Forming the Ideal Learner

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CLEMSON
PHYSICS AND ASTRONOMY

The Ideal Learner

- Is curious.
- Pursues understanding.
- Recognize that all learning is not fun.
- Accepts failure.
- Personalizes knowledge.
- Has many questions.
- Shares their knowledge.

WABISABI LEARNING

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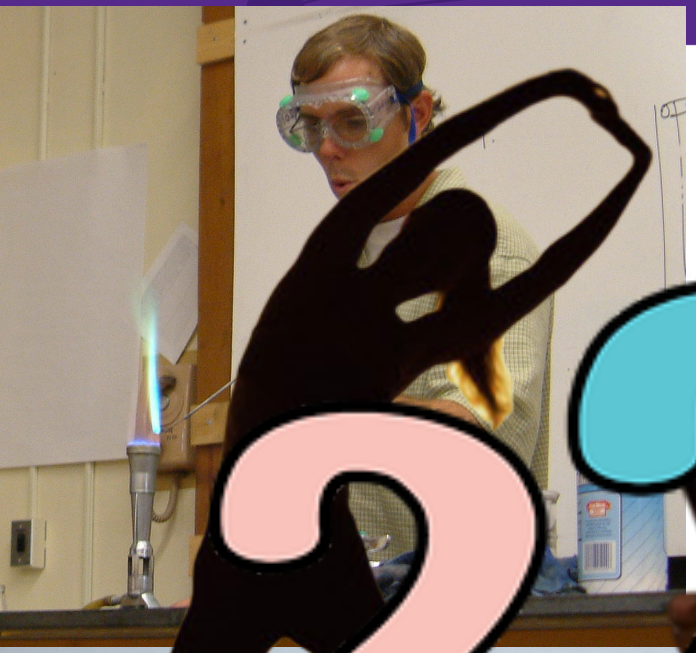
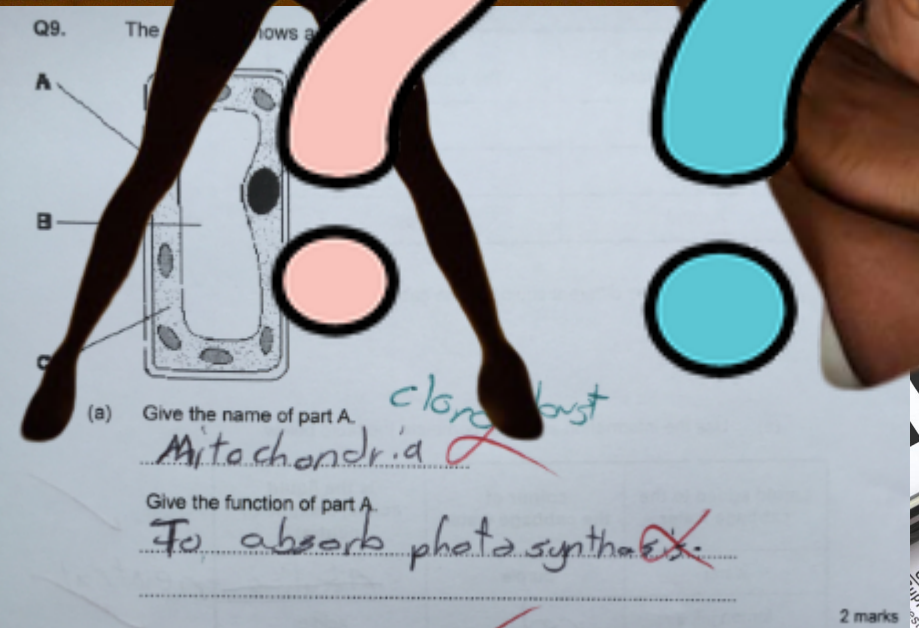
Many Competing Priorities





We need to teach them to learn

- They already know how.
- We just need to guide them….

Chemical learning

- When we are busy we tend to cram learning into one large chunk.
- Chemical learning is VERY RAPID.
- Chemical signals are transferred between neurons.
- Triggers actions and reactions.
- DOES NOT REFLECT LONG TERM LEARNING.

Taken From: After watching this, your brain will not be the same | Lara Boyd | TEDxVancouver

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Structural learning

- But the next time you try to juggle…you are not good yet.
- The structure of the brain can actually be changed by making new neural pathways.
- This occurs through **repetition** over **time**.

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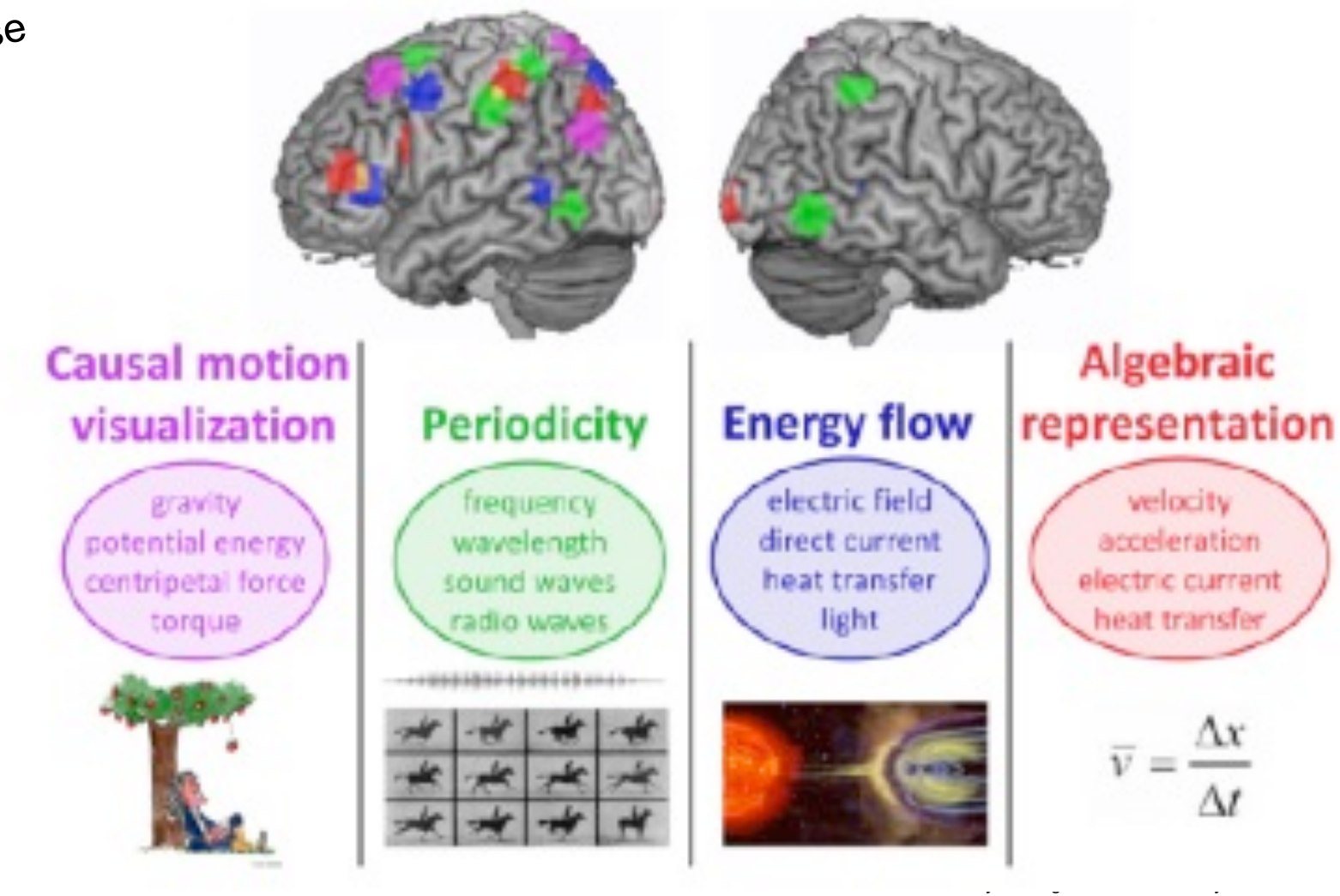
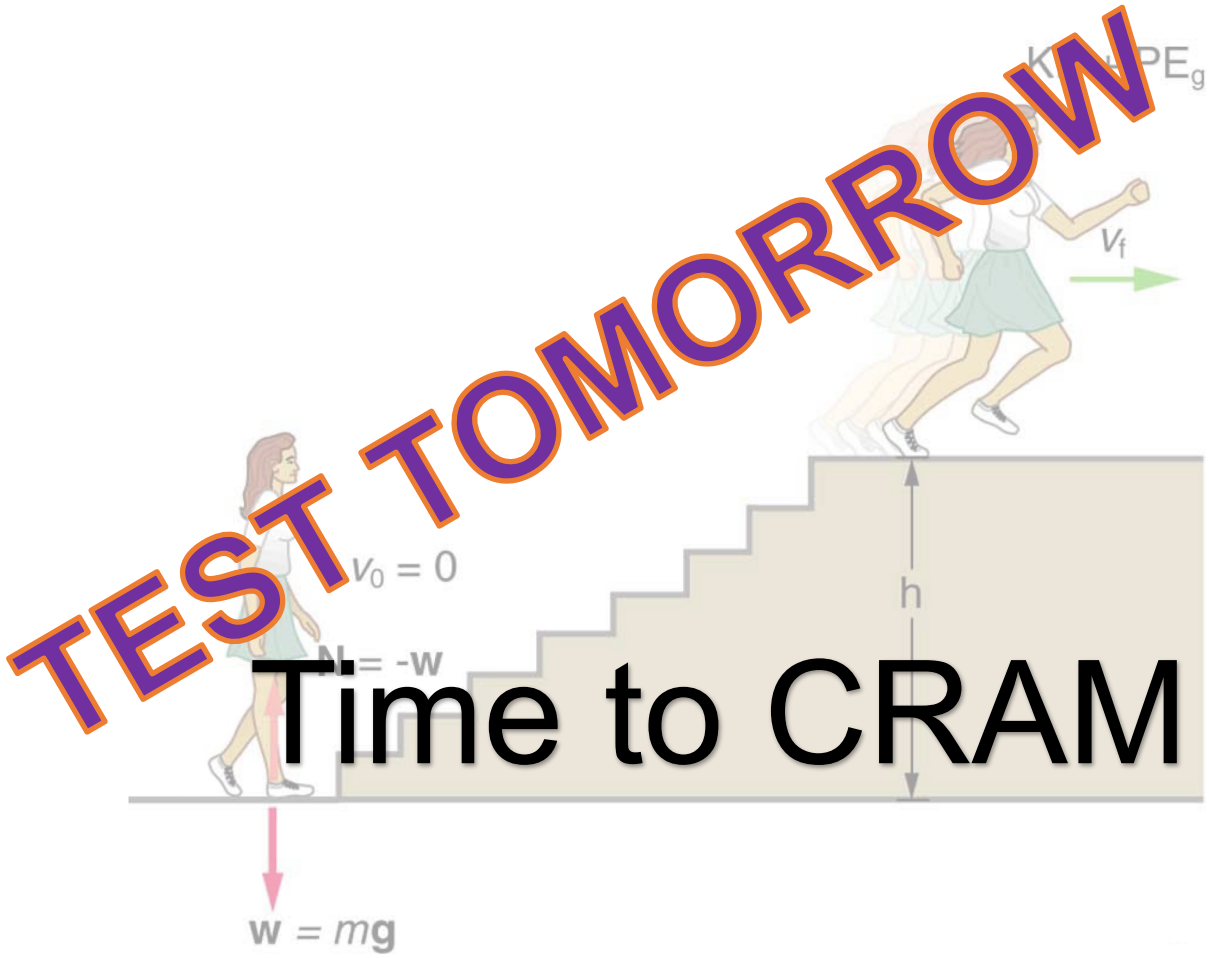
FMRI

Our brains repurpose existing neural networks!



APA citation: Scientists discover how the brain repurposes itself to learn scientific concepts (2016, April 12) retrieved 21 September 2019 from https://medicalxpress.com/news/2016-04-scientists-brain-repurposes-scientific-concepts.html

Cramming is ineffective



- Studying ONLY the night before shows poor comprehension on exams.
- Low risk formative assessments due throughout the week provide students an opportunity to gradually build knowledge.
- Understanding is strengthened through repeated contact with the material.

Low risk formative assessment

Multiple short assignments encourage ongoing engagement.

Extra Credit

Homework

In Class Participation

Class Preparation

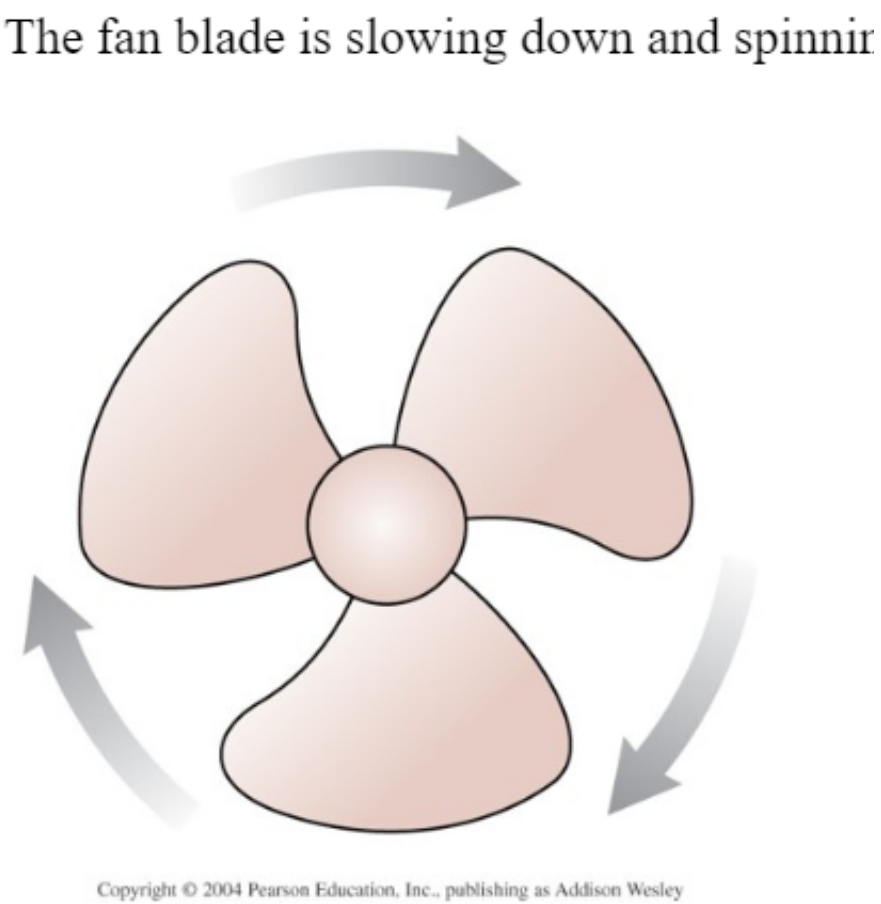
Review

Monday	Tuesday	Wednesday	Thursday	Friday
January 6	7 No class	8	9 Ch 16	10
13	14 Ch 16	15 P17A	16 Ch 17	17 HW 16 due
20 MLK Jr.	21 P17B CH 17	22 MCS due P18A	23 Ch 18	24 HW 17 due
27 Ptest1	28 **Review**	29 Thermometer	30 **Test 1** Ch 16-18	31 HW 18 due
February 3 P19A	4 Ch 19	5 P19B Battery	6 Ch 19	7 HW 19 due
10 P20A	11 Ch 20	12 P20B Bend Water	13 Ch20	14 HW 20 due
17 P21A	18 Ch 21	19 Ptest2	20 Ch 22	21 HW 21 due
24	25 **Review**	26	27 **Test 2** Ch 19-21	28
March 2 P22A & P22B	3 Ch 22	4 P23A Ferrofluid	5 Ch 23	6 HW 22 due
9 P25A	10 Ch 23/25	11 P25B WorldofEnergy	12 Ch 25	13 HW 23 due
16 Spring Break	17 Spring Break	18 Spring Break	19 Spring Break	20 Spring Break
23 Ptest3	24 **Review**	25 Speed of Light	26 **Test 3** Ch 22, 23, 25	27 HW 25 due
30 P26A	31 Ch 26	April 1 P26B	2 Ch 26/28	3 HW 26 due

Engaging them little by little…

Class Preparation

- 10% of Course grade
- Short video introducing concept then scaffolded questions
- Introduces basics of what will be in lecture the following day.



Engaging them little by little…

Class Participation
10% of Course Grade

- Keeps students engaged in the material of part of their grade is tied to it.
- Gives them a break of focus.
- Allows peer interaction.

Assuming the period is ?, Determine the length of the rope these men are using.

a. Impossible to determine
b. 2m
c. 3m
d. 4m
e. 6m

$$T = 2\pi\sqrt{\frac{L}{g}}$$

$$L = \left(\frac{T}{2\pi}\right)^2 g$$

Roxy proposes that the period of the swing should be changing as more guys pile onto the swing. If her assertion is true, it is because the effective length of the string is _____ and the period is subsequently _____.

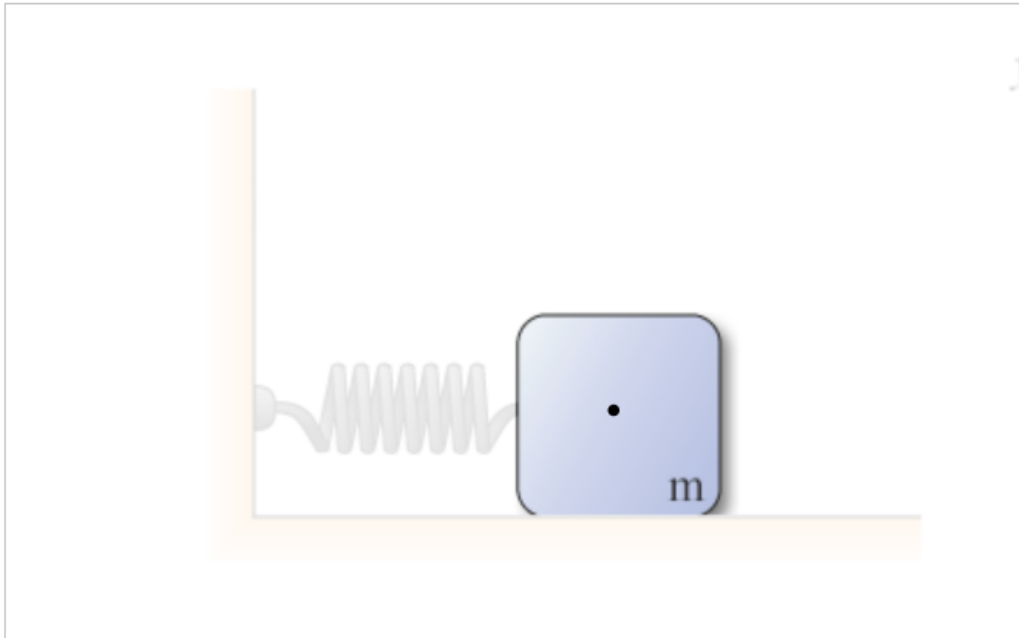
a. increasing, increasing
b. increasing, decreasing
c. decreasing, increasing
d. decreasing, decreasing

D

$$T = 2\pi\sqrt{\frac{L}{g}}$$

Engaging them little by little…

25% Part (a) Assuming the block is released from the initial position and be
draw the Free Body Diagram for the block. Use *Fsp* as the spring force. If necessary
friction.



- Homework is 20% of course grade.
- Student led discussion board allows for dialog on problems.
- Homework occurs after class preparation, in class participation quizzing and lecture…formative but a bit higher stakes.
- Multiple attempts allow for mistakes and learning.

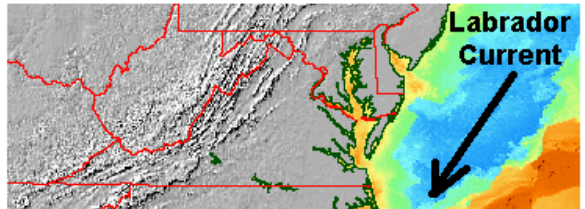
Engaging them little by little…

- Test review.
- Just a participation grade.
- Critical thinking activity based on real world situations and data.

Like most late 19th-century lighthouses, Cape Hatteras used a Fresnel lens, about 2500 lbs of glass and bronze. The assembly was
projected the light and 24 bulls eye lenses provided the flashes. Let's model the lens as a hollow sphere. Calculate the rotational kin
the system rotates at ½ rpm. You will want to model this as a thin walled sphere.

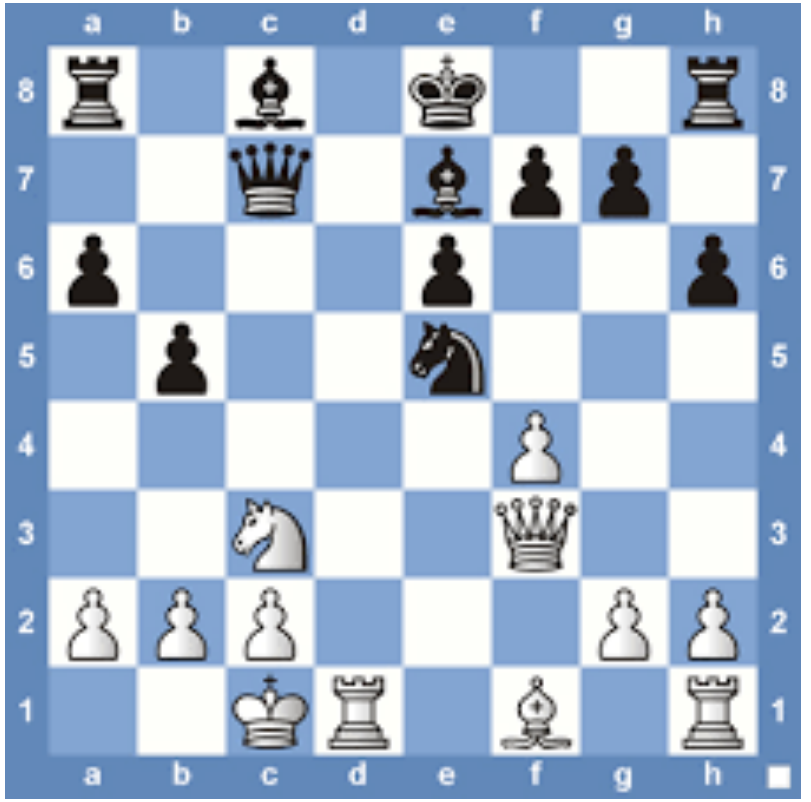
- 154 kgm^2/s^2
- 197 kgm^2/s^2
- 3.47 kgm^2/s^2
- 4.28 kgm^2/s^2

The outer Banks of North Carolina are a series of Barrier Island where the Labrador Current and the Gulf Stream meet. The ocean
the barrier islands as well as other sand banks further out from shore. The Gulf Stream propels boats along, making if faster to trav
straight line path to the destination. Due to the accumulation of sand banks along this much traveled route, light houses were not c
to sailors before the invention of sonar. Therefore, Light Boats were deployed onto sand banks in the ocean as a caution to sailors.



Extra Credit?

- A 1973 study by Chase and Simon investigated memory and chess.
- Chess experts and amateurs were shown images of games in progress and asked to recall the location of the pieces.
- Experts did great, amateurs did poorly.
- Experts could see the “why” behind the position of the pieces.



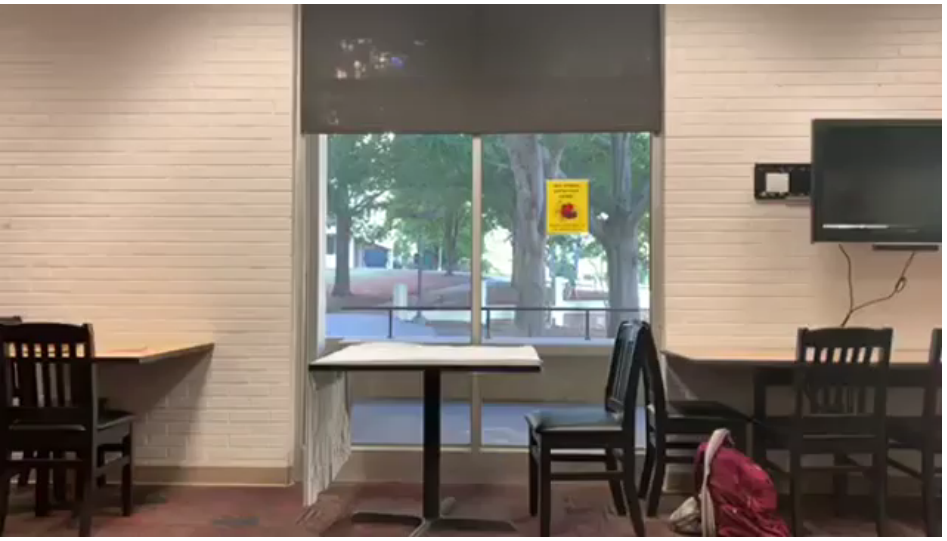
https://doi.org/10.1016/B978-0-12-170150-5.50011-1

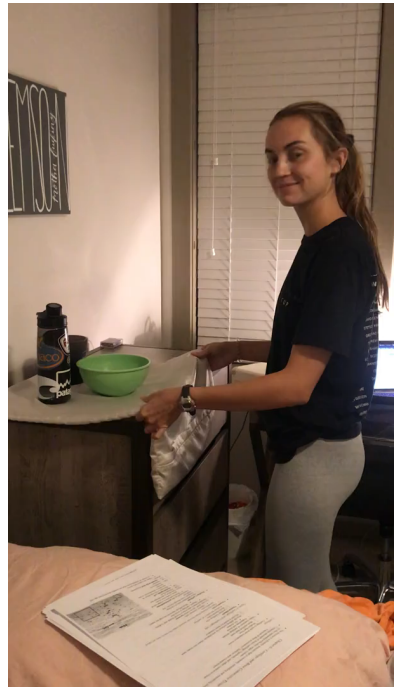
Extra Credit?

- The pieces were then randomly arranged and participants asked to recall location.
- Experts and amateurs both did equally poor jobs.
- There was no meaning in the way the pieces were arranged.

Engaging them little by little…

Extra Credit
1% added to course grade
Makes the topic meaningful.





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Engaging them little by little…

- Old tests are provided but the work on these is not for credit!
- Testing yourself beats out other study methods…even re-reading and reviewing notes.
- Testing shows how well you can use what you have learned.

20. George of the Jungle swings on a muscadine vine that is 8 m long. What is the tension in the vine if George, whose mass is 80 kg, is moving at 2.5 m/s when the vine is vertical?

a. 950 N
b. 850 N
c. 740 N
d. 1000 N
e. 60N

ANSWER: B

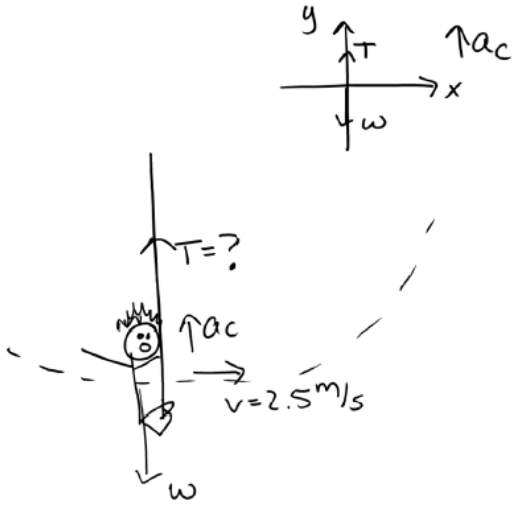
$$a_c = \frac{v^2}{r} = \frac{\left(2.5\frac{m}{s}\right)^2}{8m} = 0.78\frac{m}{s^2}$$

$$\Sigma F_y = ma_y$$

$$T - w = ma_c$$

$$T = ma_c + w$$

$$T = 80\ kg\left(0.78\frac{m}{s^2}\right) + (80\ kg)\left(9.8\frac{m}{s^2}\right) = 850\ N$$



https://psychcentral.com/news/2011/01/25/to-really-learn-testing-beats-more-study/22891.html?utm_source=zapier.com&utm_medium=referral&utm_campaign=zapier

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Engaging them little by little…

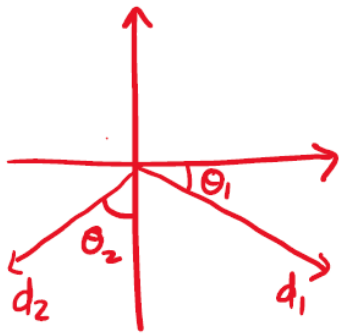
14. Amar walks 8.0 m in a direction 30° south of east. He then walks 4.0 m in a direction 60° west of south. Where does he end up?
A) 6.9 m at an angle 60° east of south.
B) 9.5 m at an angle 60° south of east.
C) 6.9 m at an angle 30° east of south.
D) 9.5 m at an angle 30° south of east.
E) 9.5 m at an angle 30° east of south.
ANSWER: C

$R_x = d_1 cos\,\theta_1 - d_2 sin\theta_2 = 8cos\,30 - 4sin60 = 3.46m$

$R_y = -d_1 sin\theta_1 - d_2 cos\theta_2 = -8sin30 - 4cos60 = -6$

$R = \sqrt{R_x^2 + R_y^2}$ =6.9m

$\theta = \tan^{-1}\frac{R_y}{R_x} = \tan^{-1}\frac{6}{3.46} = 60^0\ S\ of\ E\ or\ 30^o E\ of\ S$



- Only a benefit the first time through.
- Looking at the answers then taking the exam does not help.
- Find out what you do not know, study then take another test to find out if you filled the knowledge gap.

Lots of work = many complaints?

- Surprisingly…no.
- Explaining the reasoning behind the assignments from the neuroplasticity of our brain to the difference between chemical and structural learning allows students to **buy in** to their own learning.
- Students appreciate that you have already thought out the best path to their success.

The Ideal Learner

Bright minds with competing priorities.

Teachers that care.

Minds guided in best practices.

Successfully learn whatever is thrown their way.

Ready to impact the world.