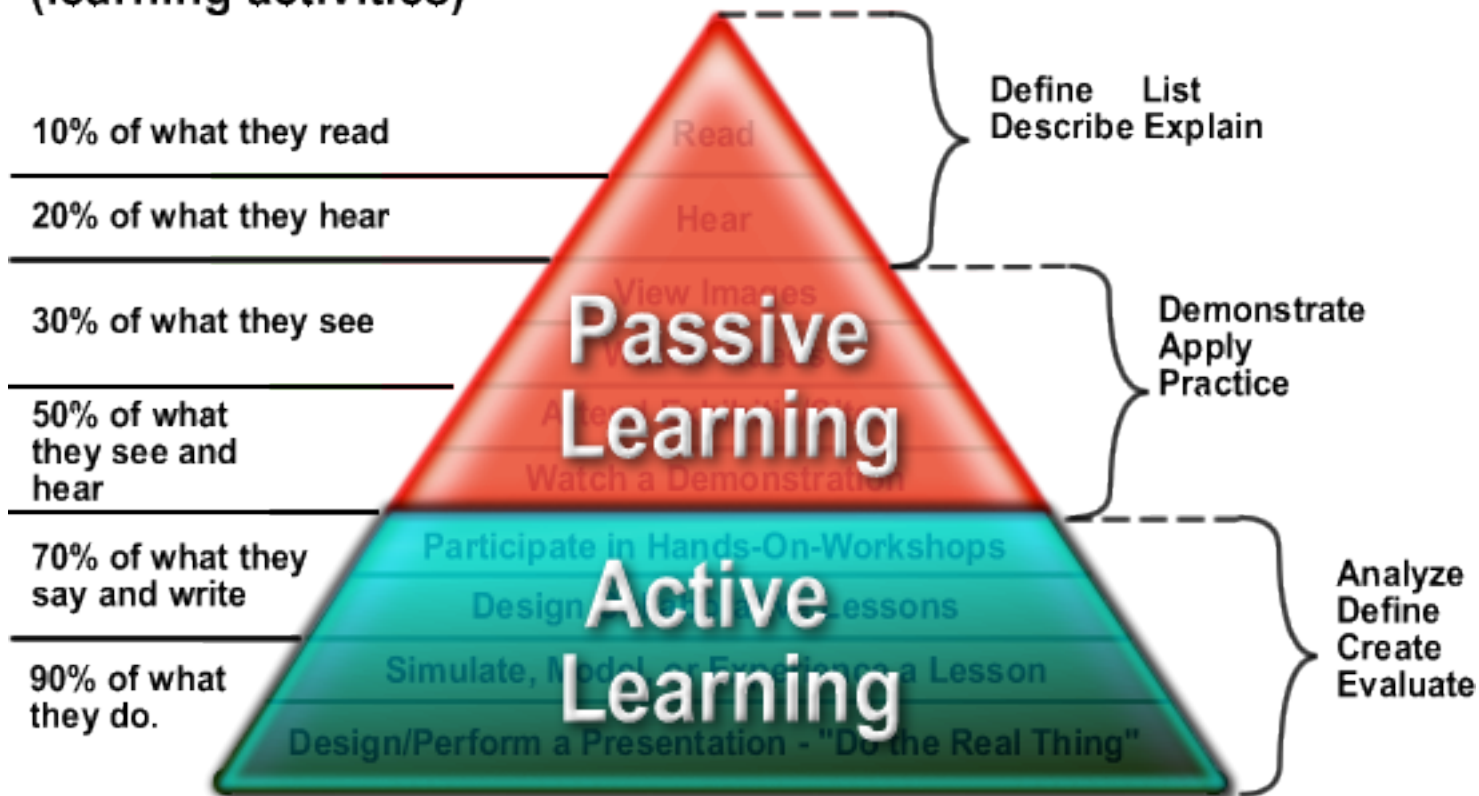


How much do students remember after a lecture?



People generally
remember...
(learning activities)

People are able to...
(learning outcomes)

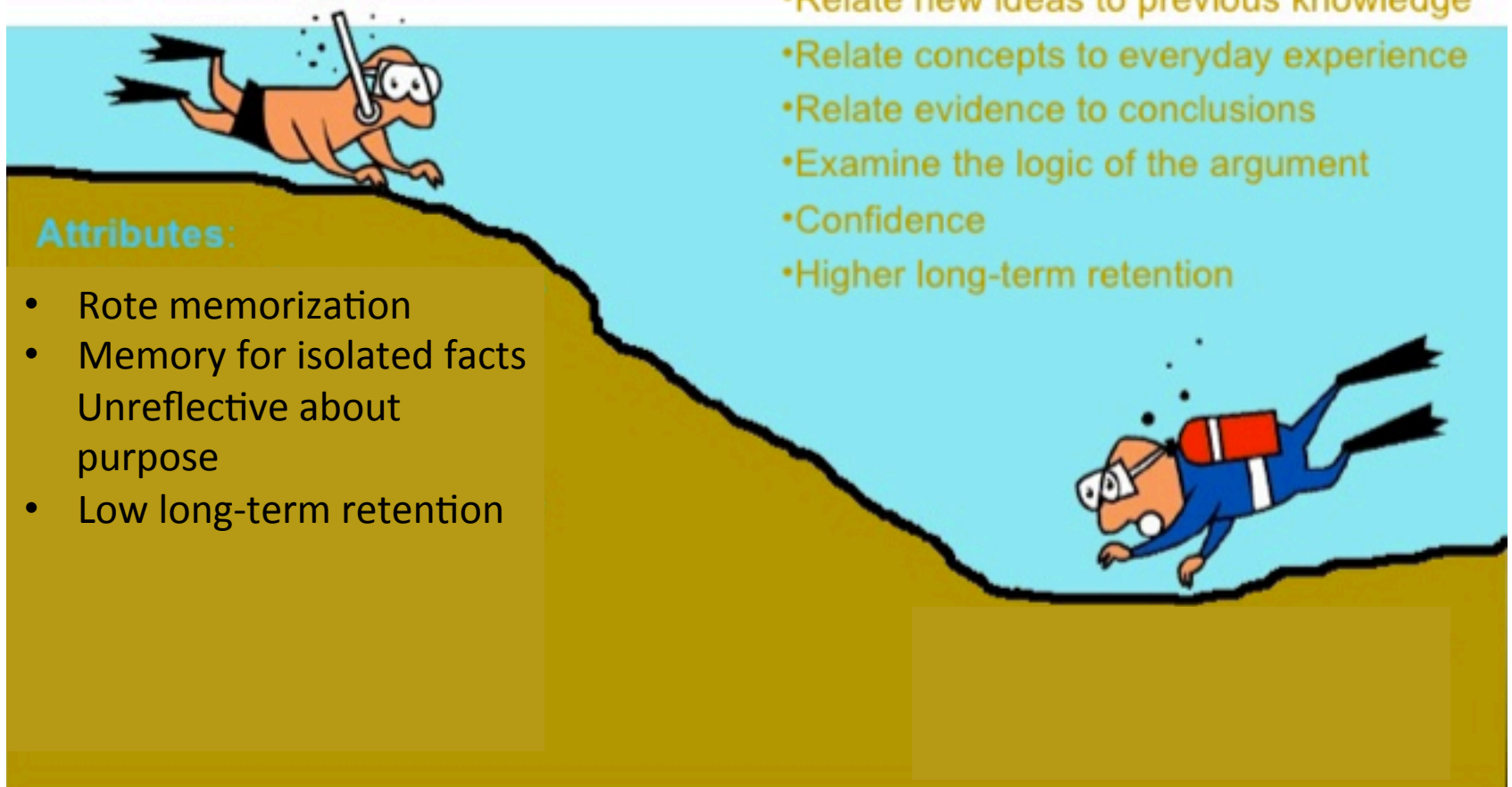


What role does a GSI play in student learning?



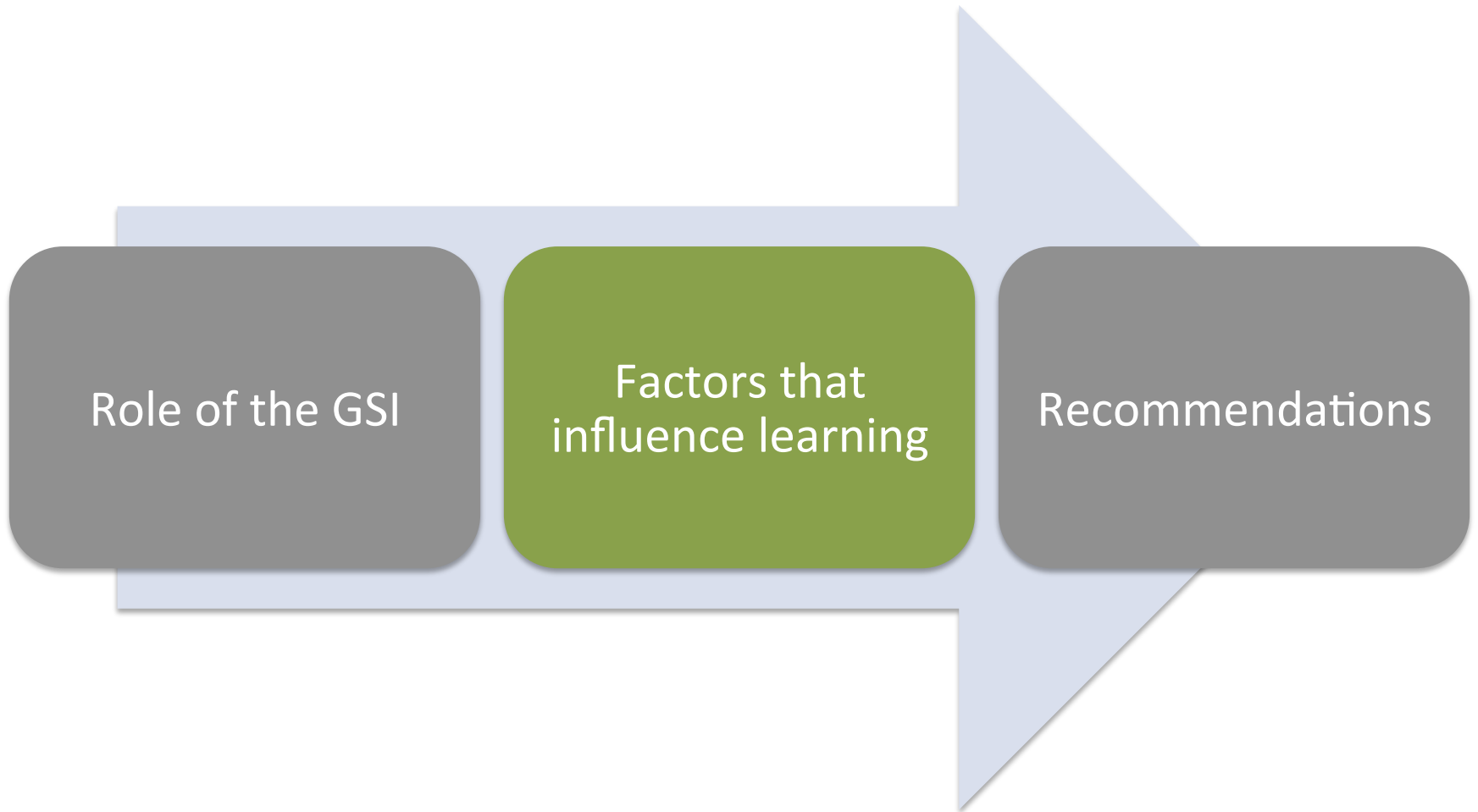
- Facilitator of learning rather than a purveyor of knowledge
 - “guide on the side”, not “sage on the stage”
- Section provides an opportunity to engage students in active learning, which promotes deeper understanding

Deep vs. surface learning



Courtesy of Rich James, Columbia University

Outline

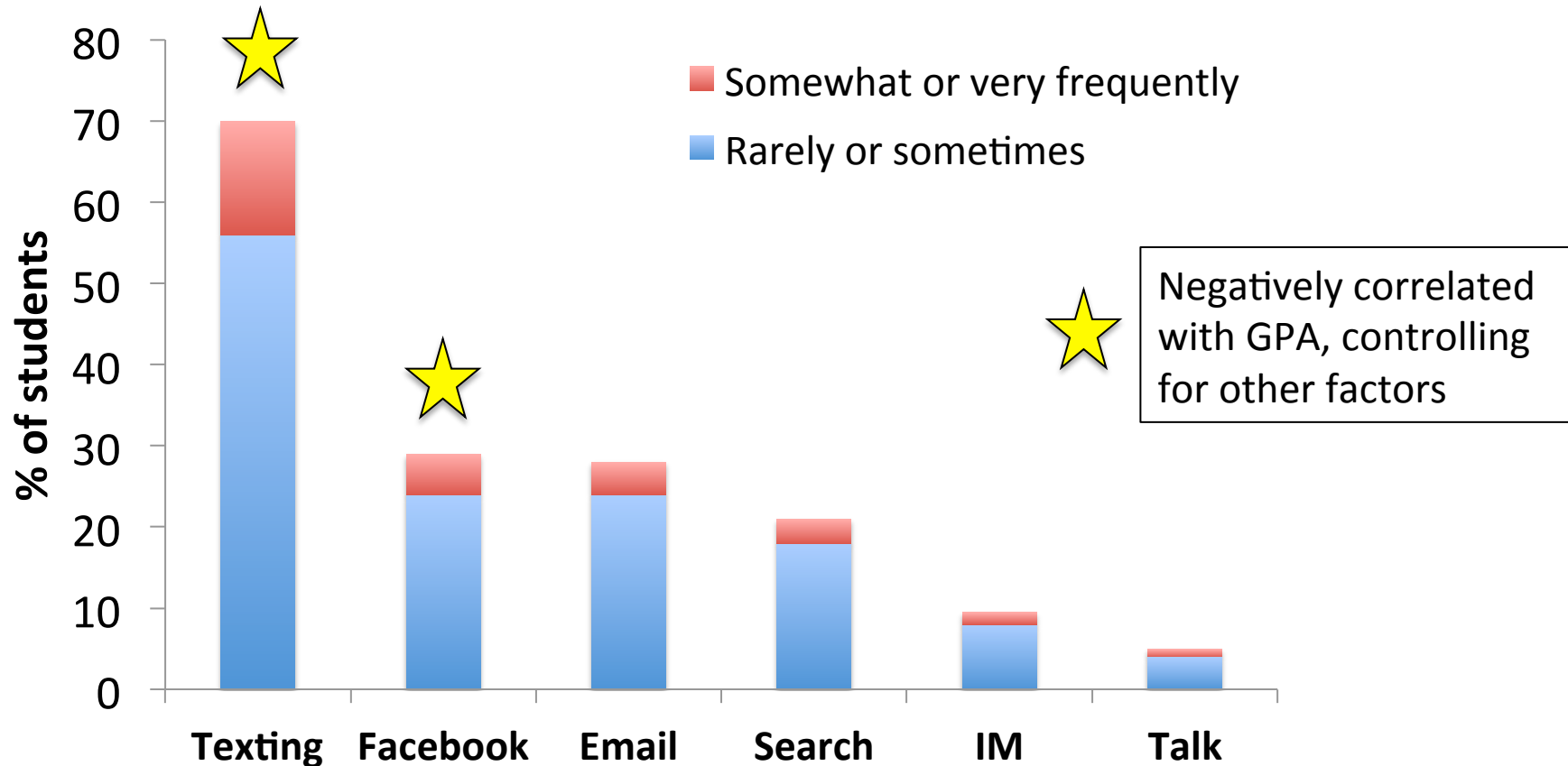


Factors that influence learning



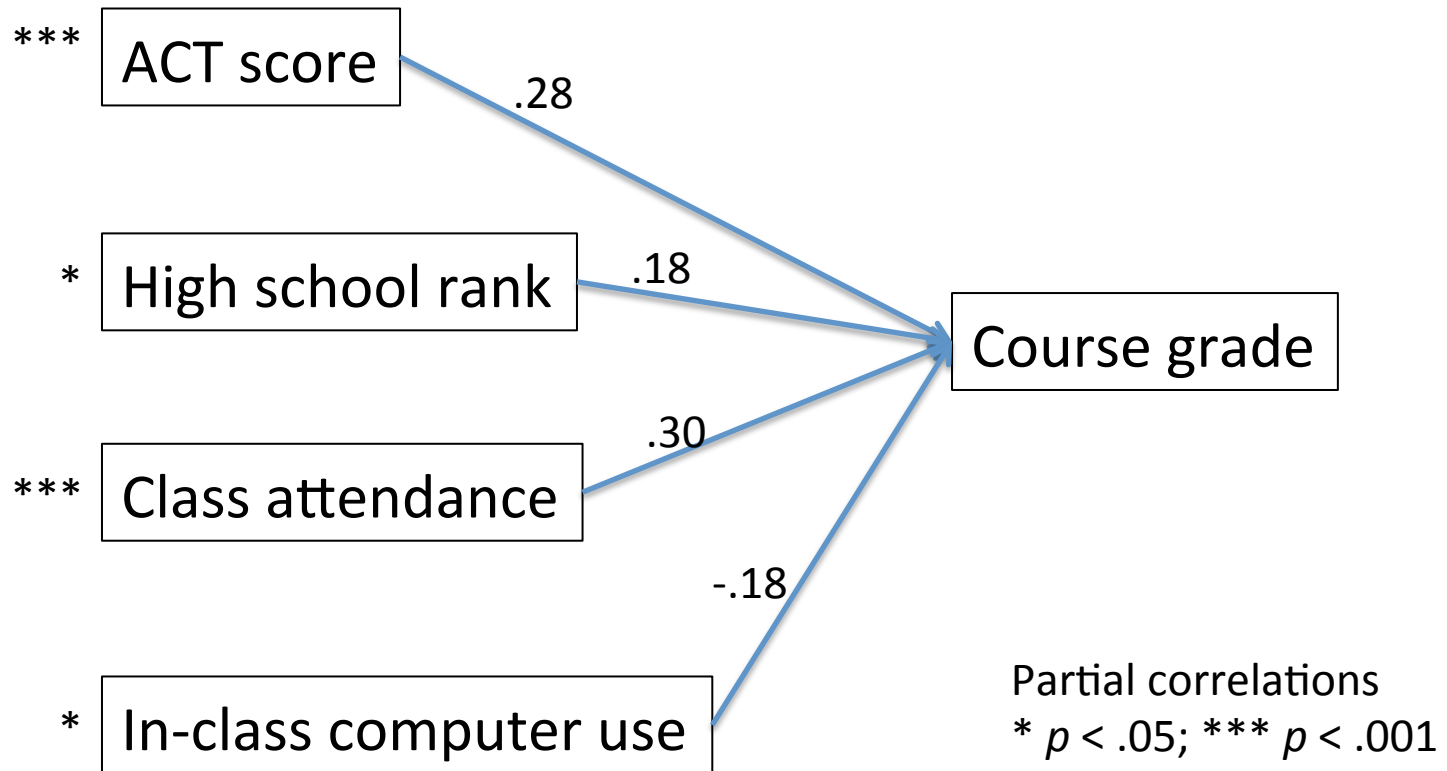
Self-reported multi-tasking during class

> 1800 college students at public universities in the northeast



Multi-tasking during class

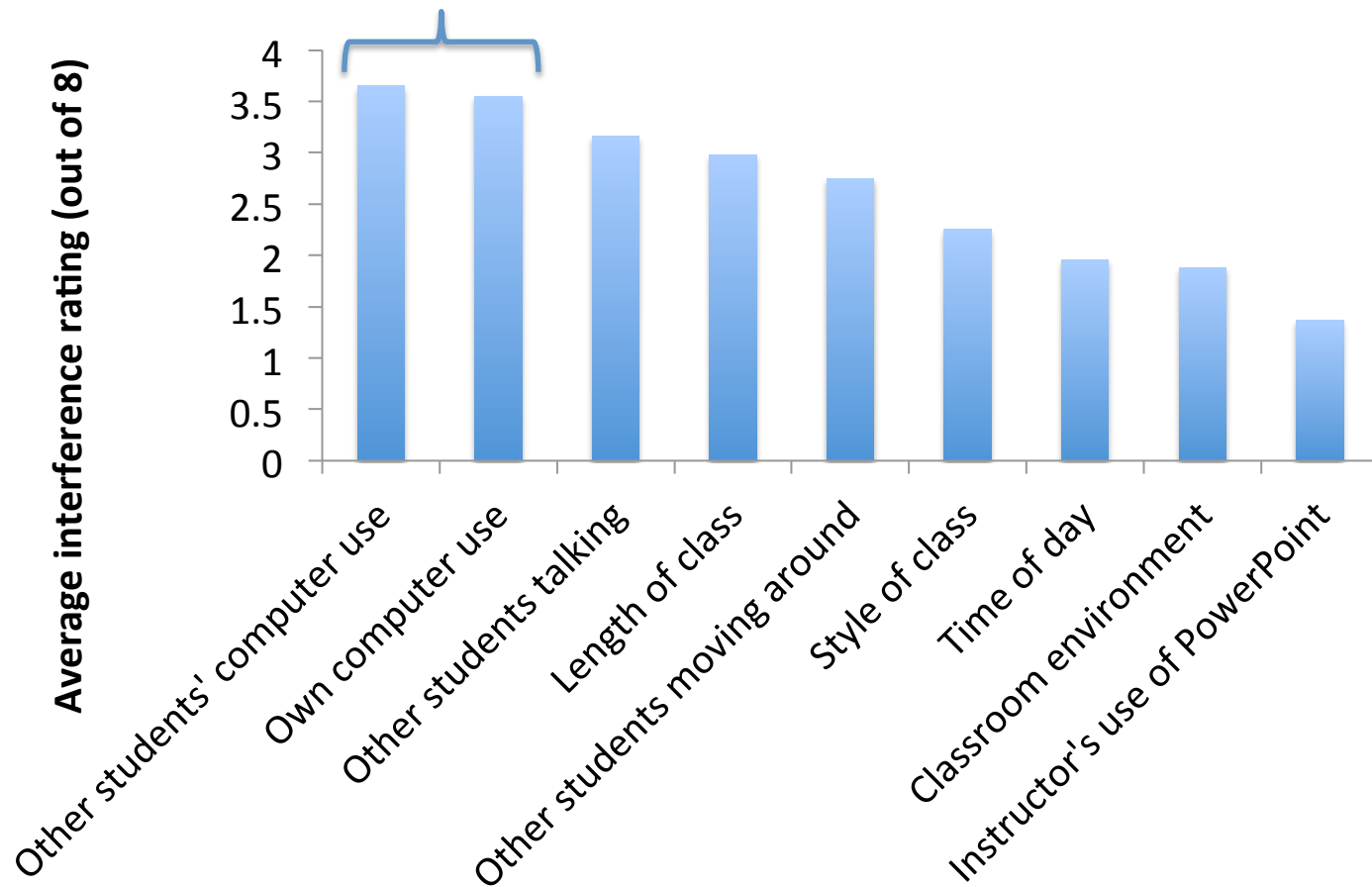
137 college students in General Psychology lecture course



Multi-tasking during class

(137 college students in General Psychology lecture course)

Student ratings re: factors that interfered with their ability to learn in class



Fried, *Computers & Education*, 2008

Note-taking: Laptop vs. notebook

- College students assigned to classrooms equipped with either laptops or notebooks
- Listened to the same lectures, instructed to use their usual note-taking strategy
- 30 min later, tested on factual recall and conceptual learning

Guess which students took more notes, and wrote down more of the lecture verbatim?

When tested on facts, who do you think did better?

When tested on ideas, who do you think did better?



Tied



Mueller and Oppenheimer, *Psychological Science*, 2014

Note-taking: Laptop vs. notebook

- Different students, same idea: College students assigned to classrooms equipped with either laptops or notebooks. Listened to the same lectures, instructed to use their usual note-taking strategy
- **When it came time to study for the exam**, whom do you think benefited more: students with the more detailed typewritten notes or those with the handwritten ones...

when tested on facts?



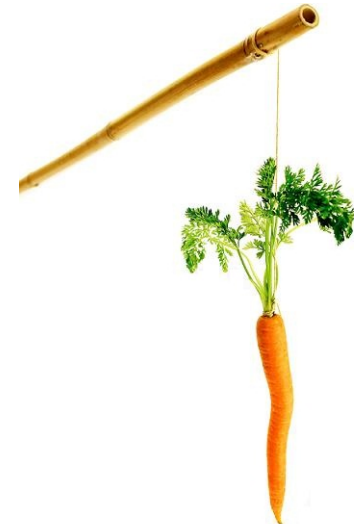
when tested on ideas?



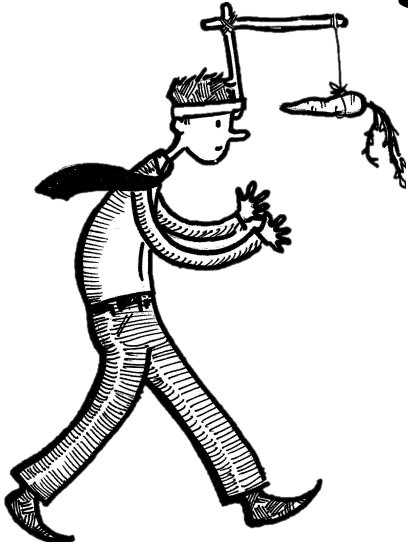
Even when laptop users were instructed not to transcribe lectures word for word, they kept doing it & their performance suffered. Pen & paper lends itself to deeper encoding.

Mueller and Oppenheimer, *Psychological Science*, 2014

Factors that influence learning



Students' motivations



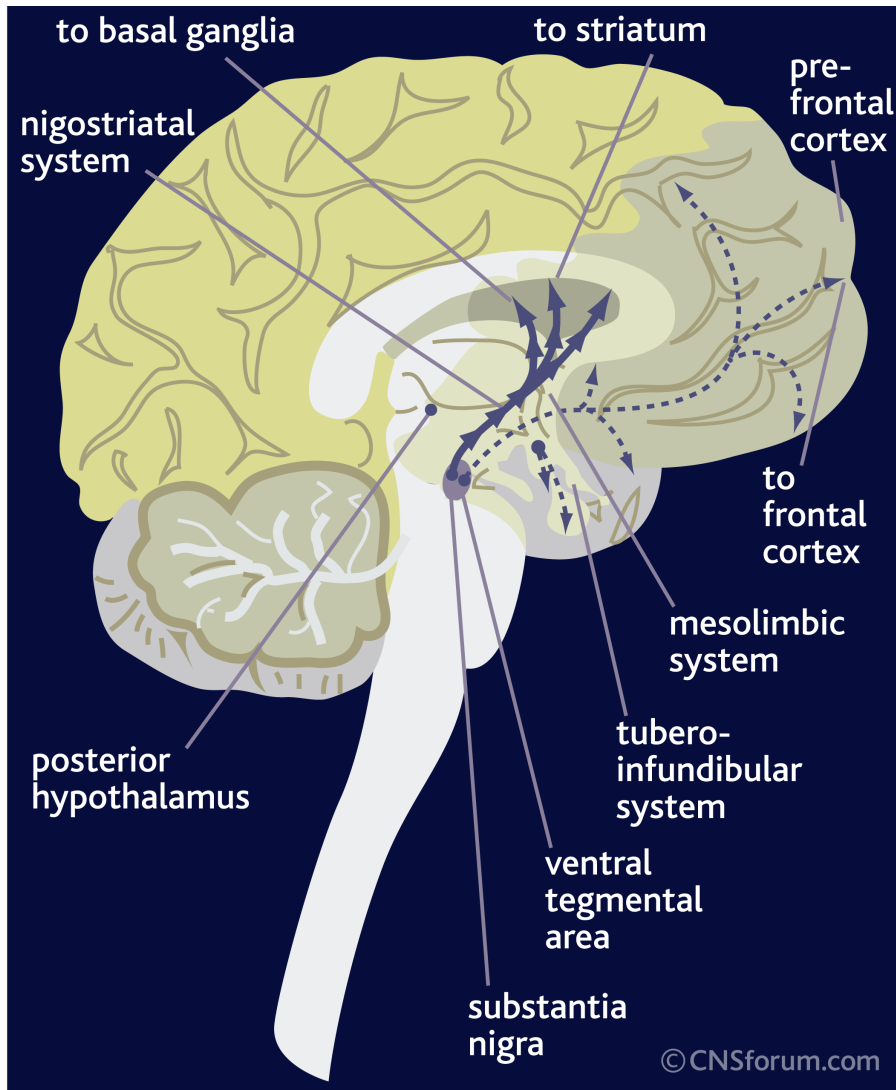
Extrinsic: Desire to achieve and/or fear of failure

Intrinsic: Motivated by interest

Being rewarded for something you enjoy can actually *dampen* intrinsic motivation

(Carol Dweck's book *Mindset*, Daniel Pink's TED talk)

Motivation is critical for learning



The anticipation of a future reward boosts dopamine signaling in the brain

This increase in dopamine...

1. Boosts working memory, enhancing performance over the short term
2. Reinforces learning, increasing the chances of exhibiting the previously rewarded behavior in the future

When an *extrinsic* reward is delivered over and over, it loses its value & is not as motivating anymore.

Students' motivations



Extrinsic: Desire to achieve and/or fear of failure

Intrinsic: Motivated by interest, curiosity

When students are *intrinsically* motivated to learn, they...

- enjoy the process more (by definition)
- show longer-term retention
- apply their knowledge more often (deep vs. surface learning)
- demonstrate higher academic achievement
- perceive themselves as more competent

Extrinsic rewards

But the occasional extrinsic reward can be helpful when...

- it's very difficult to make the material interesting (boring but important: e.g., definitions, anatomy...)
- rote memorization is needed, not critical thinking or creativity

Find or create games to help make this type of material palatable

Playful learning

- The ingredients of play are precisely those that *promote learning*:
 - *Intrinsically* motivating (fun)
 - Opportunity for novel experiences
 - Active engagement
 - Learning from others
 - Strengthening of social bonds
 - Stress reducing

Ideas for classroom activities:

<http://web.calstatela.edu/dept/chem/chem2/Active/main.htm>



Ideas for encouraging intrinsic motivation

- *Be playful* in section. This is not a waste of time, *as long as* the activities are geared towards learning the material.
- Be *enthusiastic*: this reminds students of how much fun learning can be if they enjoy the process rather than focusing on the endpoint
- Make clear why the course material is going to be useful to them (beyond getting a good grade)
- Make connections from course material to topics that interest them, via analogies or examples
- De-emphasize grades – and explain why (intrinsic motivation is more powerful than extrinsic)

Students' and instructors' mindsets



Carol Dweck
Stanford University

FIXED Mindset:

Intelligence is a static trait. Some students are smart & some are not

GROWTH Mindset:

Intelligence can be developed through effort & instruction

It pays to have a growth mindset



Carol Dweck
Stanford University

- Significantly raises students' grades and achievement test scores (Blackwell, Trzesniewski, & Dweck, 2007; Good, Aronson, & Inzlicht, 2003)
- Helps underrepresented students remain engaged and achieve well, even in the face of stereotypes (Blackwell et al., 2007; Good et al., 2003; Aronson, Fried, & Good, 2002)
- Creates a love of learning and a resilience that is essential for great accomplishment

Factors that influence learning



Sleep

Colleges Open Their Eyes: ZZZs Are Key To GPA



By [JUSTIN POPE](#) : 08/30/12 09:33 PM ET EDT : [AP](#)

“campus life [is like] a giant laboratory experiment designed for maximum sleep deprivation: irregular schedules, newfound freedom, endless social interaction, loud and crowded housing, late-night exercise and food washed down by booze, coffee and energy drinks.”

http://www.huffingtonpost.com/2012/08/31/colleges-open-their-eyes-_n_1846148.html

Prof. Matthew Walker and Allison Harvey, Department of Psychology



Cardiovascular Exercise

- Increased blood flow to the brain
 - Brings O₂, glucose, nutrients to brain cells
- Stimulates the growth of new cells in the hippocampus, a brain structure that is critical for memory
- Stimulates the growth of connections between neurons in the brain
- Over time, improves resilience to stress (less stress hormone released)
- **Short-term effects on mood, stress, concentration, and memory that last for several hours**
- **Long-term benefits evident in as little as 6 months**

Factors that influence learning



Cognitive enhancer



- Improves arousal, attention, and processing speed
- New study in *Nature Neuroscience* (2014) shows that it improves memory retention when taken immediately *after* learning



Outline



Role of the GSI

Factors that
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Recommendations

Capitalizing on students' perceptions of GSIs

- Less intimidating
- Approachable
- Understanding

Anxiety impedes learning.
Rapport with instructor boosts
motivation.

- Enthusiastic

GSI enthusiasm increases the likelihood
of student retention in the sciences
(O'Neal et al., *J Coll Sci Teach*, 2007)

- Flexible
- Informal

Can create an atmosphere that is
conducive to playful learning & inquiry

Handling *negative* perceptions of GSIs

- **Hesitant, Nervous, Uncertain**

Solutions?

- **Take control** over your own section
 - Students sometimes perceive GSIs as not being in control of section material, and of merely carrying out the job. If you feel a sense of ownership & pride in how you run your section, you will be more enthusiastic and confident
- Remember, you're the "guide on the side", not the "sage on the stage"
 - If you don't feel pressure to **know everything**, you'll probably be...
 - less nervous
 - less likely to *over-prepare*
 - more likely to admit when you don't have the answer
 - more motivation to encourage active inquiry

Adopt good teaching practices from the beginning

- Standard teaching practices are not very effective. We've known this for years, but inertia is powerful
- Leading section is your opportunity to develop *good* teaching habits, discovering ways to promote active learning & deepen understanding
- It's still important to practice standard classroom instruction, but this is best done via guest lectures (a great way to build a strong teaching portfolio)

Make sure your own needs are met before you step into the classroom



Are you getting enough sleep, exercise, and down-time?

Final recommendations



- Replace section lectures with activities
- Ask students to put away their digital devices
- Adopt & promote a growth mindset
- Adopt & model healthy habits

