1. Get onto the Wifi (see instructions on table)

2. Go to: http://LCatalytics.com

3. Create student account with signup code DEMO

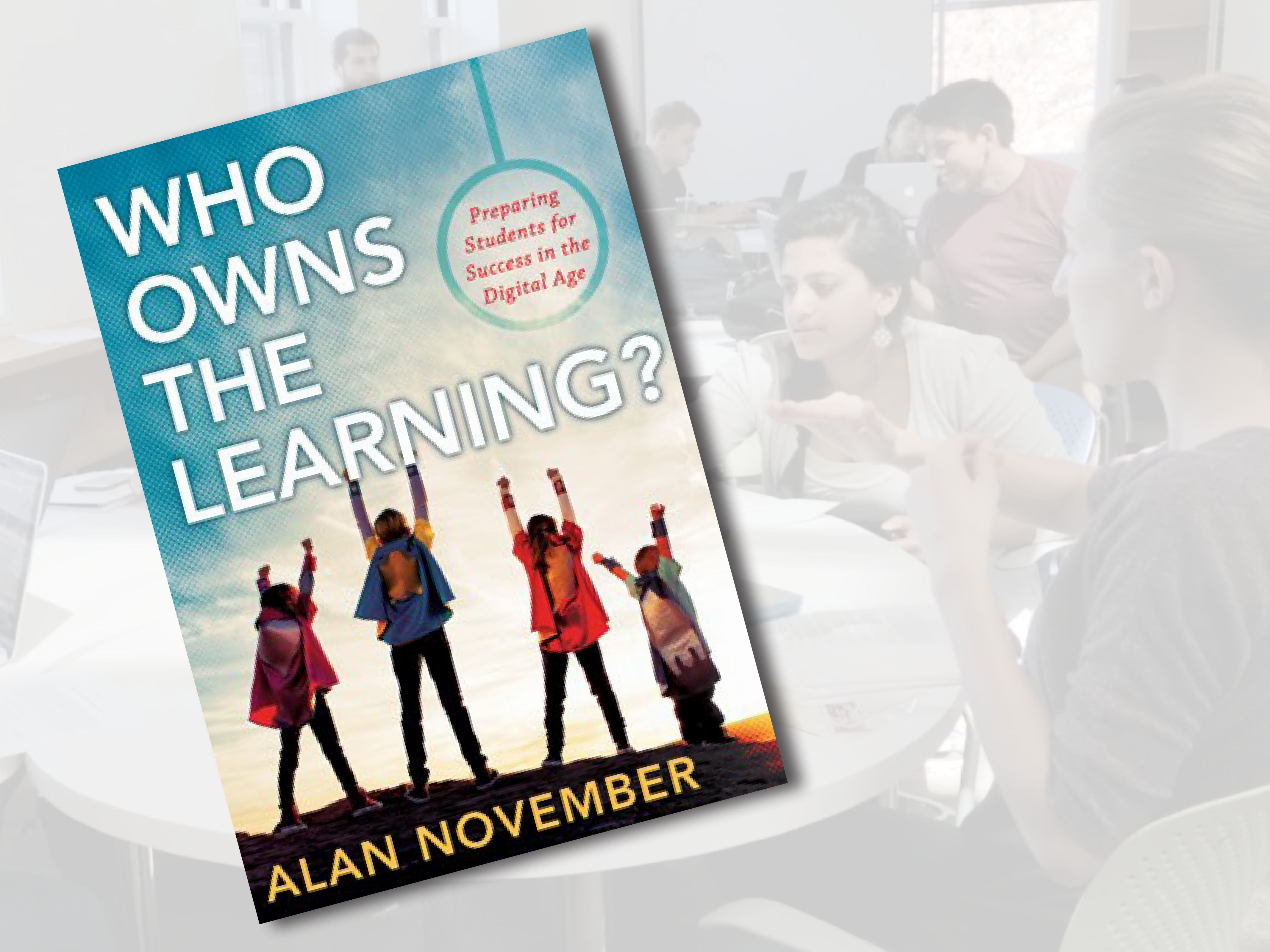
4. Join session 1234567

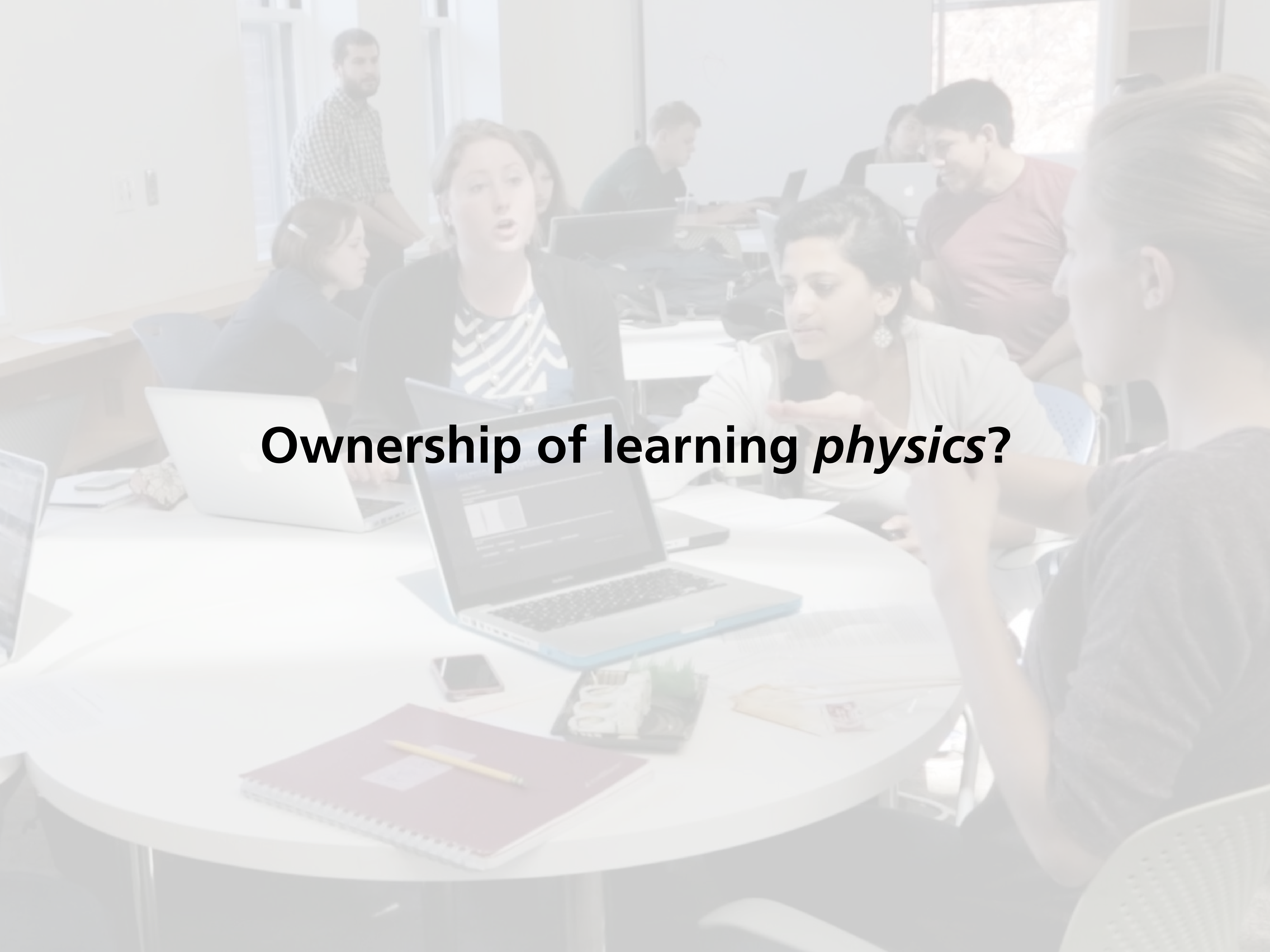
Flat space, deep learning

1ère journée de l'innovation pédagogique
Université de Lausanne
Lausanne, Suisse, 28 novembre 2013

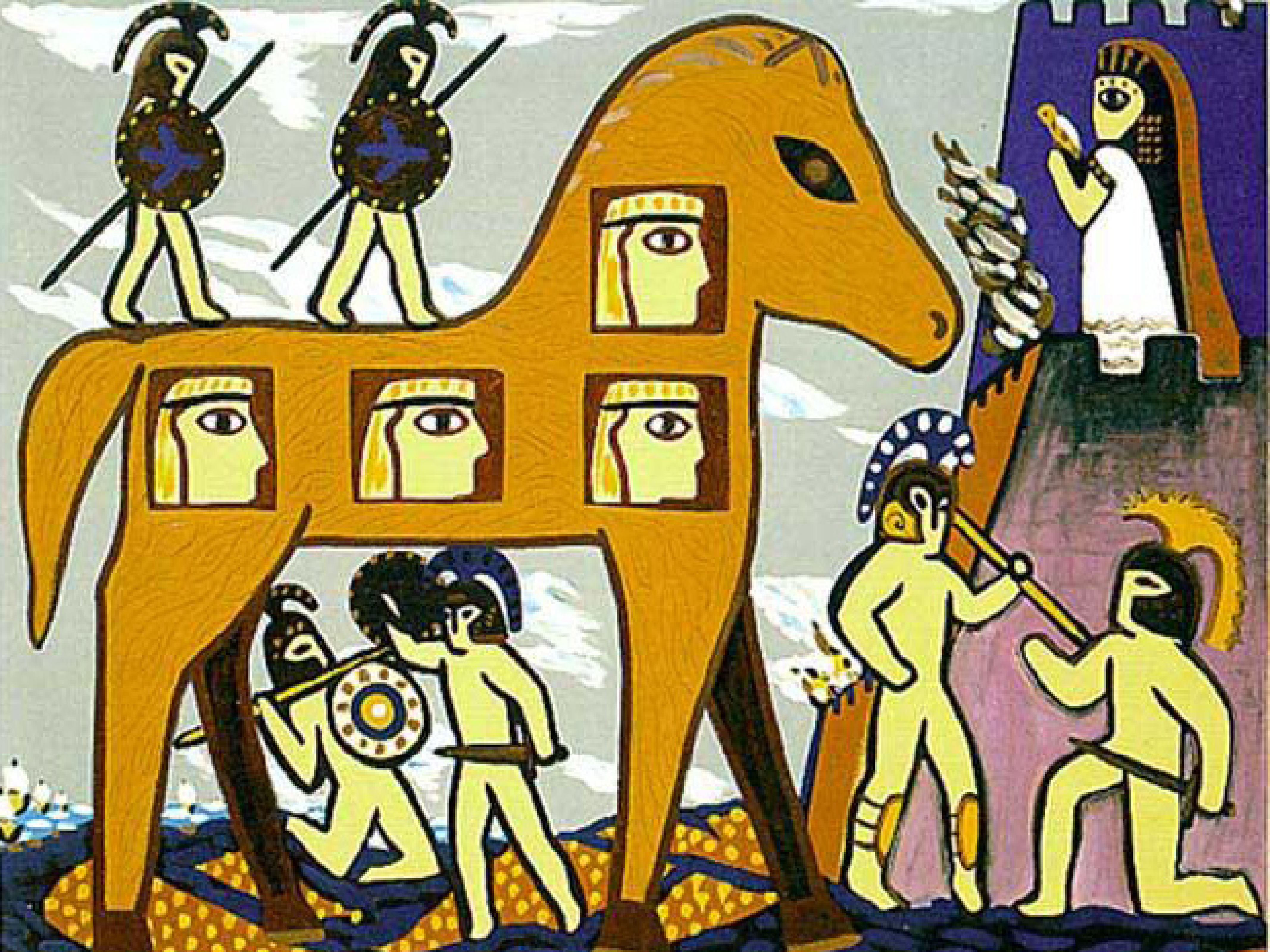
Flat space, deep learning

1ère journée de l'innovation pédagogiq
Université de Lausanne
Lausanne, Suisse, 28 novembre 2013


WHO OWNS THE LEARNING?
Preparing Students for Success in the Digital Age
ALAN NOVEMBER



Ownership of learning *physics*?

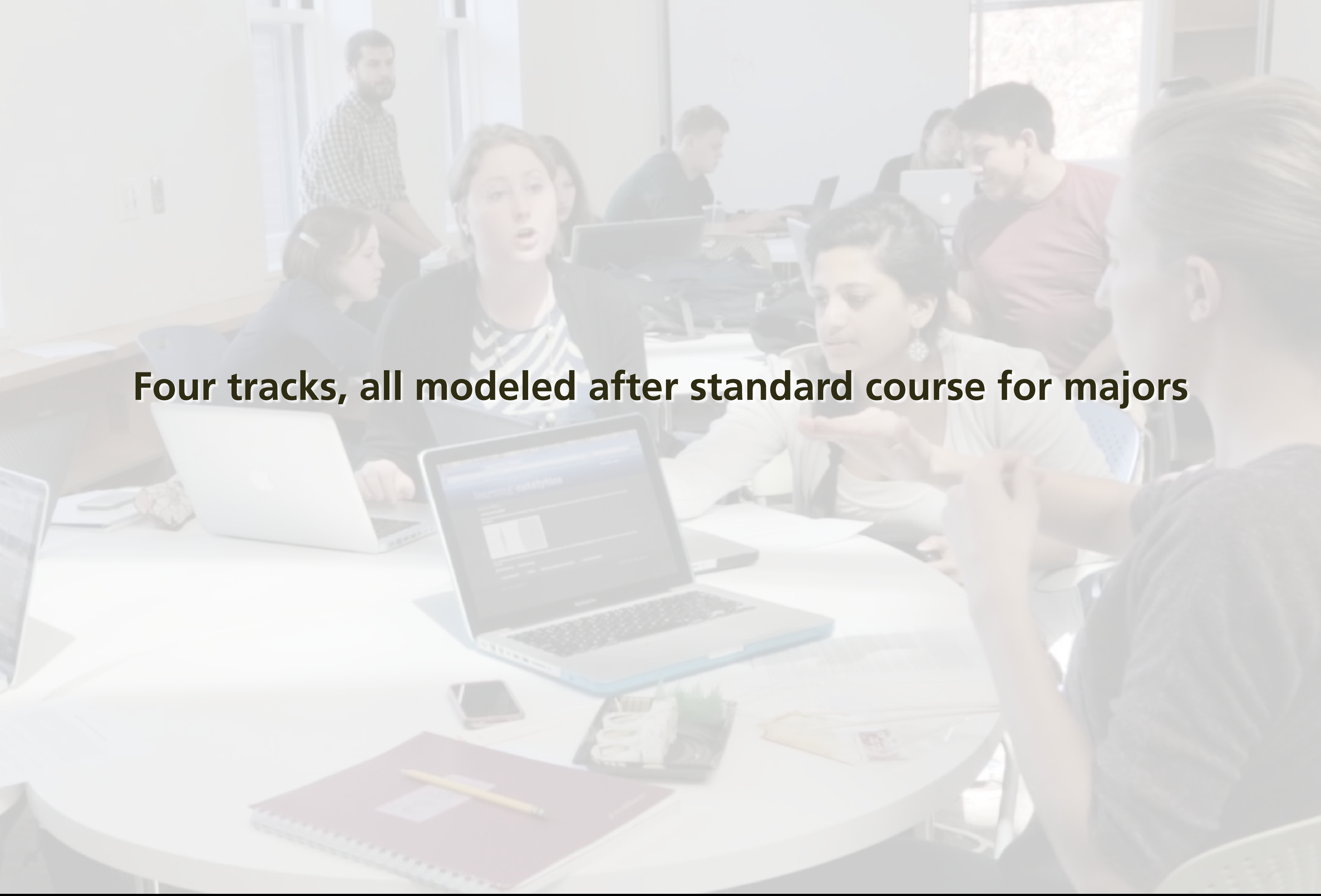


team & project-based approach

1 design

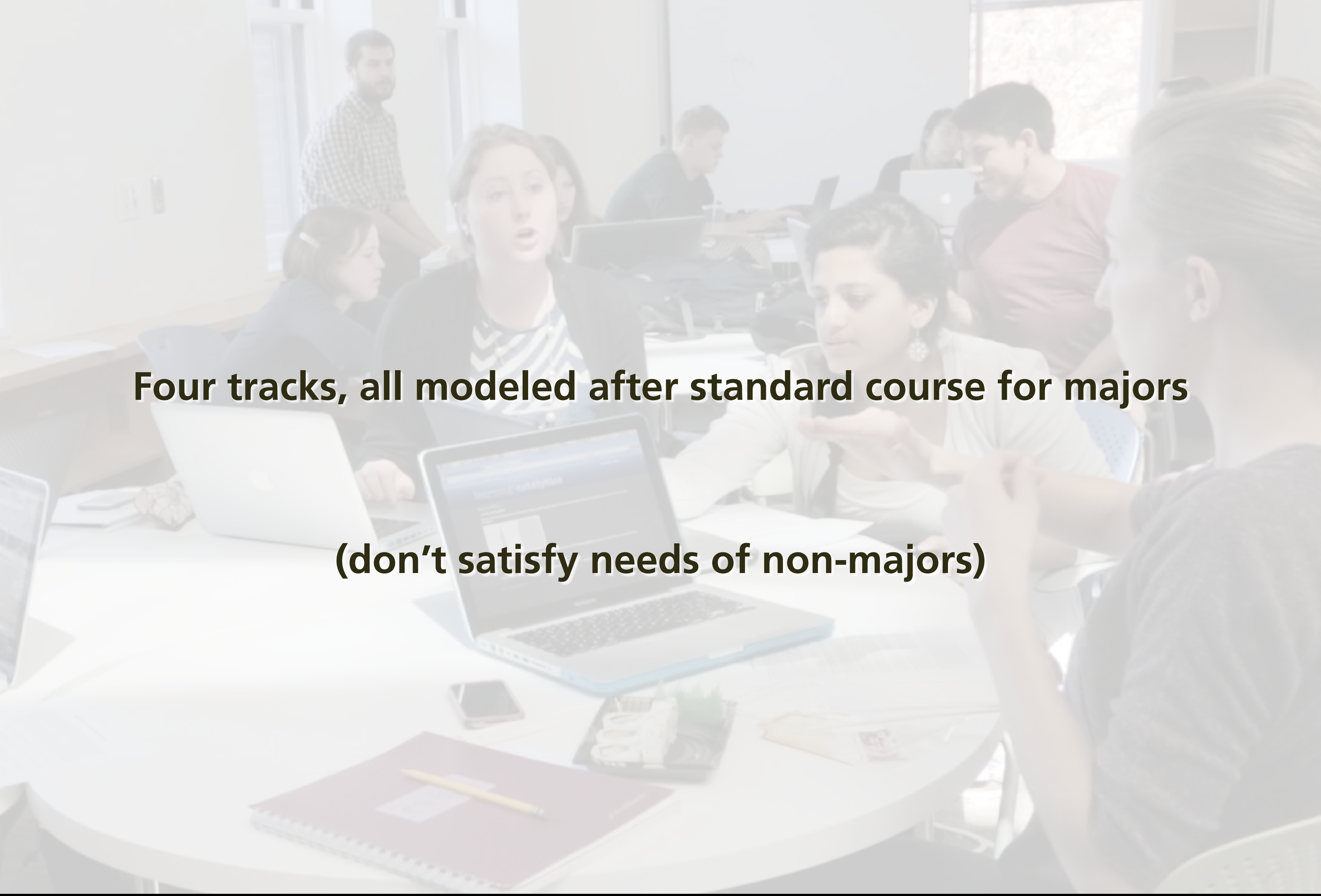
1 **design** **2** **approach**

1 design 2 approach 3 results



Four tracks, all modeled after standard course for majors

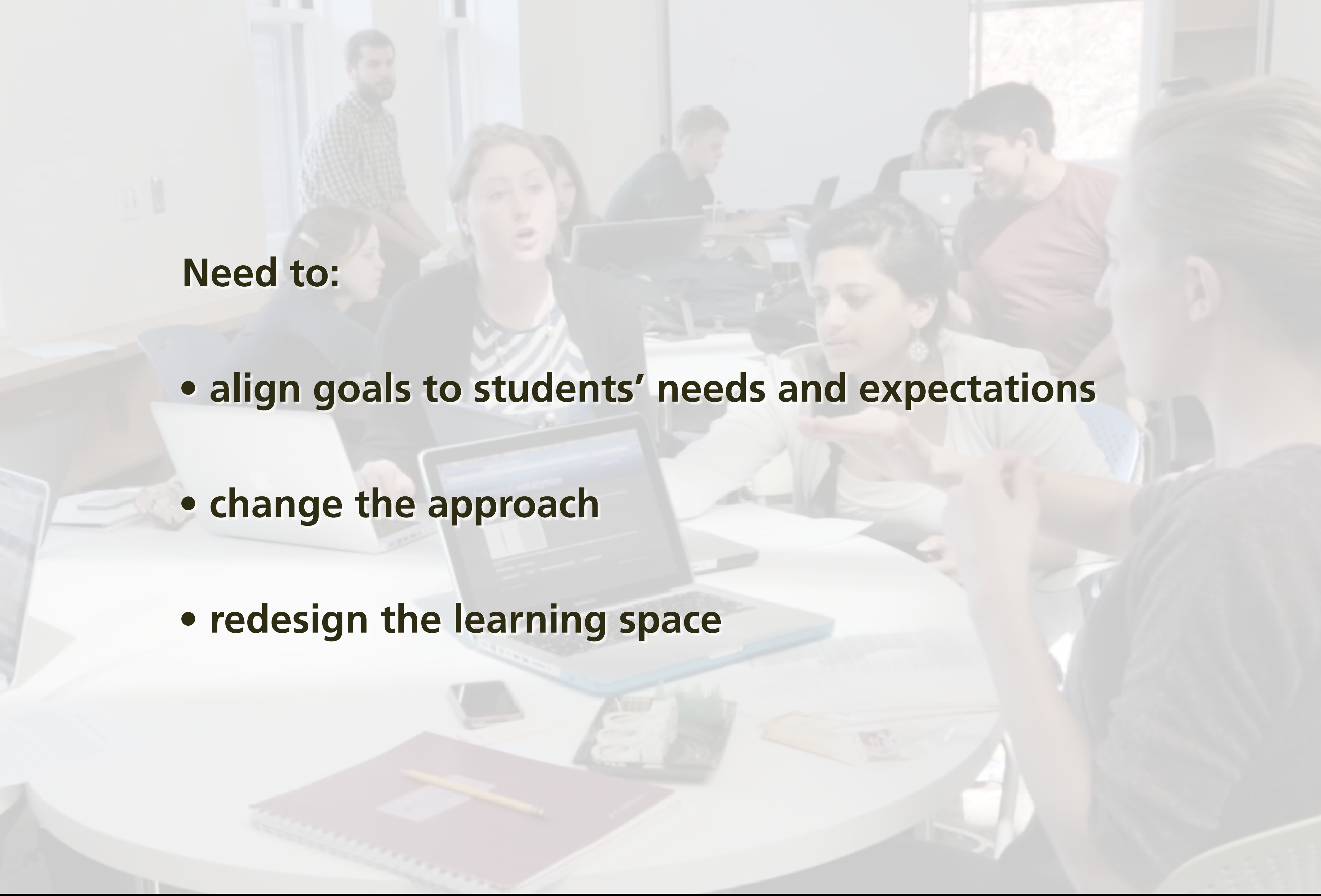
1 design



Four tracks, all modeled after standard course for majors

(don’t satisfy needs of non-majors)

1 design



Need to:

- align goals to students' needs and expectations
- change the approach
- redesign the learning space

competencies

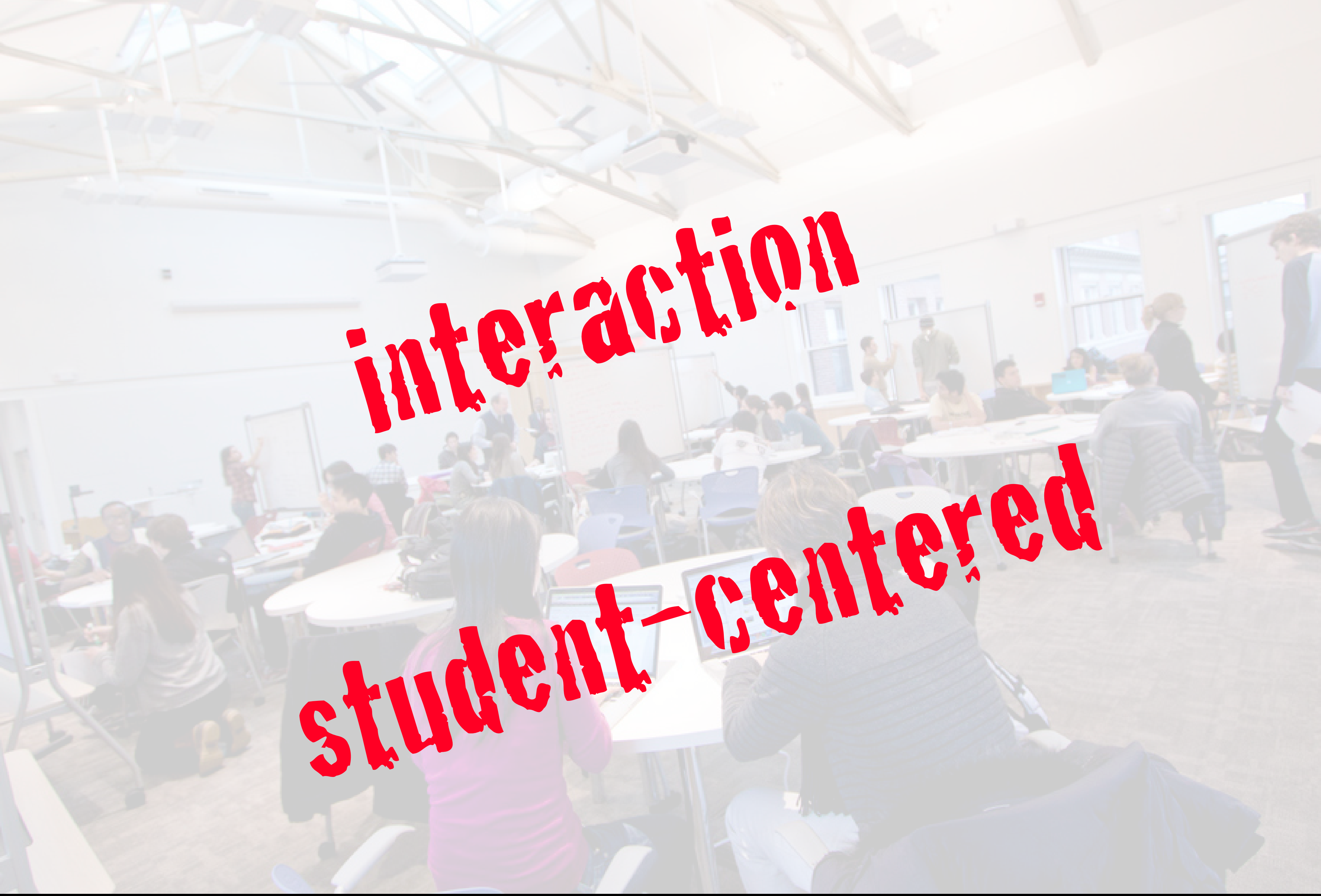
course goals

content-specific goals

1 design

1 design

1 design



1 design

1 design 2 approach

1 design

2 approach

1 design 2 approach

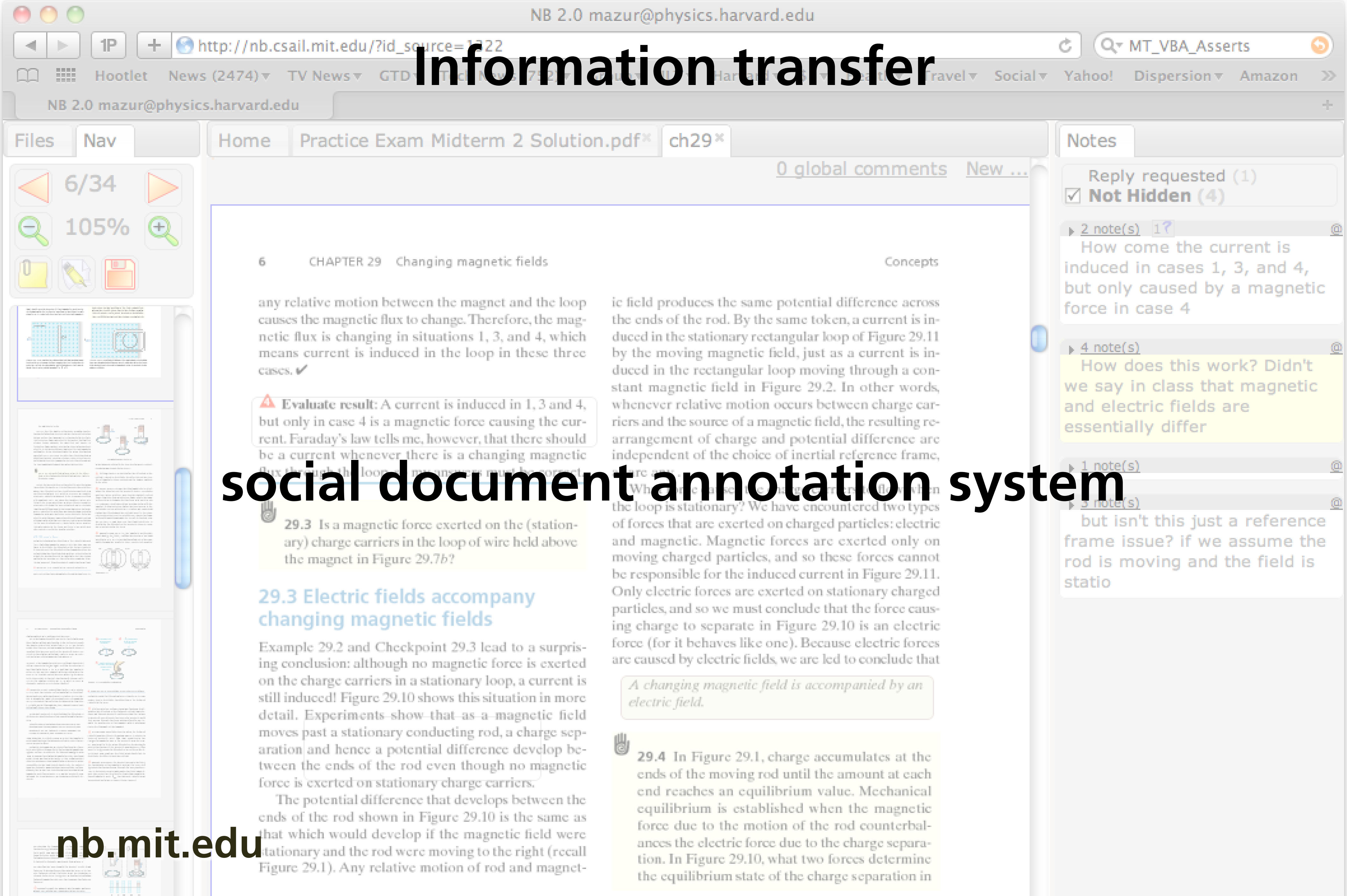
❶ design ❷ approach

Three major components:

- information transfer (out of class)
- in-class activities
- projects

Information transfer

social document annotation system

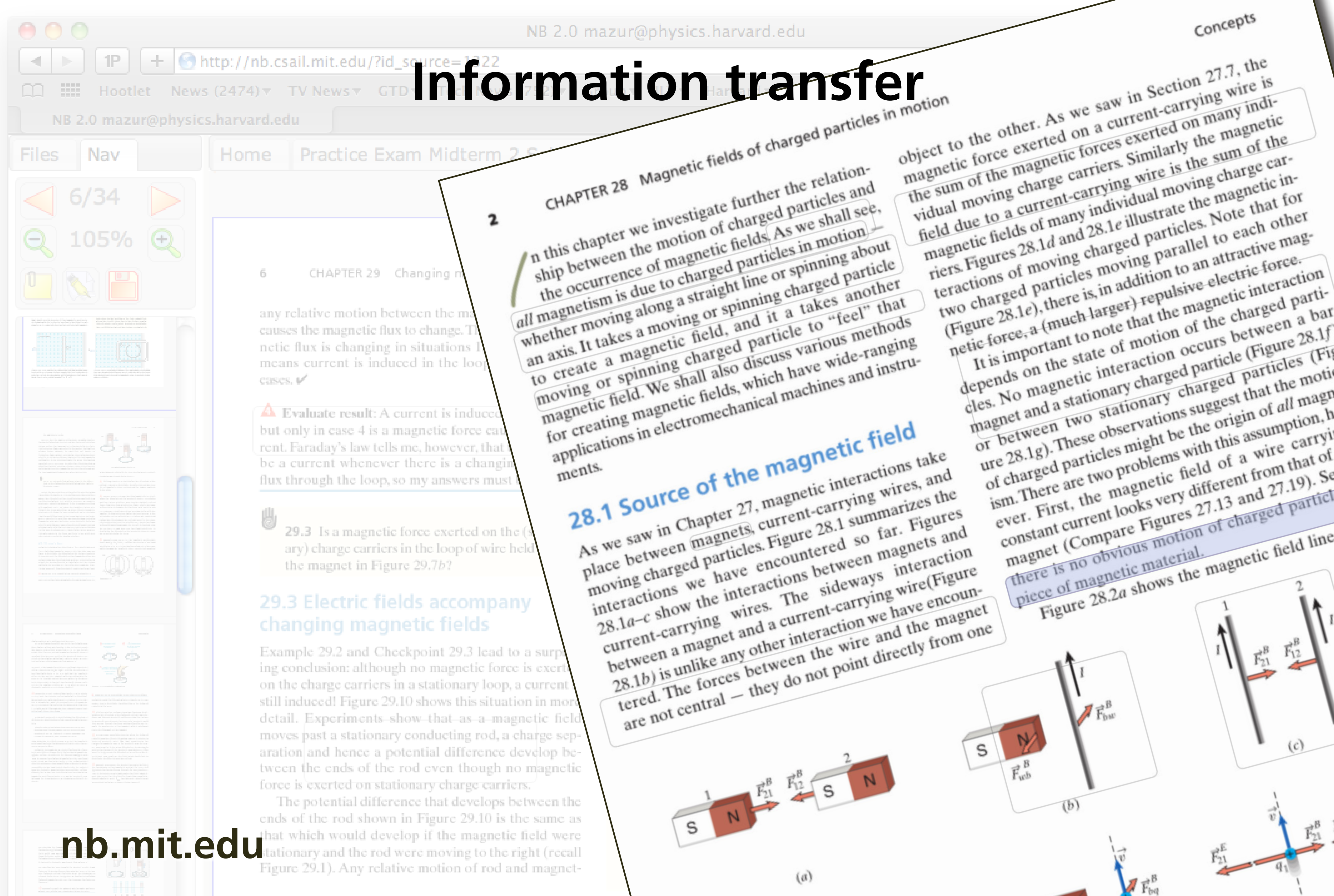


nb.mit.edu

1 design

2 approach

Information transfer



1 design

2 approach

Information transfer

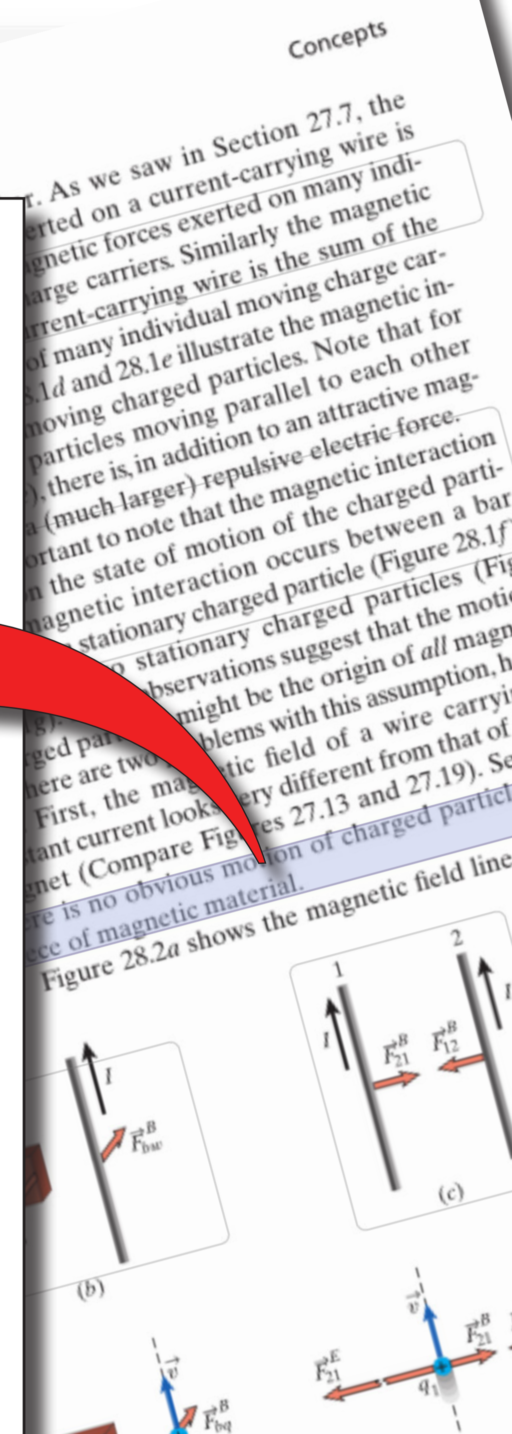
Student 1 – 25 Feb, 04:55PM
Yeah, this is where I'm confused. From the first paragraph: "It takes a moving or spinning charged particle to create a magnetic field..." however there is no obvious motion of charged particles in a piece of magnetic material (bar magnet for example?). How does this reconcile?

Student 2 – 26 Feb, 08:29PM
Maybe they are trying to say that there is no OBVIOUS motion, but they are i… moving via a current. Therefore, it meets their definition that it takes moving … ticles to create a magnetic field

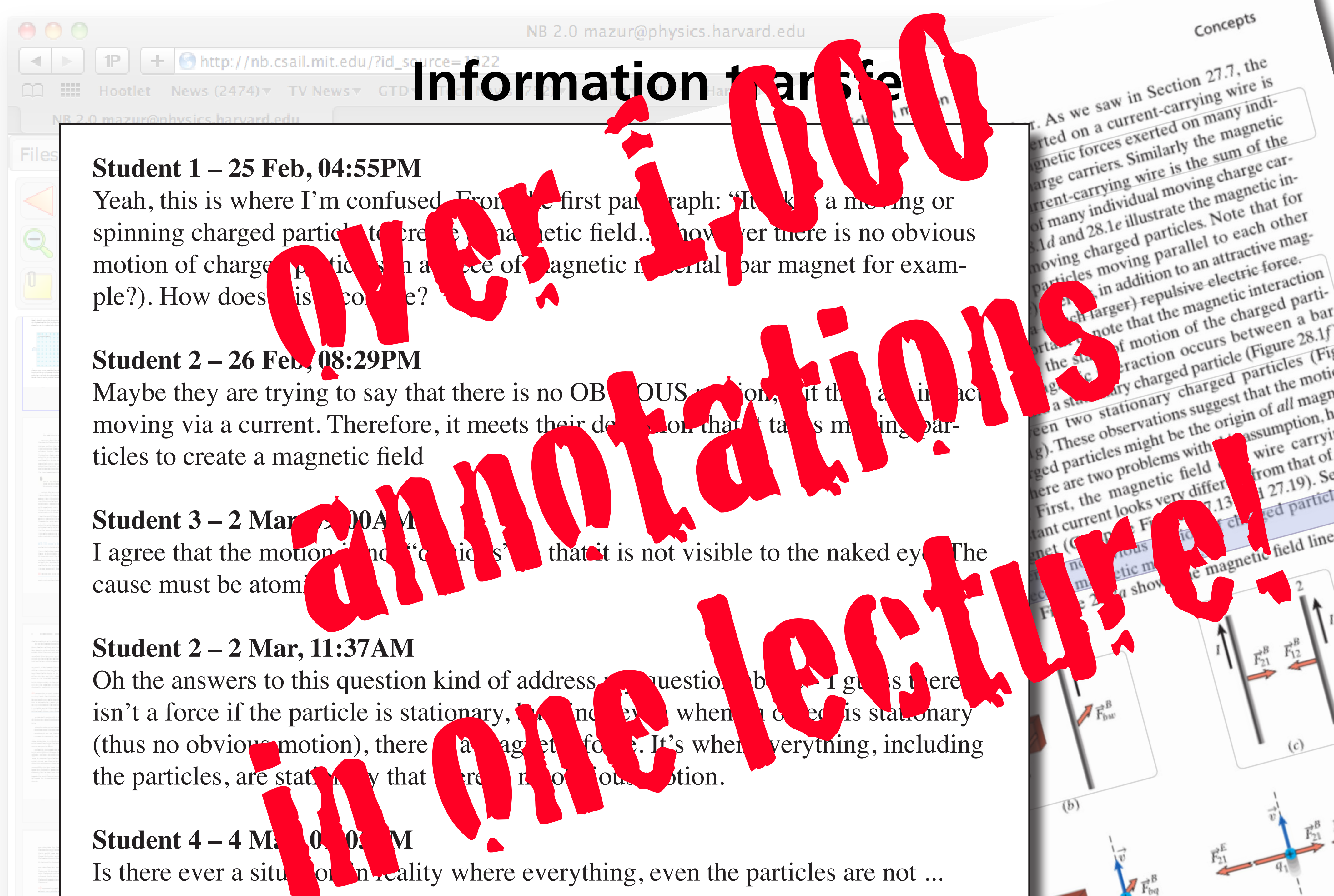
Student 3 – 2 Mar, 09:00AM
I agree that the motion is not "obvious" in that it is not visible to the naked eye. The cause must be atomic.

Student 2 – 2 Mar, 11:37AM
Oh the answers to this question kind of address my question above - I guess there isn't a force if the particle is stationary, but since even when an object is stationary (thus no obvious motion), there is a magnetic force. It's when everything, including the particles, are stationary that there is no obvious motion.

Student 4 – 4 Mar, 01:05PM
Is there ever a situation in reality where everything, even the particles are not ...



1 design 2 approach



1 design 2 approach

In-class activities

1 **design** 2 **approach**

In-class activities

2 weekly 3-hour class periods

In-class activities

blend of best practices

In-class activities

estimation

blend of best practices

In-class activities

estimation

blend of best practices

reflection

In-class activities

estimation

blend of best practices

readiness assurance

reflection

In-class activities

learning catalytics

estimation

blend of best practices

reflection

readiness assurance

In-class activities

learning catalytics

estimation

tutorials

readiness assurance

blend of best practices

reflection

1 design

2 approach

In-class activities

learning catalytics

estimation

tutorials

readiness assurance

blend of best practices

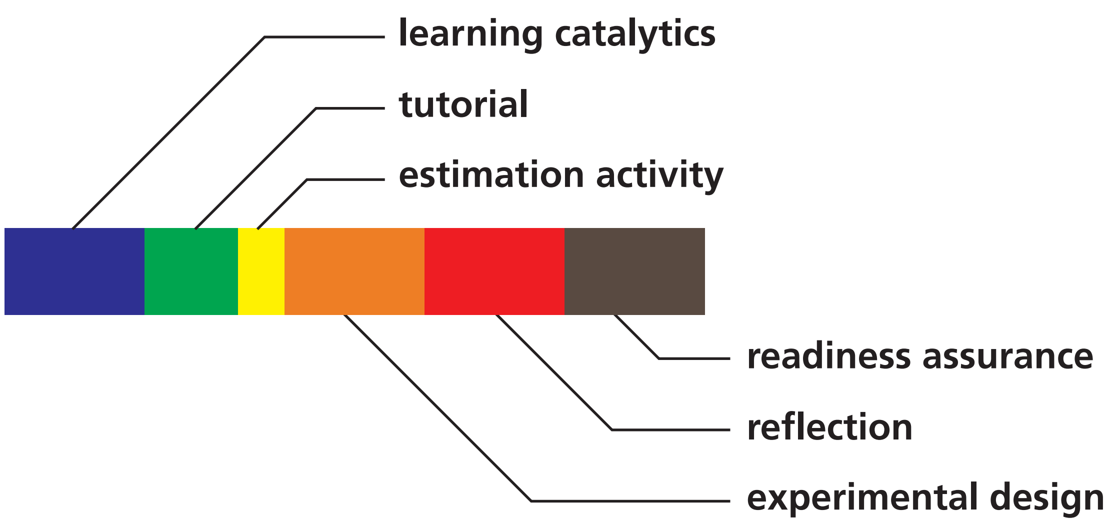
experimental design

reflection

1 design

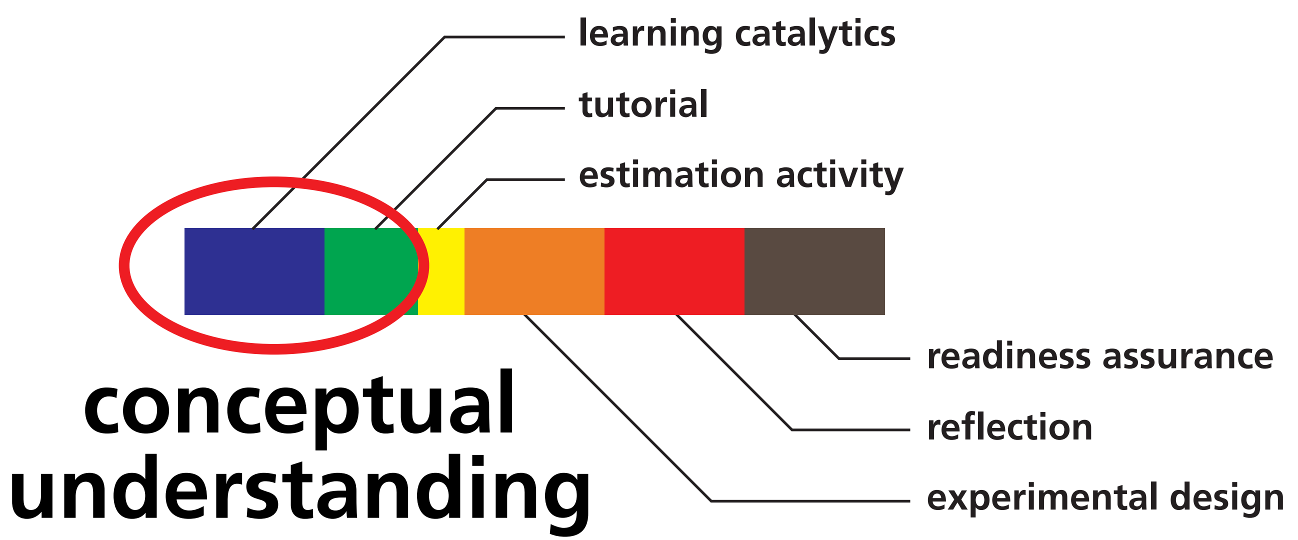
2 approach

In-class activities

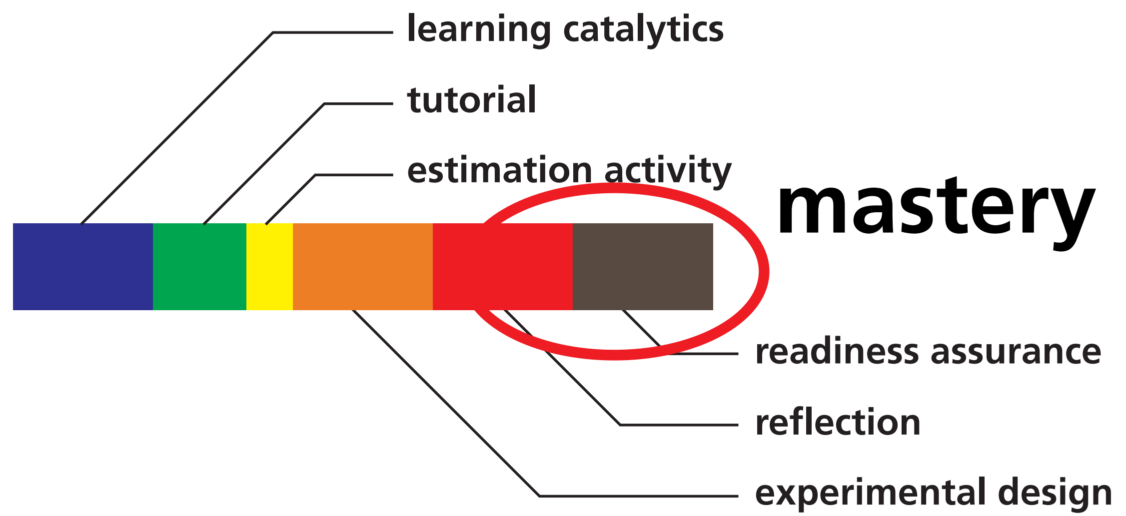


❶ design ❷ approach

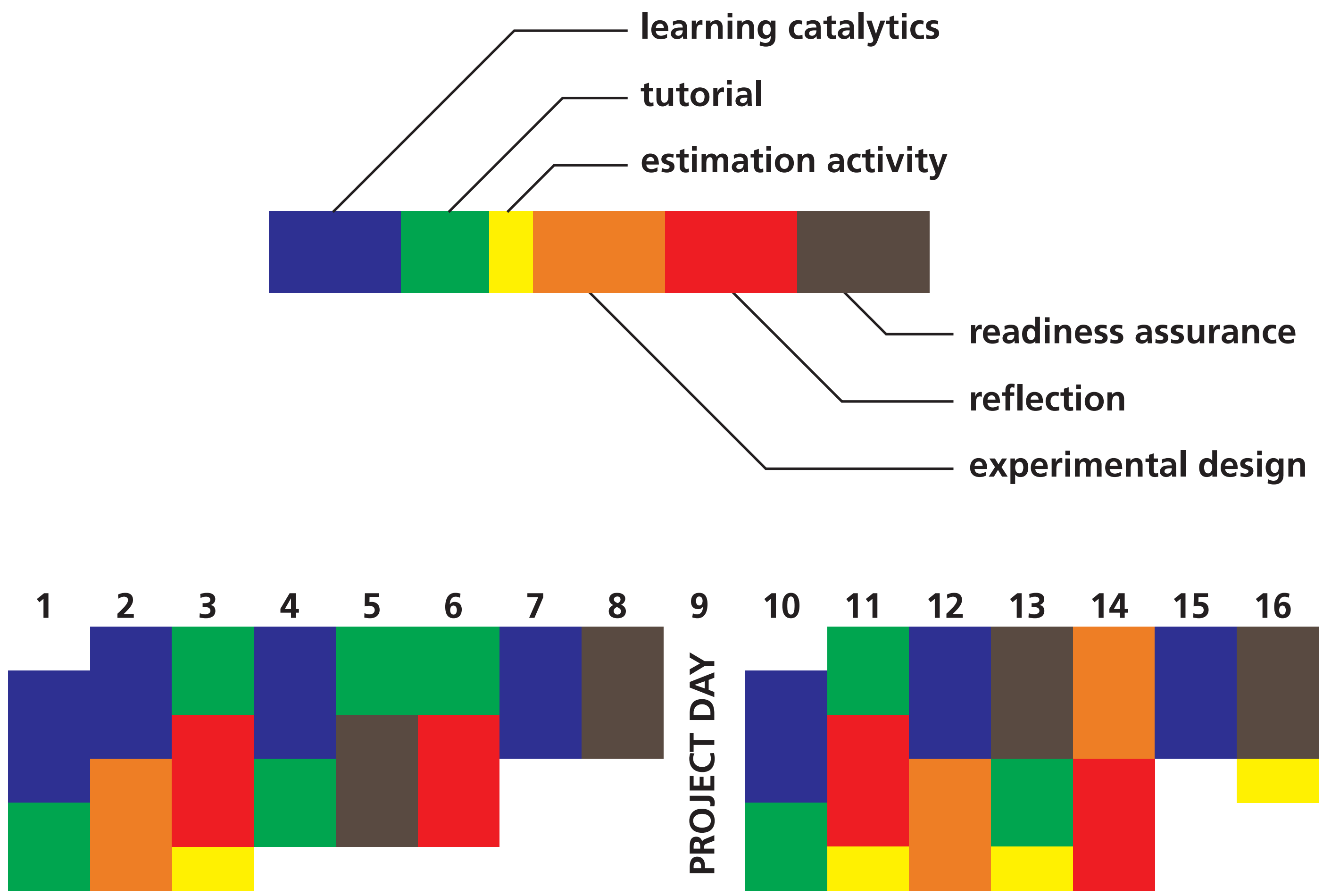
In-class activities



In-class activities



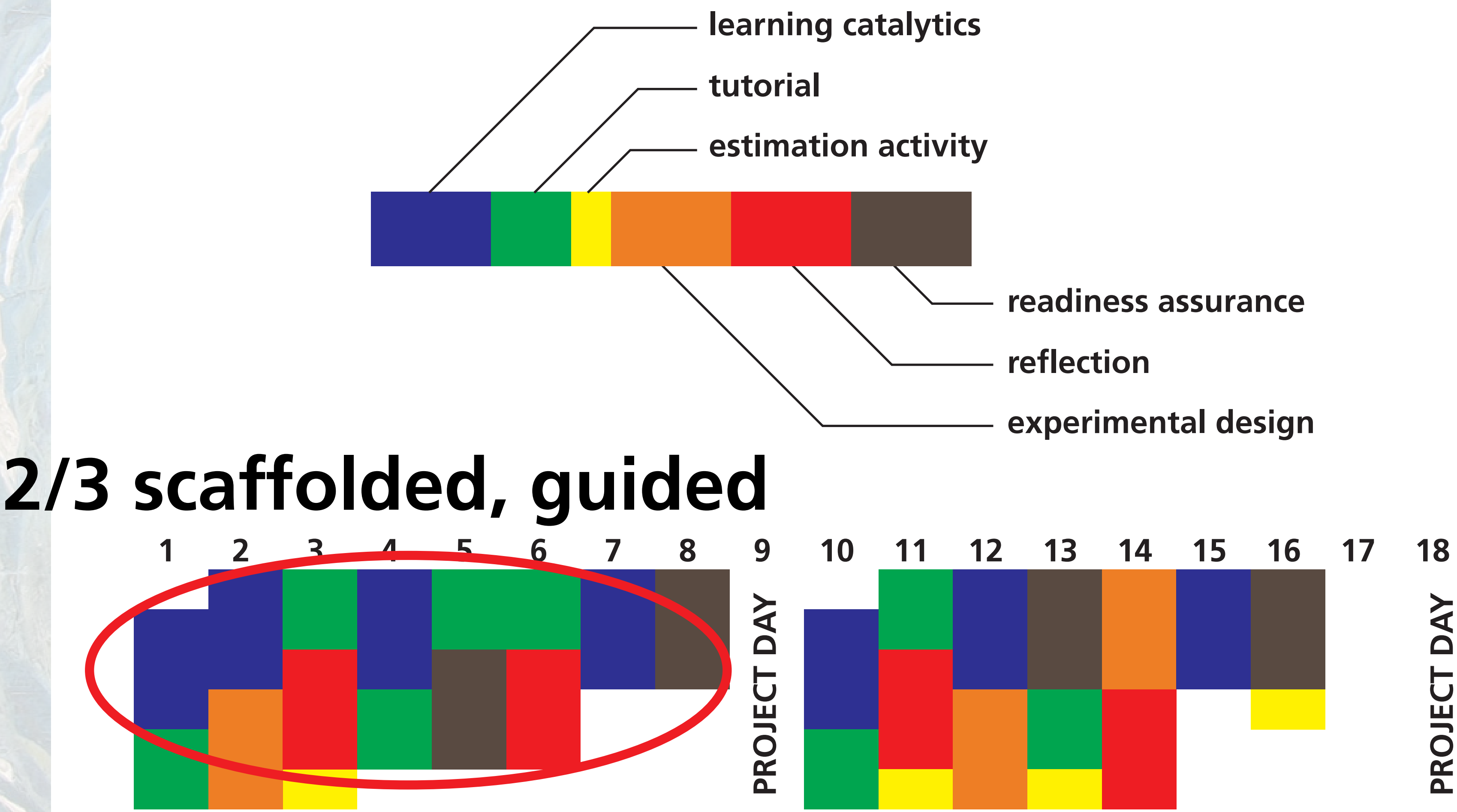
In-class activities



1 design

2 approach

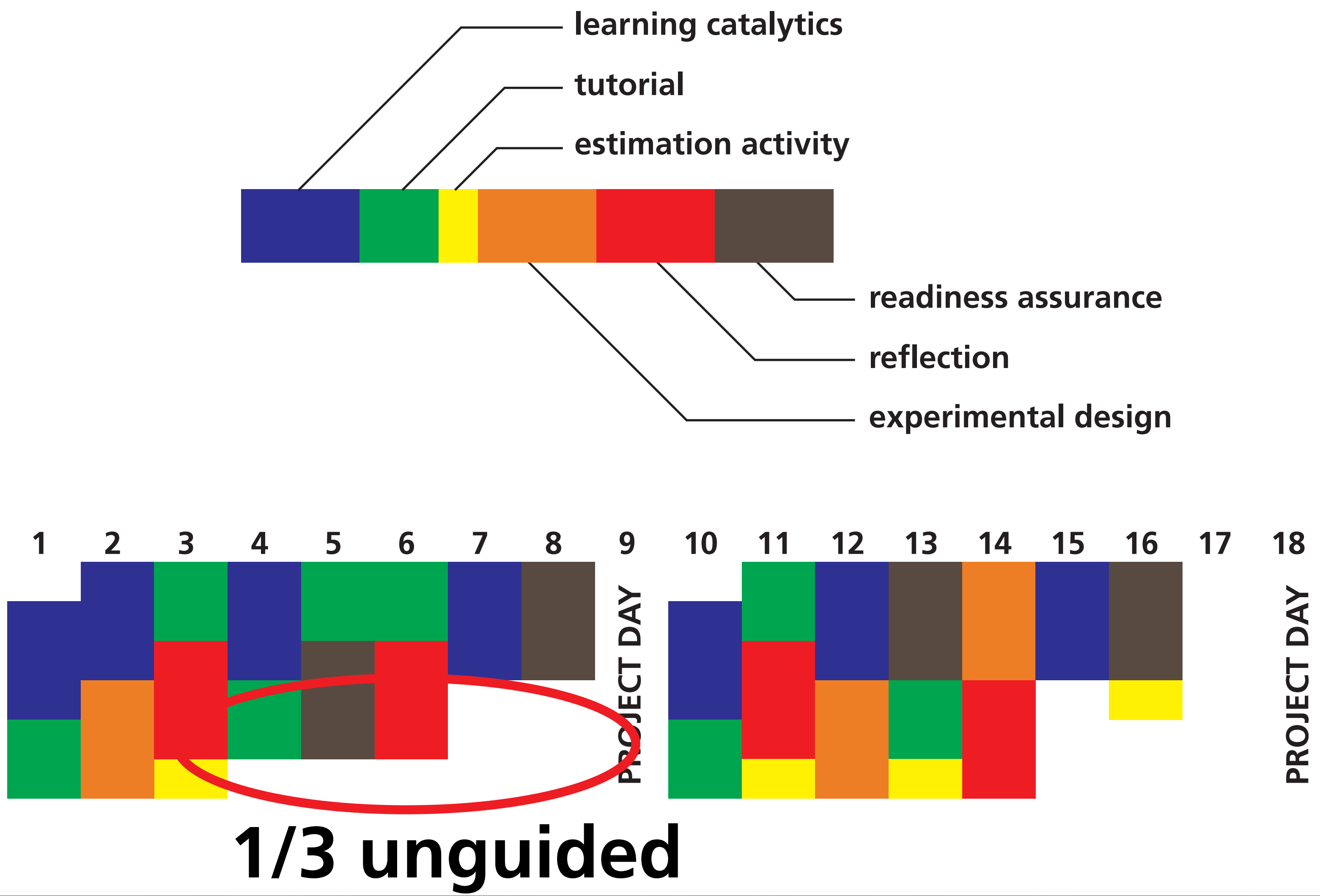
In-class activities



1 design

2 approach

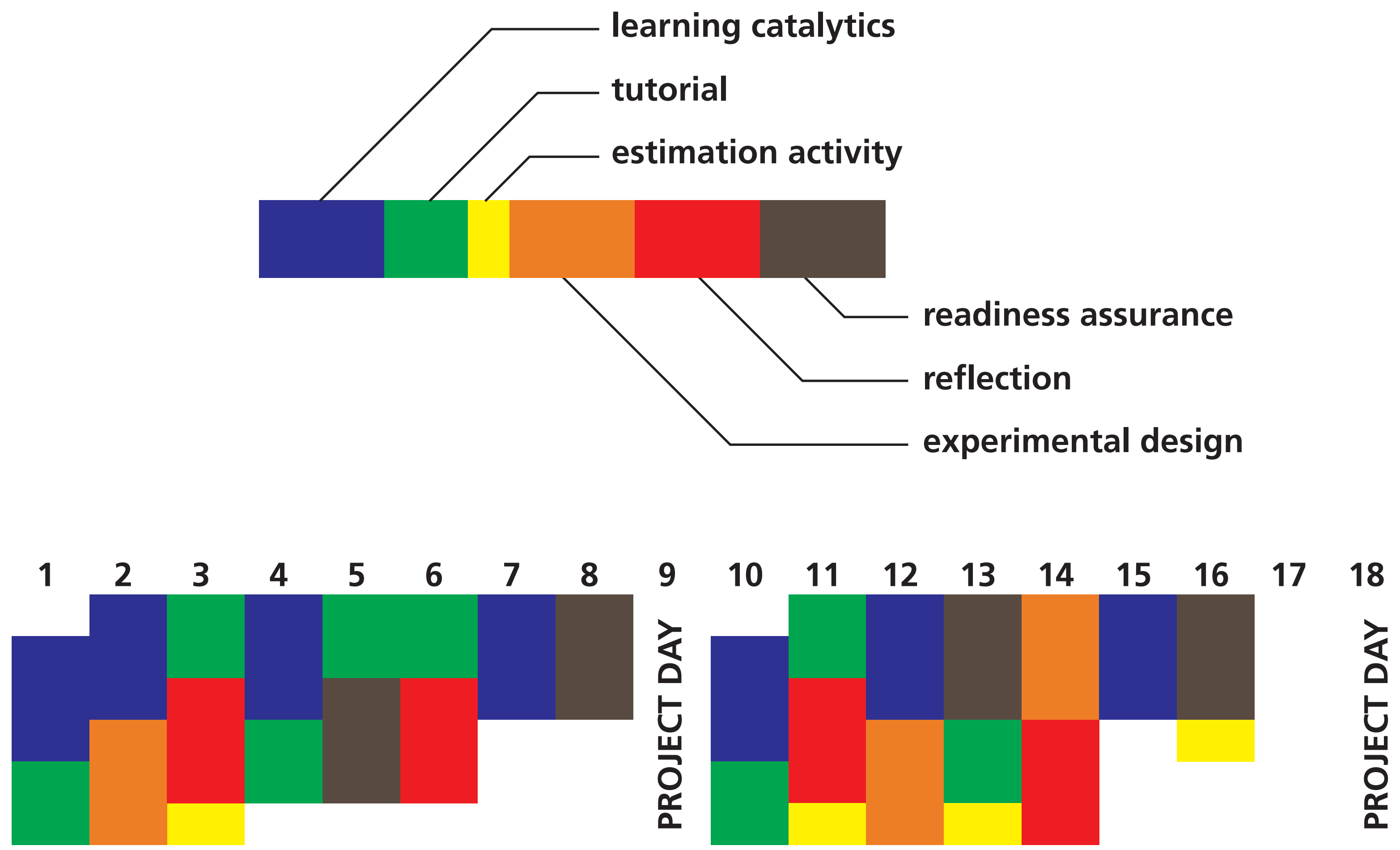
In-class activities



1 design

2 approach

In-class activities



1 design

2 approach

learning catalytics

1 design

2 approach

learning catalytics

goal: develop conceptual understanding

learning catalytics

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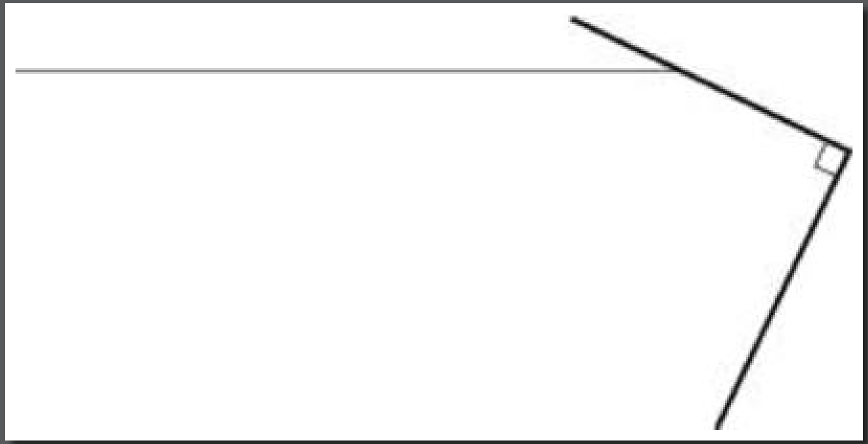
4. direction Light enters horizontally into the combination of two perpendicular mirrors as shown below.

Deliver Show all results



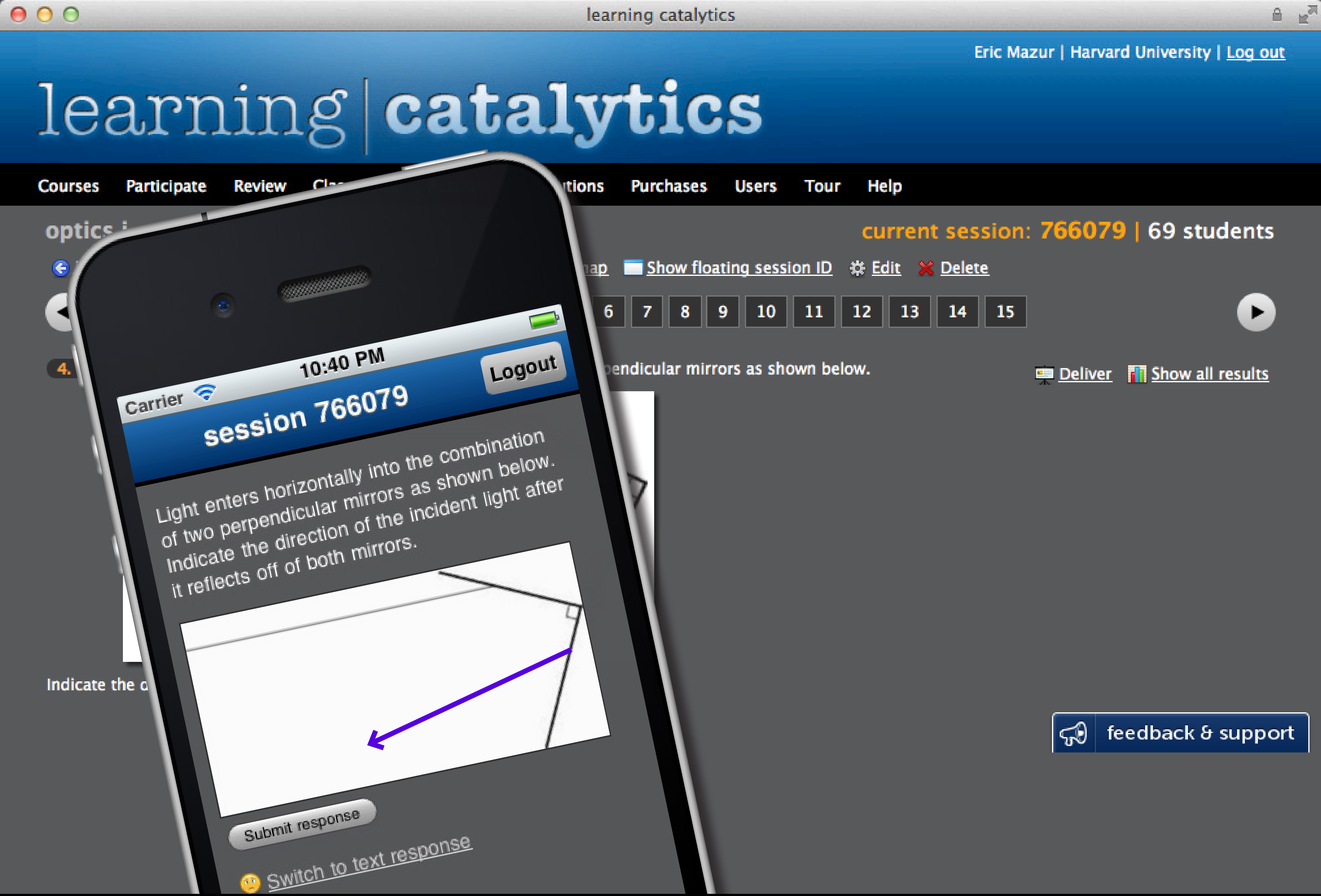
Indicate the direction of the incident light after it reflects off of both mirrors.

feedback & support

1 design 2 approach

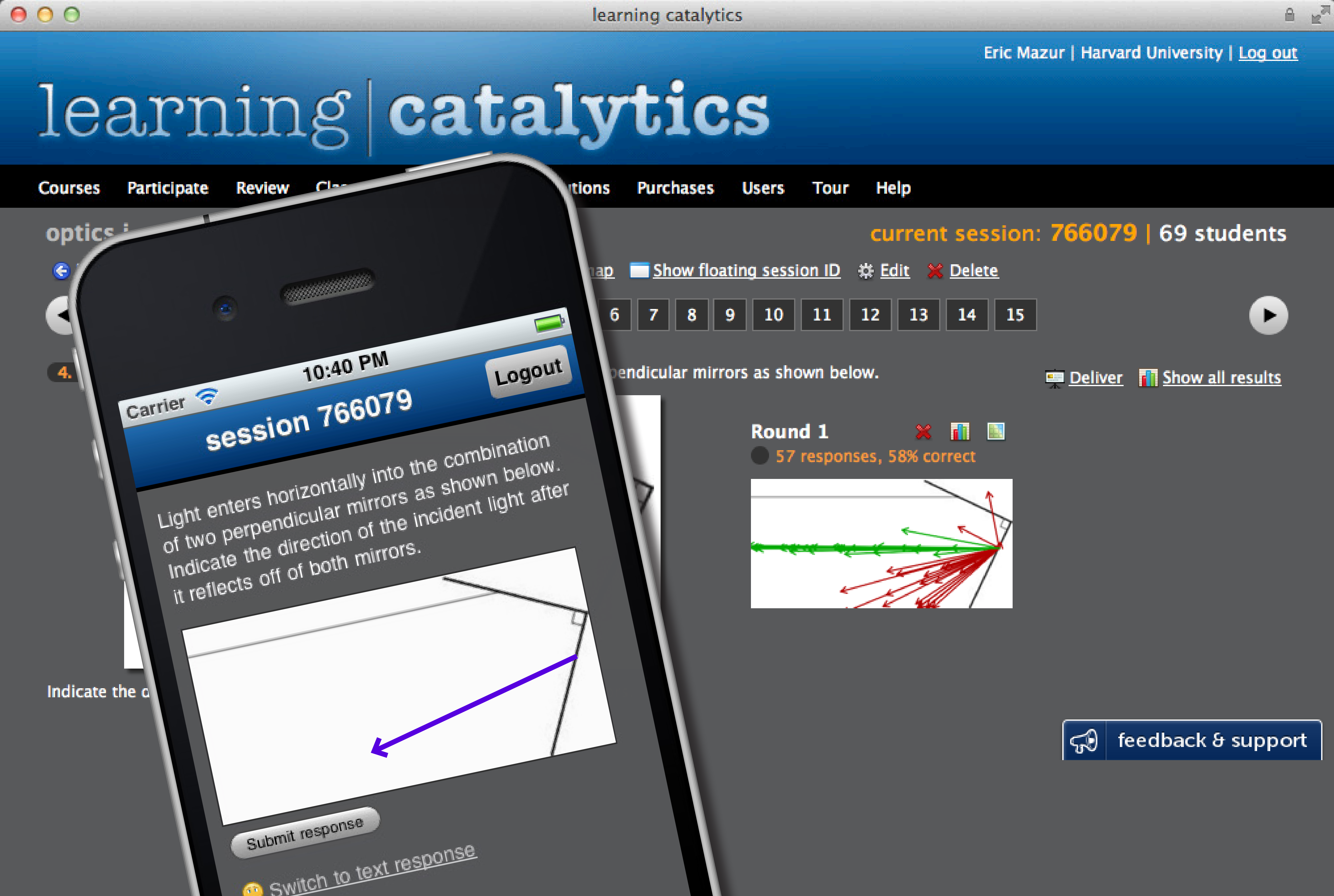
1 design

2 approach



1 design

2 approach



1 design

2 approach

1 design

2 approach

1. Get onto the Wifi (see instructions on table)

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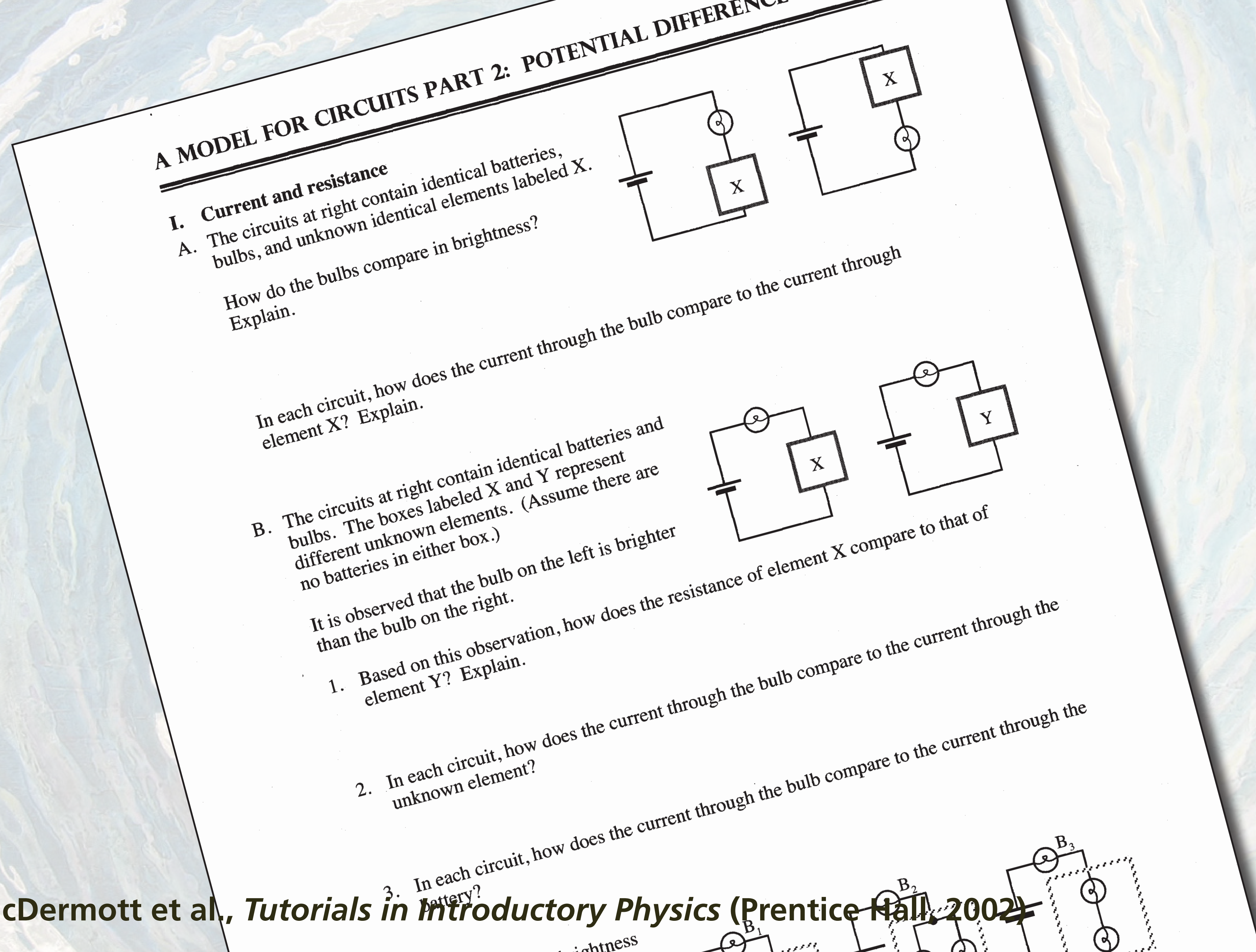
tutorials

tutorials

goal: address documented misconceptions



A MODEL FOR CIRCUITS PART 2: POTENTIAL DIFFERENCE

I. Current and resistance

A. The circuits at right contain identical batteries, bulbs, and unknown identical elements labeled X.

How do the bulbs compare in brightness? Explain.

In each circuit, how does the current through the bulb compare to the current through element X? Explain.

B. The circuits at right contain identical batteries and bulbs. The boxes labeled X and Y represent different unknown elements. (Assume there are no batteries in either box.)

It is observed that the bulb on the left is brighter than the bulb on the right.

1. Based on this observation, how does the resistance of element X compare to that of element Y? Explain.

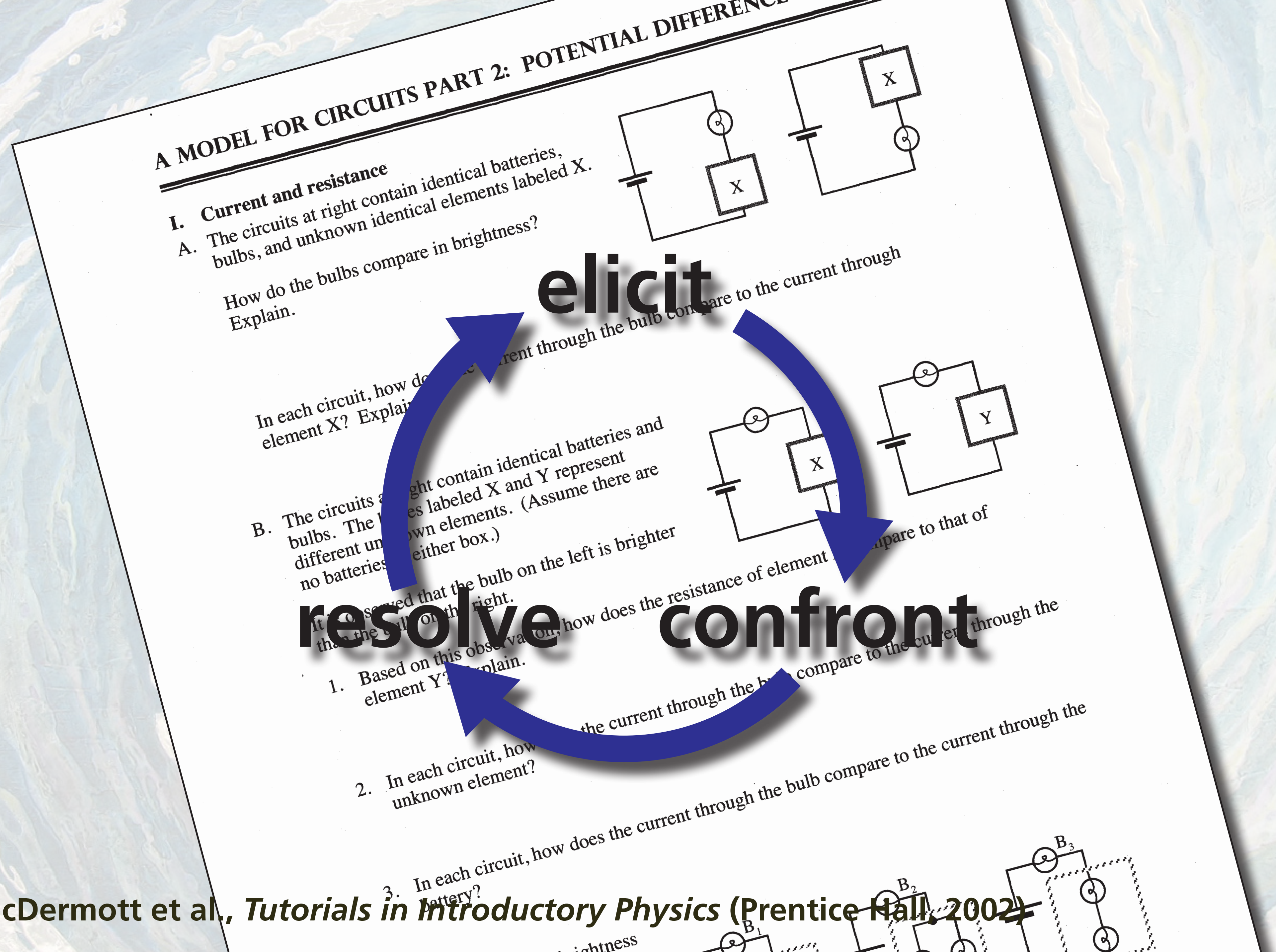
2. In each circuit, how does the current through the bulb compare to the current through the unknown element?

3. In each circuit, how does the current through the bulb compare to the current through the battery?

McDermott et al., *Tutorials in Introductory Physics* (Prentice Hall, 2002)

1 design

2 approach



McDermott et al., *Tutorials in Introductory Physics* (Prentice Hall, 2002)

1 design 2 approach

estimation activity

estimation activity

goal: develop qualitative reasoning skills

AP50b Spring 2013

Estimation Activity 2

M March 11

Instructions: estimate (not guess!) the quantities below to the nearest order of magnitude. The first team to correctly enter all values wins.

1. Design a solenoid that can generate the same amount as the Earth's magnetic field.
2. How much current can one wearing a silver bracelet generate by walking in front of a microwave? (Assume you are wearing thick layer of clothes and your arms/bodies somehow act as insulators)
3. Estimate the flux of the Earth's magnetic field through the top of the table you are working on now.
4. Estimate the time for a radio signal to travel around the Earth.
5. As an undergrad in the 60s, Nobel Laureate claims to have built the "world's largest solenoid" by wrapping some copper wire around a football field 3 times and by plugging it into a car battery. What kind of currents and fields do you expect this coil generated?
6. What is the potential difference that causes a lightning strike?

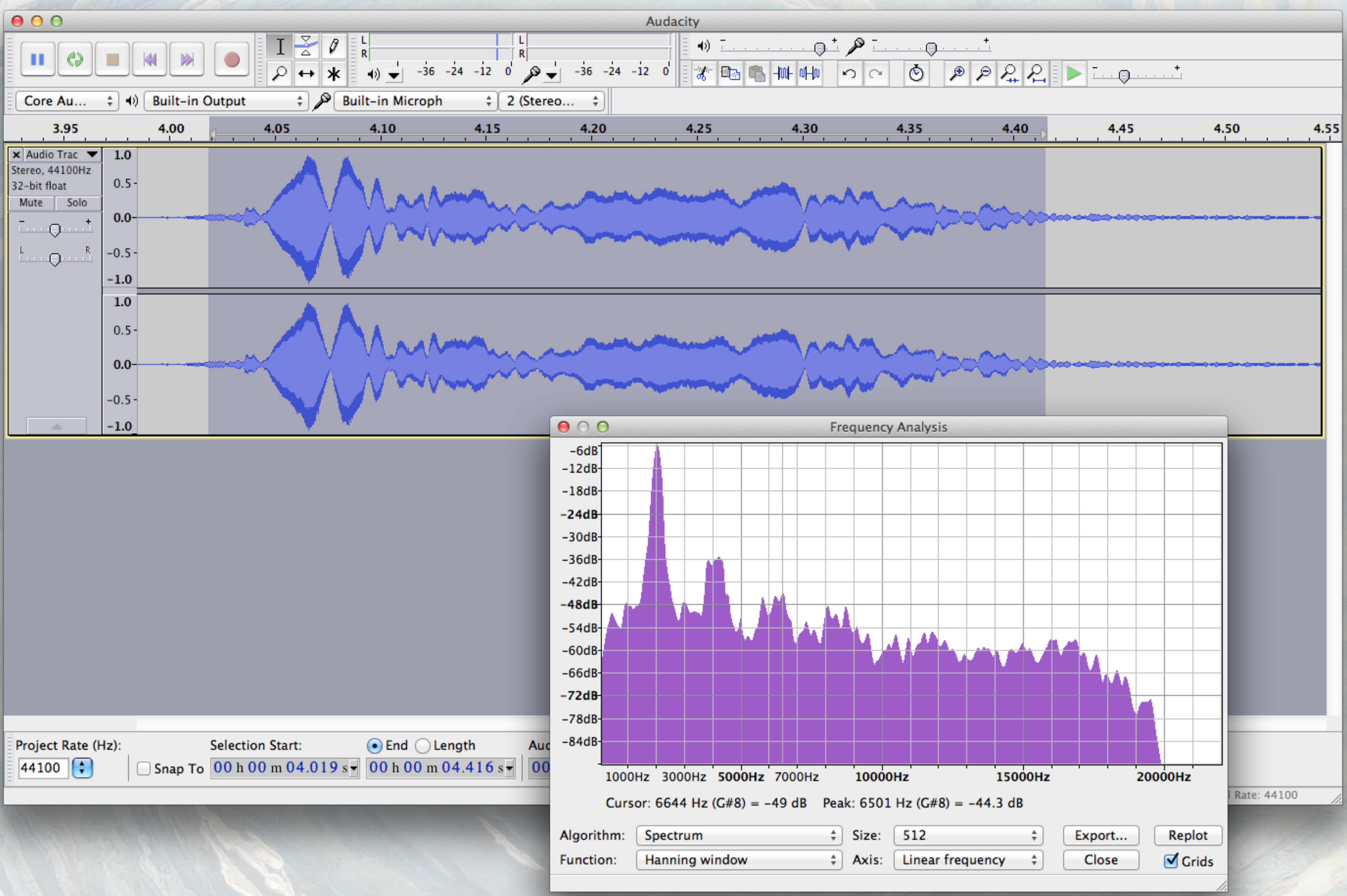
"What is the potential difference that causes a lightning strike?"

1 **design** 2 **approach**

experimental design activity

experimental design activity

goal: develop experimental skills



1 design **2 approach**

homework reflection

1 design

2 approach

goal: develop problem solving

and metacognitive skills

homework reflection

AP50b Fall 2013

Problem Set 1

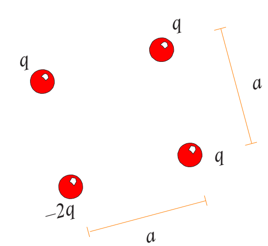
due W Feb 6 in class

Instructions: as we need to quickly scan your work so we can return it before the end of class, please:

- use 8.5 x 11" paper
- no-dog ears or torn out of ring-bound notebook
- dark ink (no light pencils)
- no staples
- name on each page
- single-sided (no writing on back)
- leave margins blank

1. ***Ink-Jet Printing.*** In an inkjet printer, letters are built up by squirting drops of ink at a piece of paper from a rapidly moving nozzle. The ink drops leave a nozzle and travel toward the paper, passing through a charging unit that gives each drop a positive charge by removing some electrons from it. The drops then pass between parallel deflecting plates where there is a uniform vertical electric field (to be discussed in Chapter 23). Estimate the number of atoms present in a droplet of ink.

2. ***Levitation.*** One possible way of levitating an object might be to use the forces associated with charged objects. For example, you have two charged particles that are fixed on a vertical pole 0.5 m apart. The lower one has a fixed charge of -3.0 μC. The upper one has a charge q_A that can be adjusted. A 30-mg particle with a charge of +8.0 μC can move freely on the pole below the other two. You wish to levitate (i.e., float) this particle at a distance of 1.0 m below the lower fixed charge. What should the adjustable charge q_A be to achieve this feat?



3. ***Charge Square.*** Four charged particles are arranged in a square as shown in the figure to the right, with $q = 3.9\times10^{-4}$ C and $a = 6.9$ mm. What is the net force on the particle at the upper right corner due to the other three?

…force between two concentrated ("point-like") masses is very similar in its …lectrostatic force between two concentrated charges. The …vastly different. To illustrate this, consider the following …spherical dust grains, 50 μm in diameter, with mass density …re electrically neutral, free of other external …vitationally. Now suppose that both …of n that would prevent …neutrons.

1 design

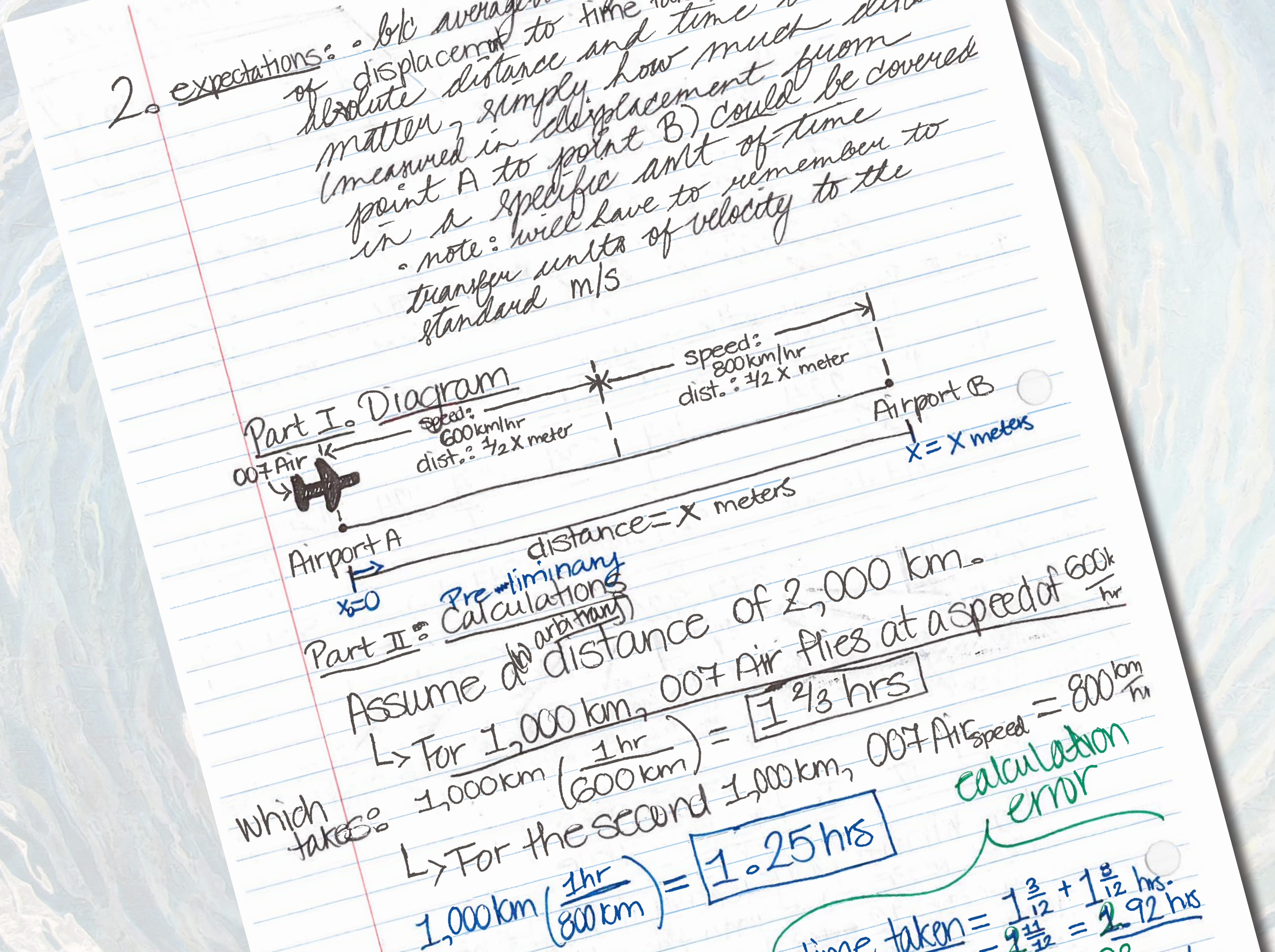
2 approach

homework	goal
solve at home	skills development
reflect in class	metacognition

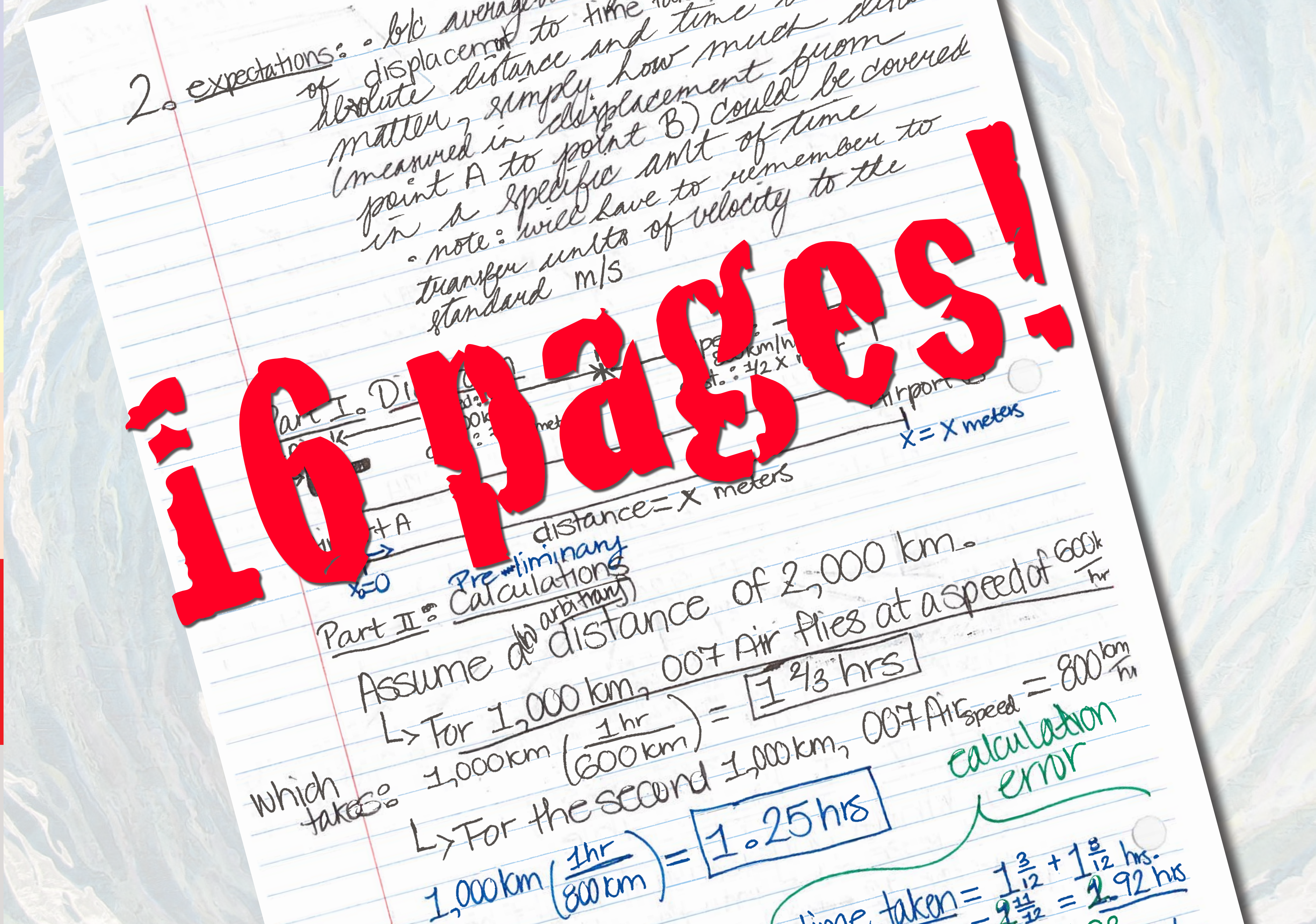
1 design 2 approach

EFFORT

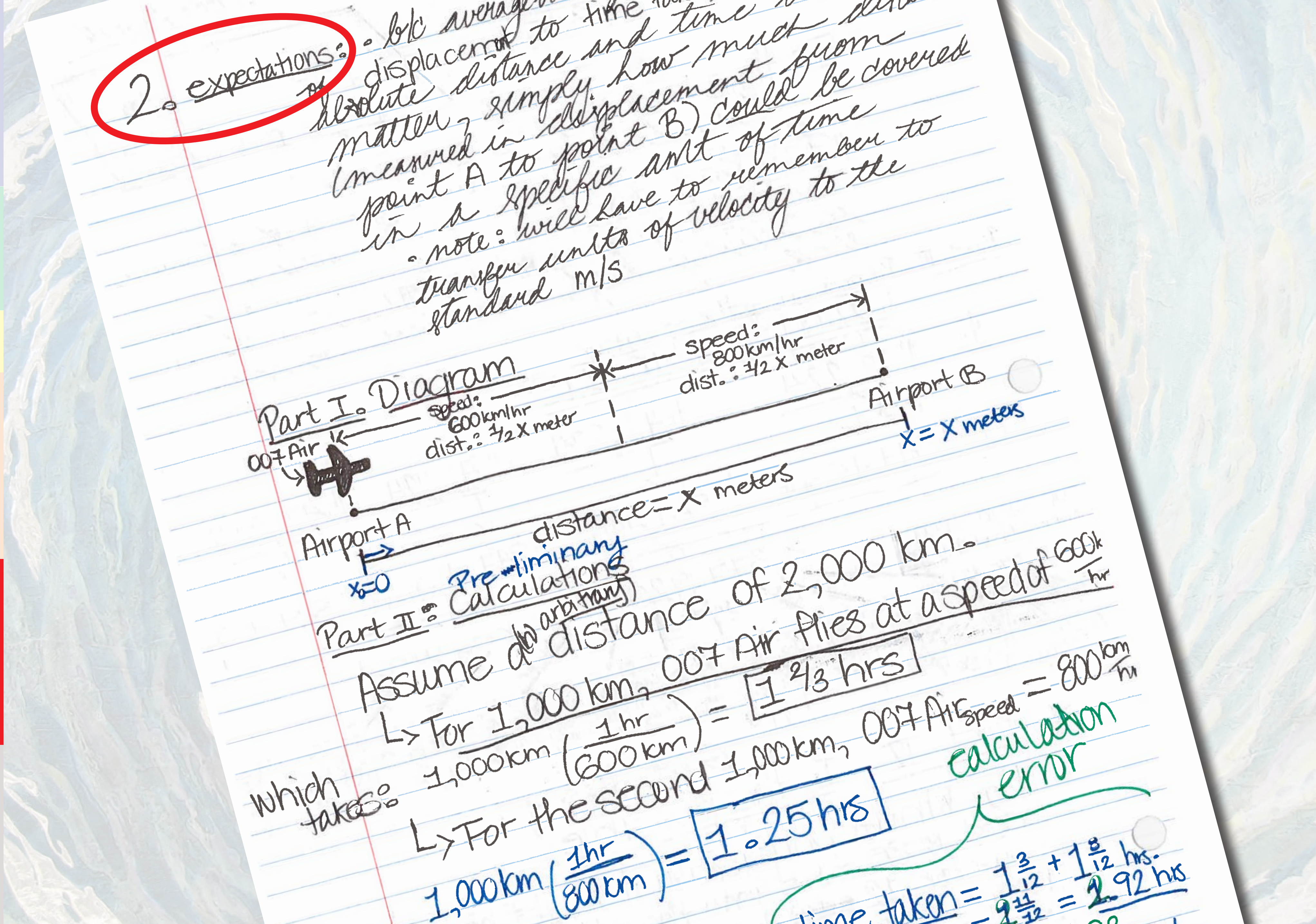
Criterion	Majority of problems/solutions	About half the problems/solutions	Less than half the problems/solutions
Expectations for each solution to a problem articulated before diving into the details?	3	2	1
Were longer problems broken down into smaller, more manageable pieces?	3	2	1
Were solutions checked for reasonableness?	3	2	1
Were solutions well organized?	3	2	1
Appropriate use of diagrams, graphical, tabular representations?	3	2	1
Are symbols defined and diagrams adequately labeled?	3	2	1



1 design **2** approach



1 design 2 approach



2. expectations:
- b/c average ... displacement to time ... absolute distance and time ... matter, simply how much distance (measured in displacement from point A to point B) could be covered in a specific amt of time
- note: will have to remember to transfer units of velocity to the standard m/s

Part I. Diagram

007 Air
speed: 600 km/hr
dist.: 1/2 X meter
speed: 800 km/hr
dist.: 1/2 X meter
Airport B
X = X meters
Airport A
x=0
distance = X meters

Part II: Preliminary Calculations

Assume a (arbitrary) distance of 2,000 km. 007 Air flies at a speed of 600 k/hr

↳ For 1,000 km, 007 Air takes: 1,000 km (1 hr / 600 km) = 1 2/3 hrs

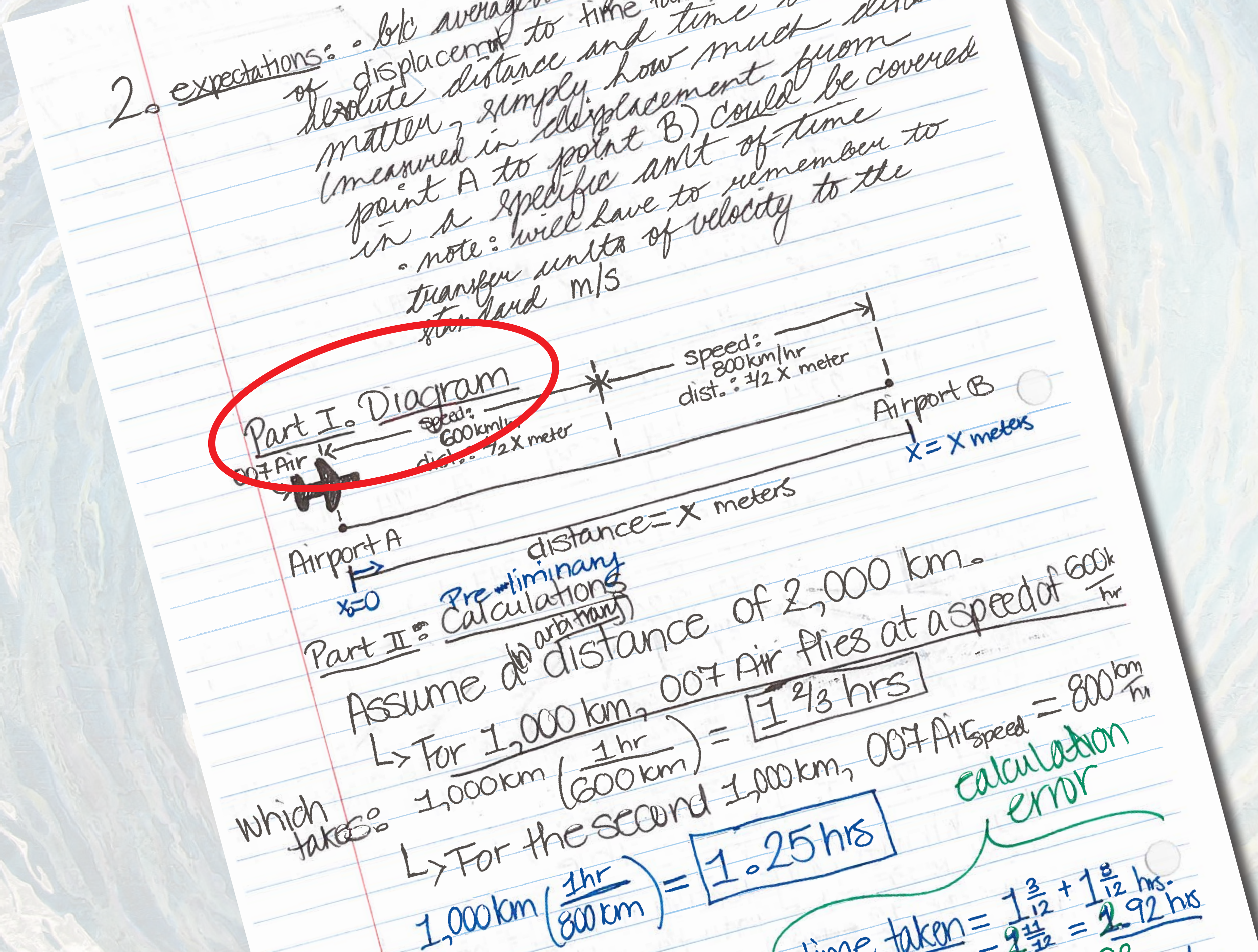
↳ For the second 1,000 km, 007 Air speed = 800 km/hr

1,000 km (1 hr / 800 km) = 1.25 hrs

calculation error

time taken = 1 3/12 + 1 8/12 hrs. = 2 11/12 = 2.92 hrs

1 design **2** approach



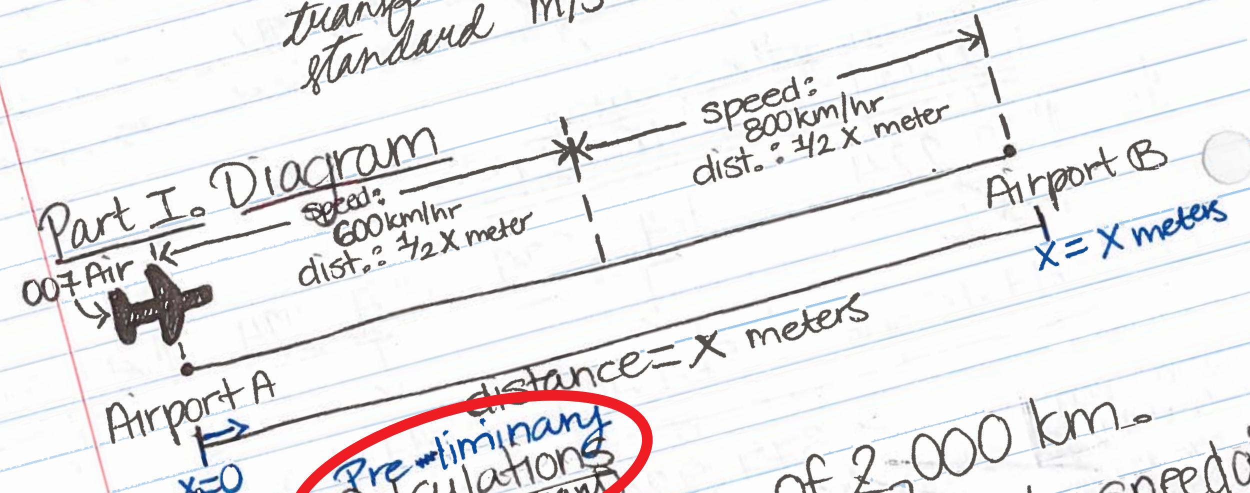
1 design

2 approach

2. expectations: • b/c average ... to time ... of displacement to time and time ... absolute distance and how much ... matter, simply how much distance (measured in displacement from point A to point B) could be covered in a specific amt of time

• note: will have to remember to transfer units of velocity to the standard m/s

Part I. Diagram



Part II: Preliminary Calculations (arbitrary)

Assume a distance of 2,000 km.

↳ For 1,000 km, 007 Air flies at a speed of 600 km/hr which takes: 1,000 km (1 hr / 600 km) = 1 2/3 hrs

↳ For the second 1,000 km, 007 Air speed = 800 km/hr

1,000 km (1 hr / 800 km) = 1.25 hrs

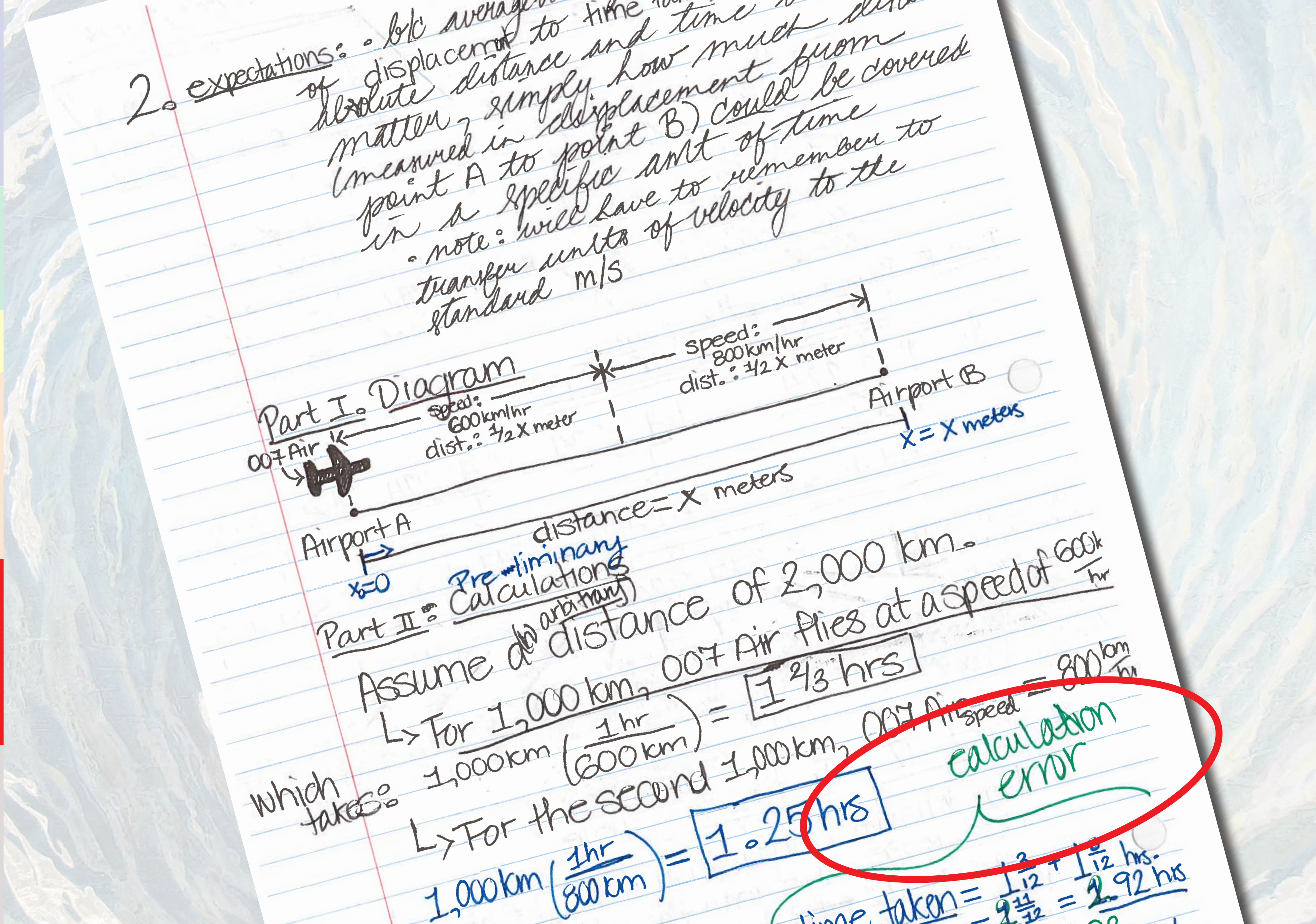
calculation error

time taken = 1 3/12 + 1 8/12 hrs. = 2 11/12 = 2.92 hrs

1 design 2 approach

reflection process

1. list assistance
2. mark up solution (blue/red)
3. list what learned
4. rate understanding (traffic light)
5. plan for review



1 design

2 approach

“I was inspired and encouraged to do these problems on my own with the promise of collaborative work [the next day]”

“I felt less pressure to find the right answer and more freedom to explore”

readiness assurance activity

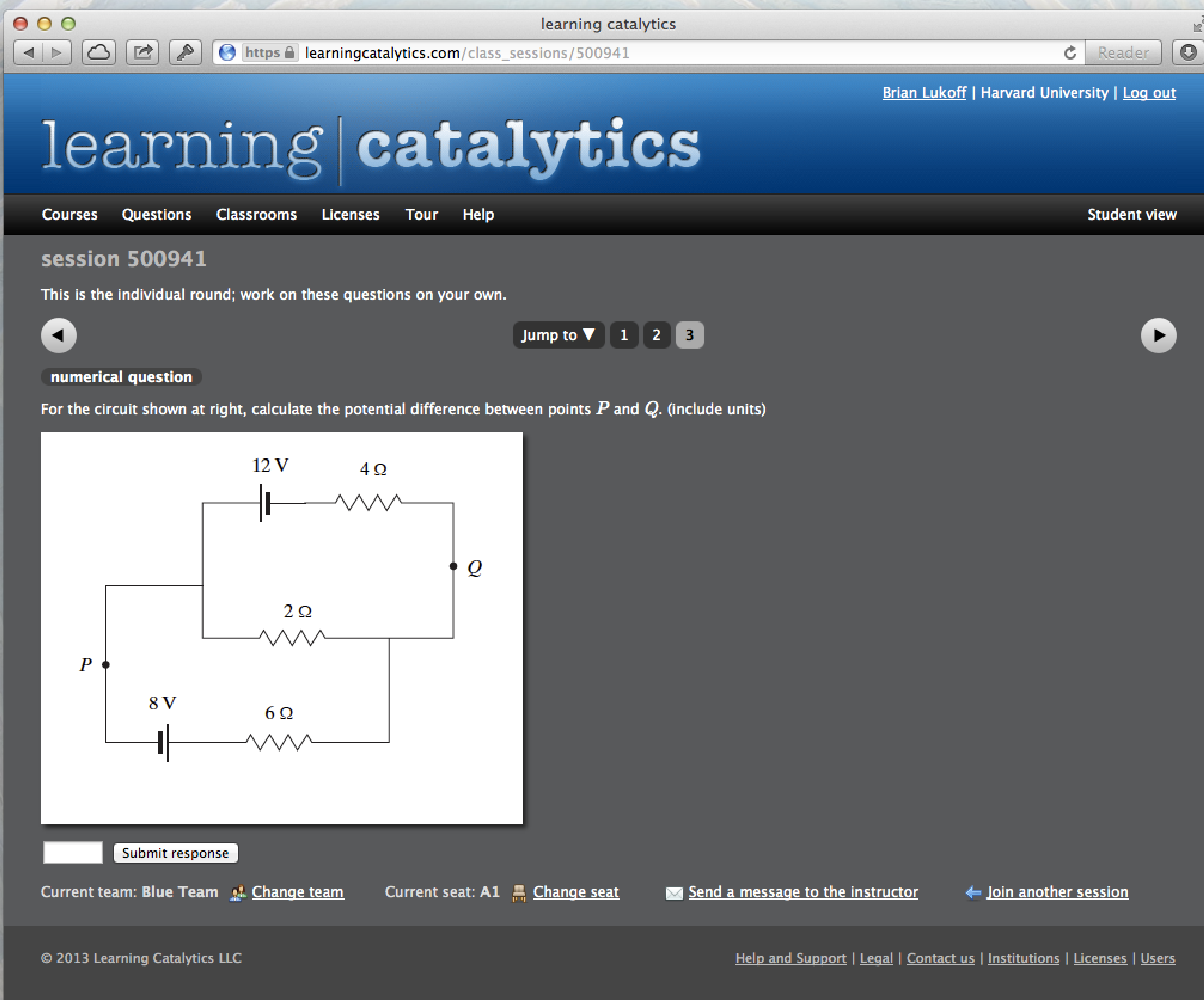
1 design

2 approach

goal: formative assessment

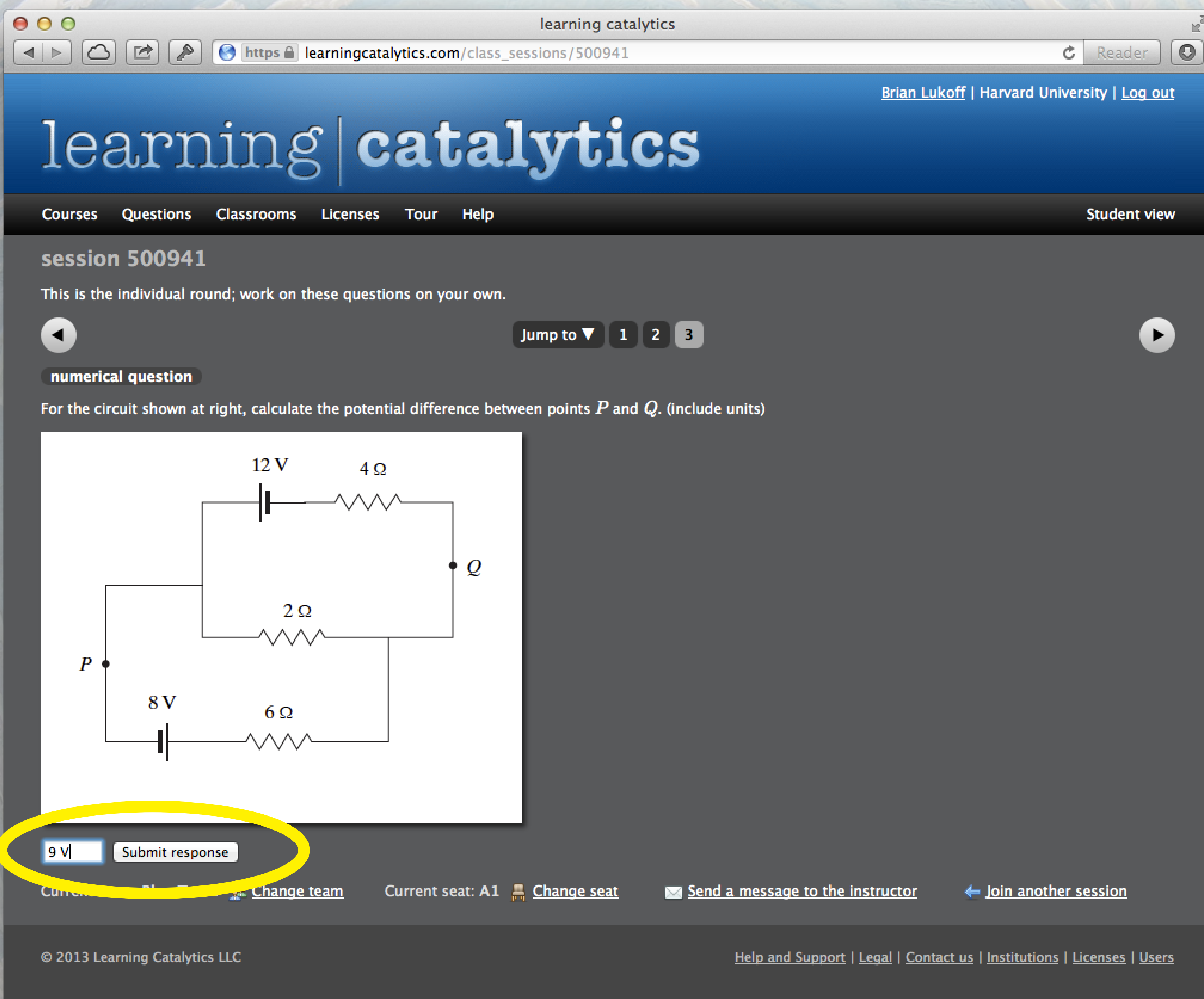
collaborative learning

readiness assurance activity



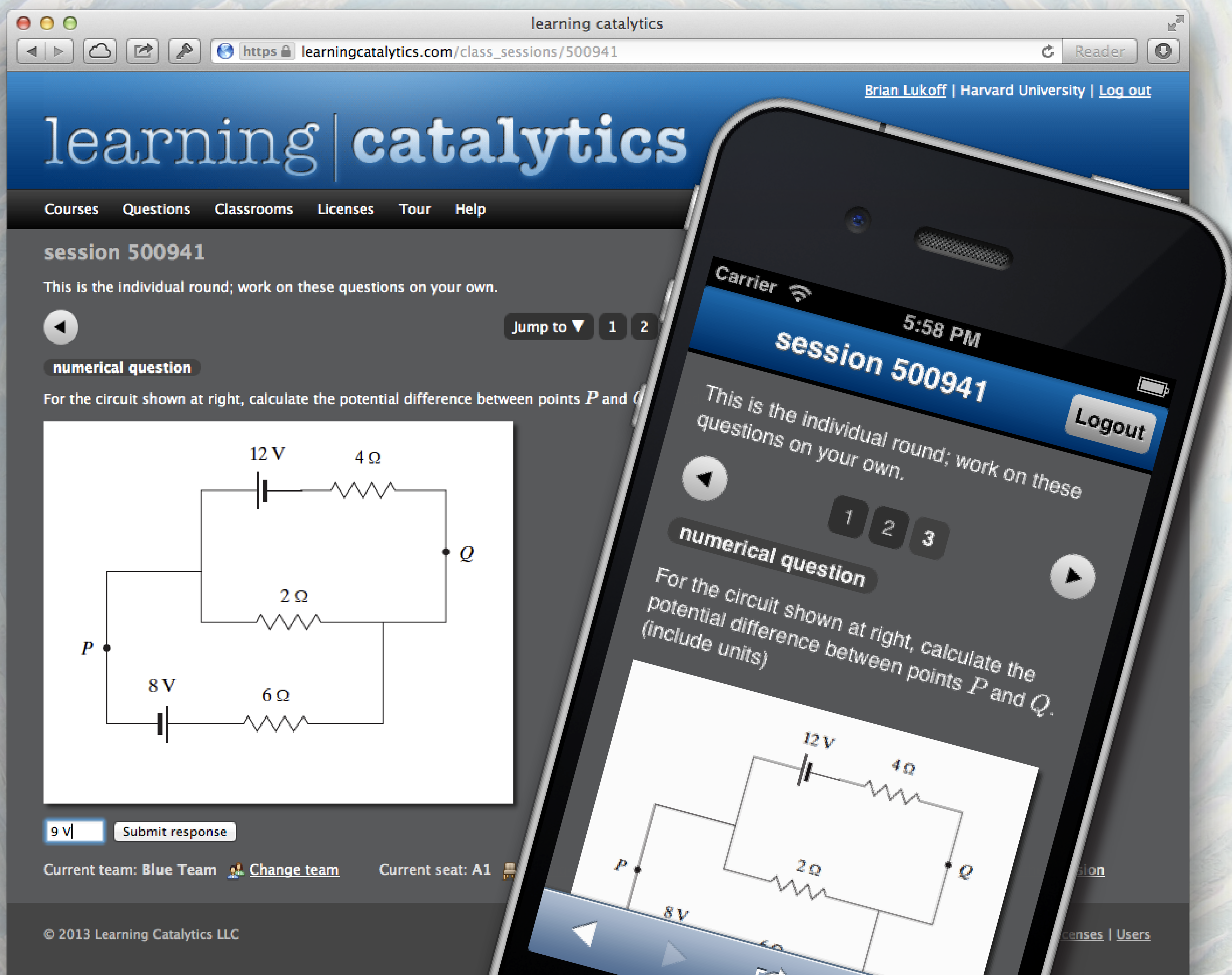
1 design

2 approach



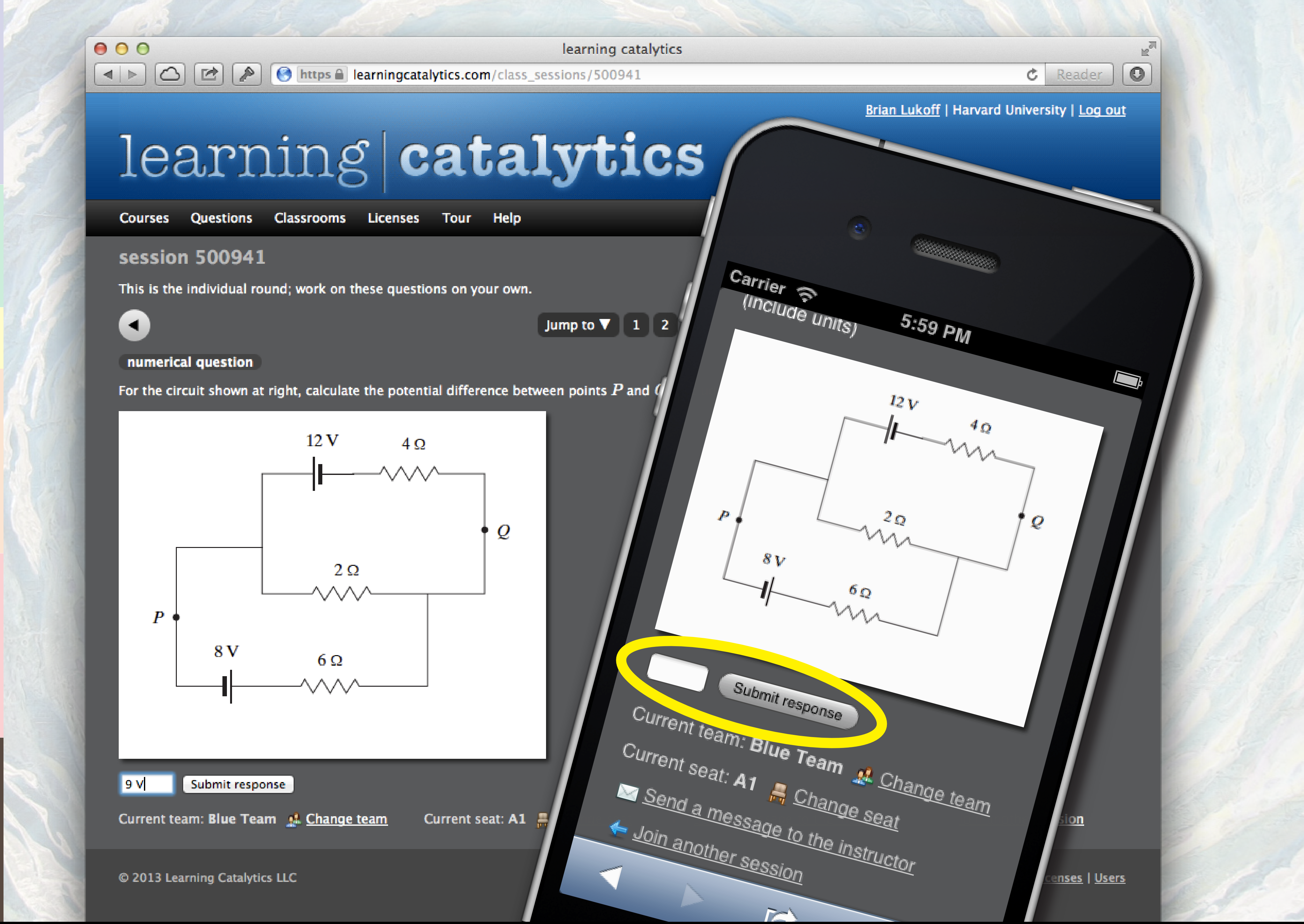
1 design

2 approach

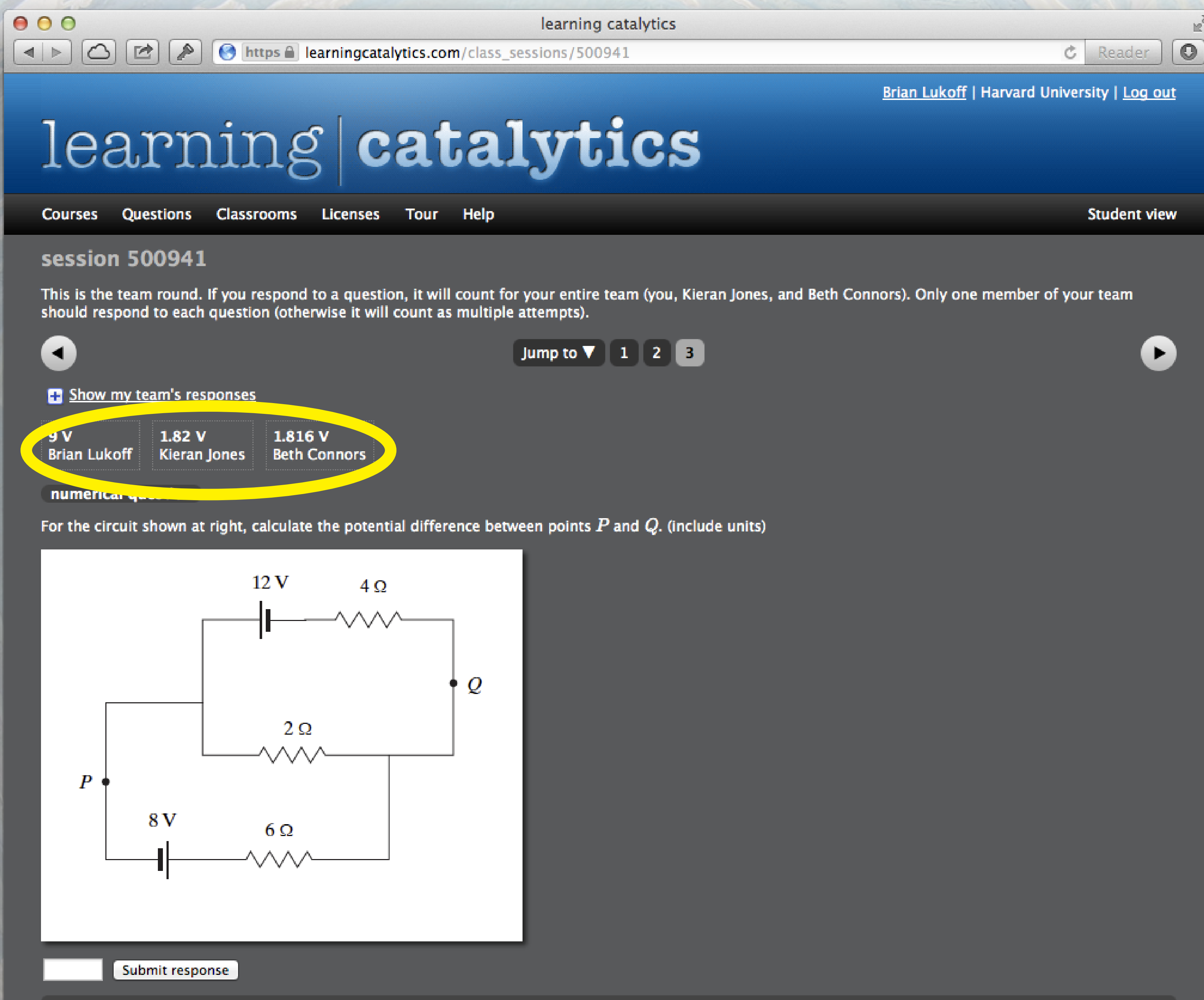


1 design

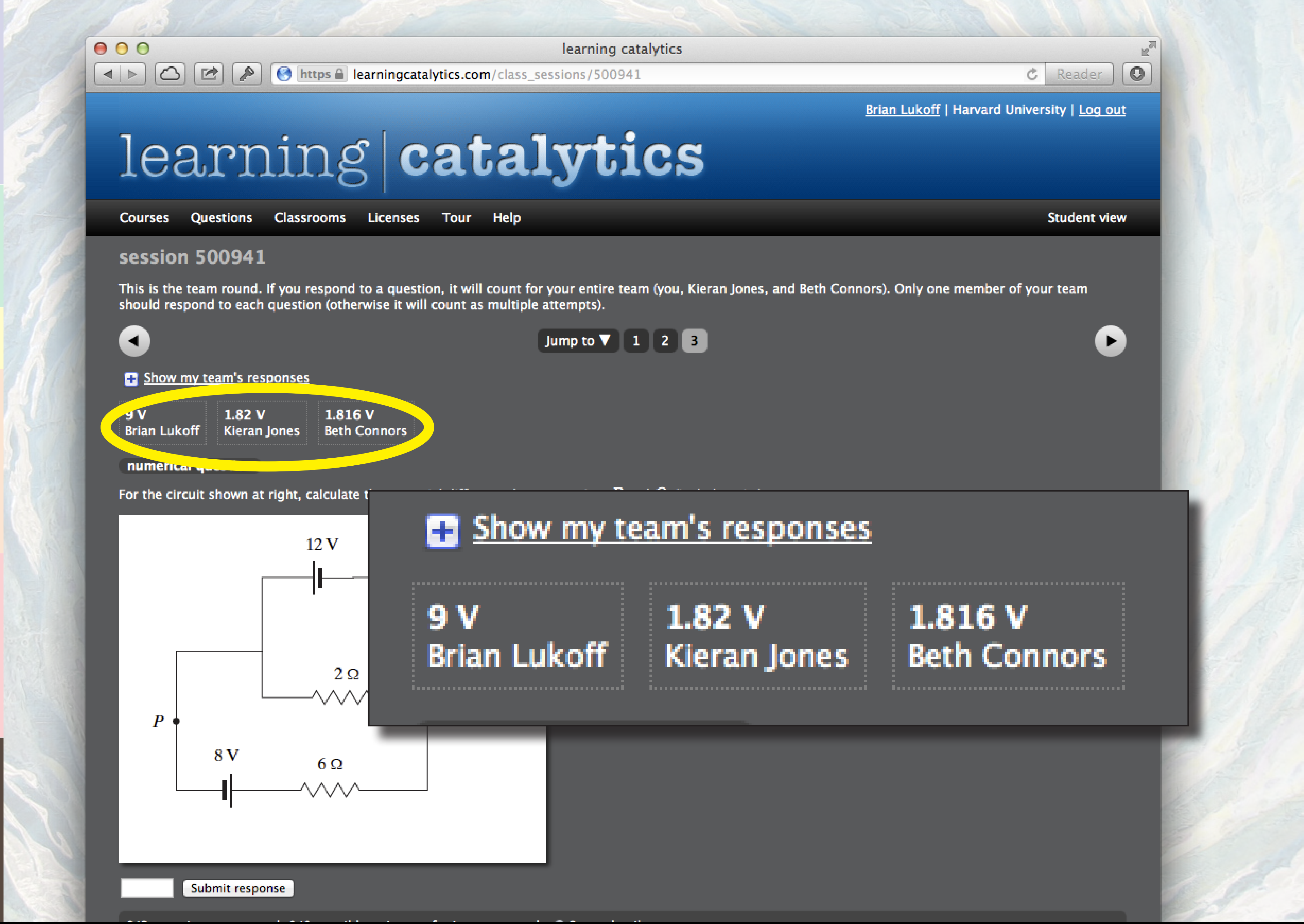
2 approach



1 design 2 approach

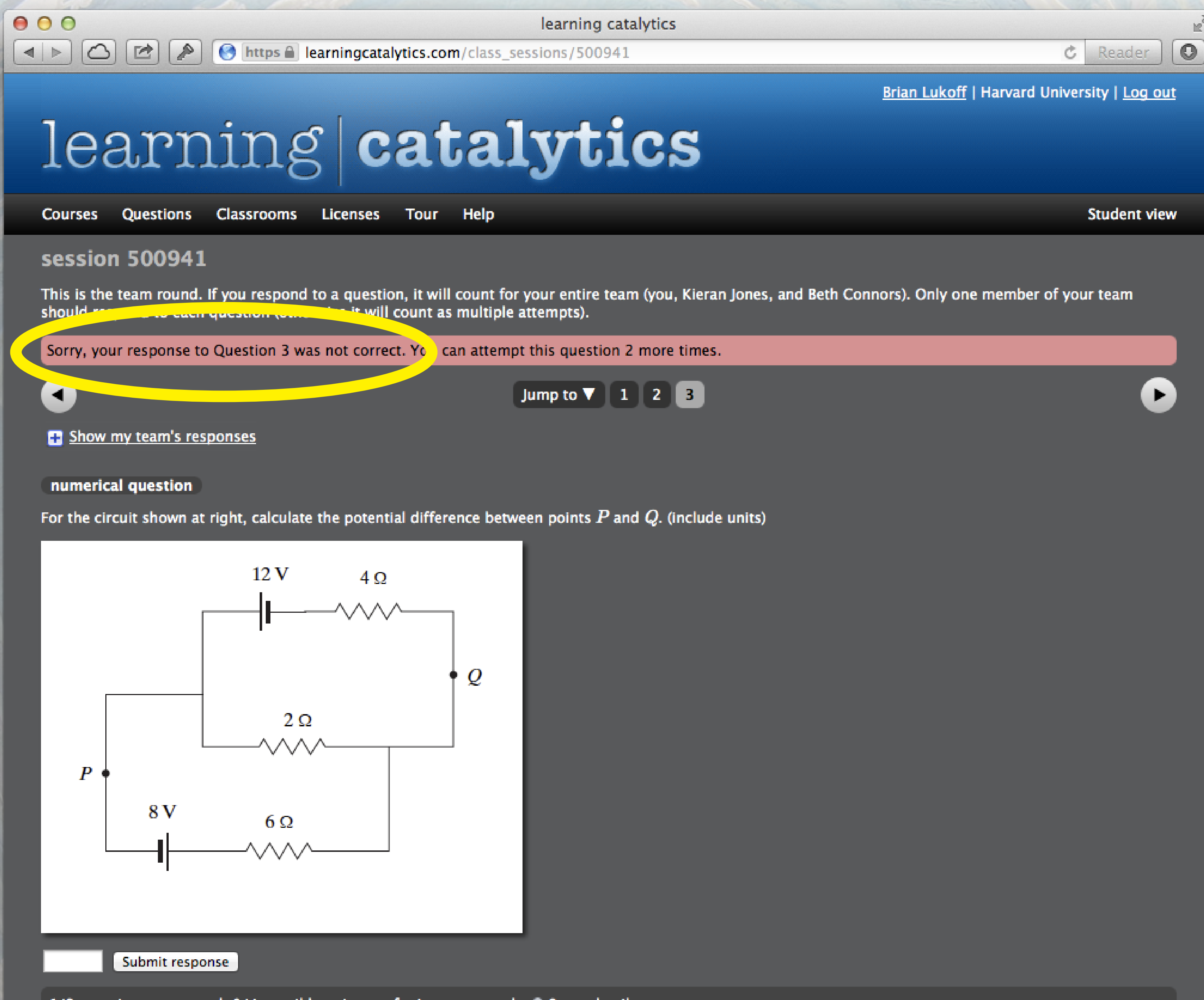


1 design **2 approach**



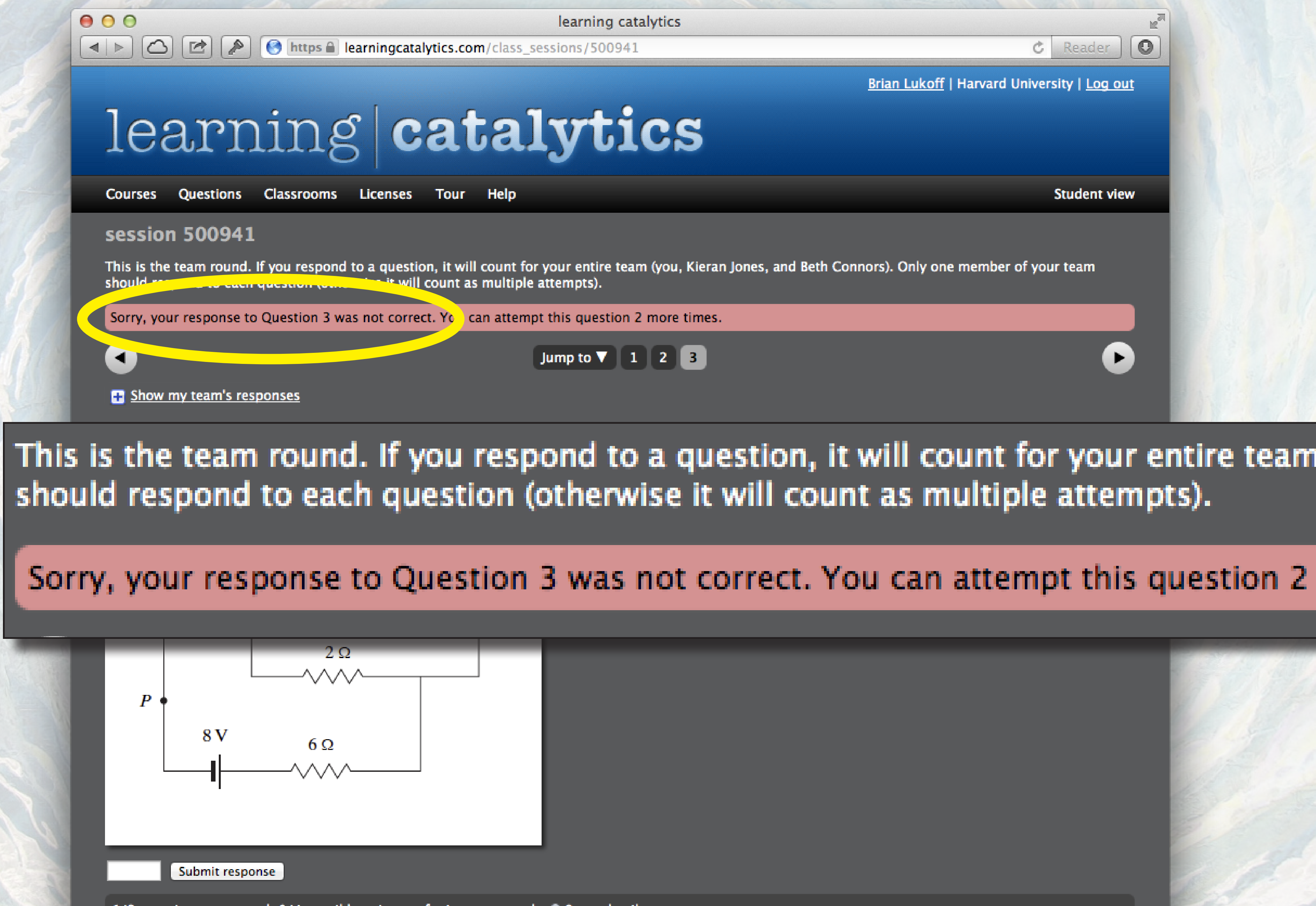
1 design 2 approach

1 design 2 approach



1 design

2 approach



1 design

2 approach

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session 500941

This is the team round. If you respond to a question, it will count for your entire team (you, Kieran Jones, and Beth Connors). Only one member of your team should respond to each question (otherwise it will count as multiple attempts).

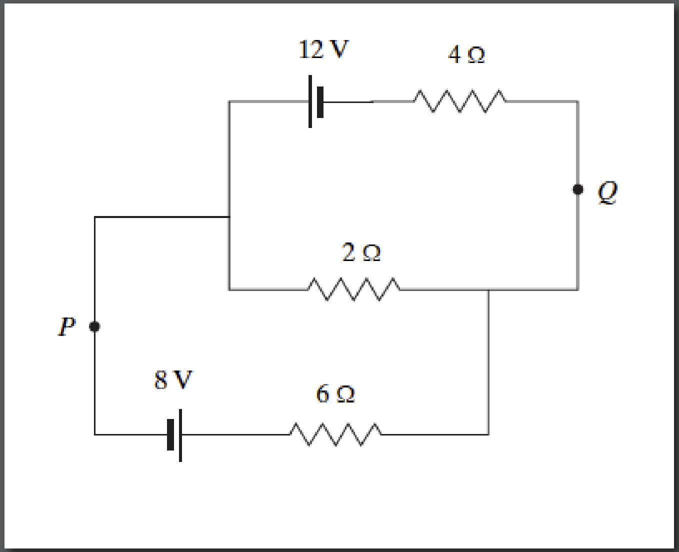
Your team answered Question 3 correctly!

Jump to ▼ 1 2 3

You have already answered this question correctly!

Question

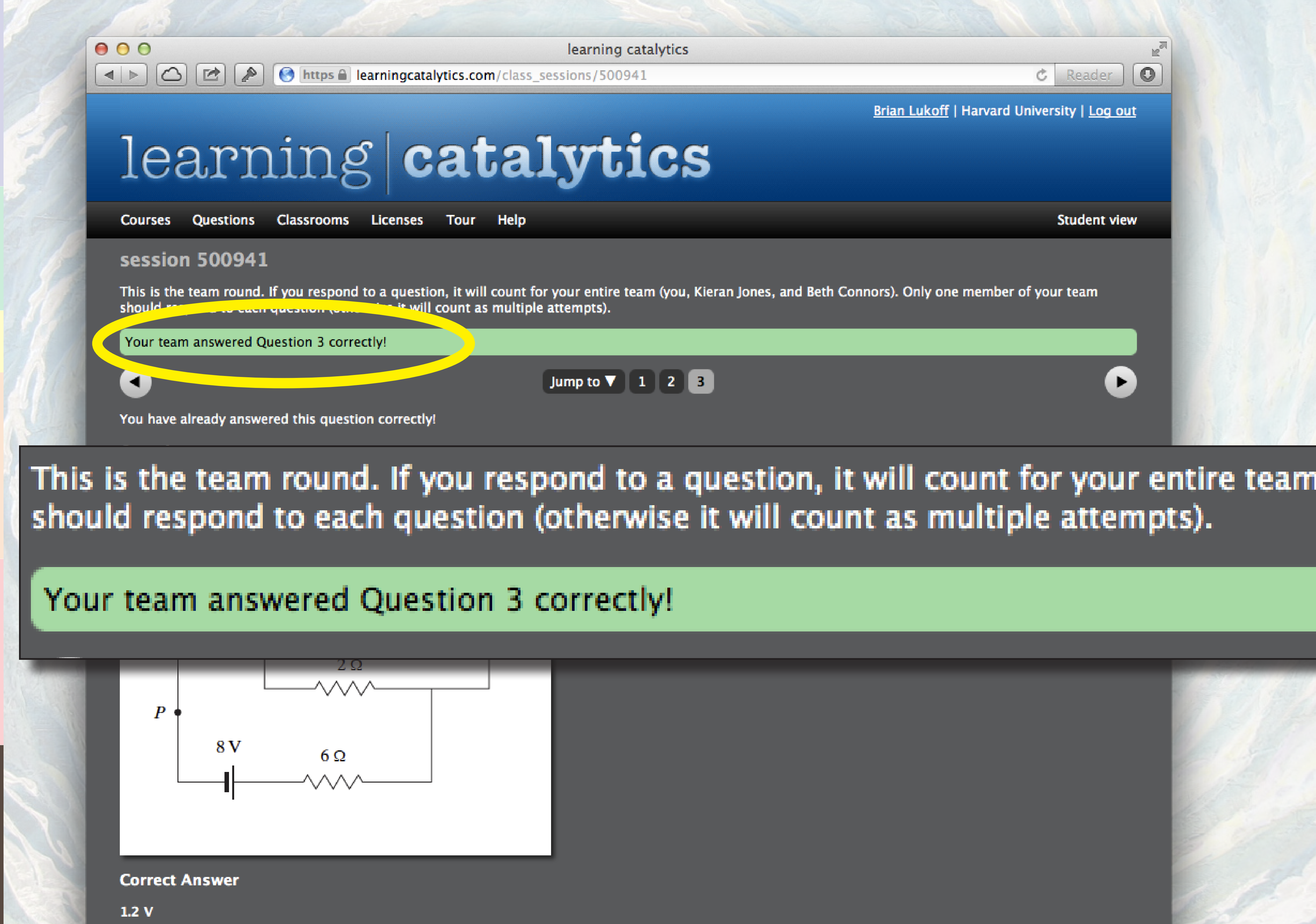
For the circuit shown at right, calculate the potential difference between points P and Q. (include units)



Correct Answer

1.2 V

1 design 2 approach



1 design

2 approach

session 500941

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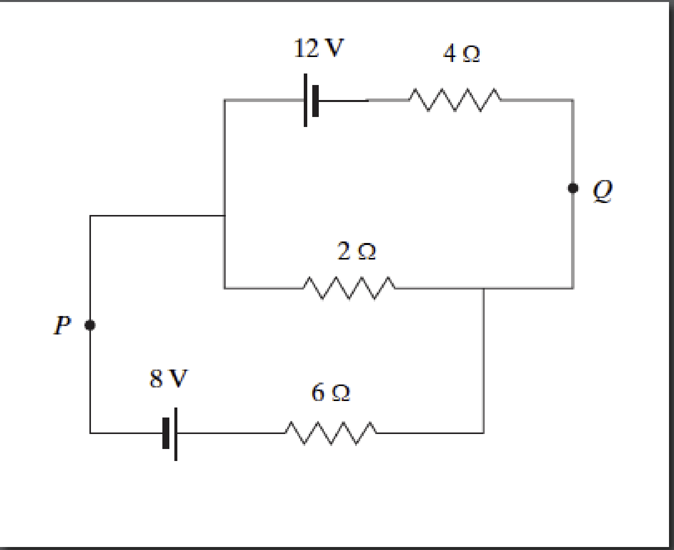


Correct Answer

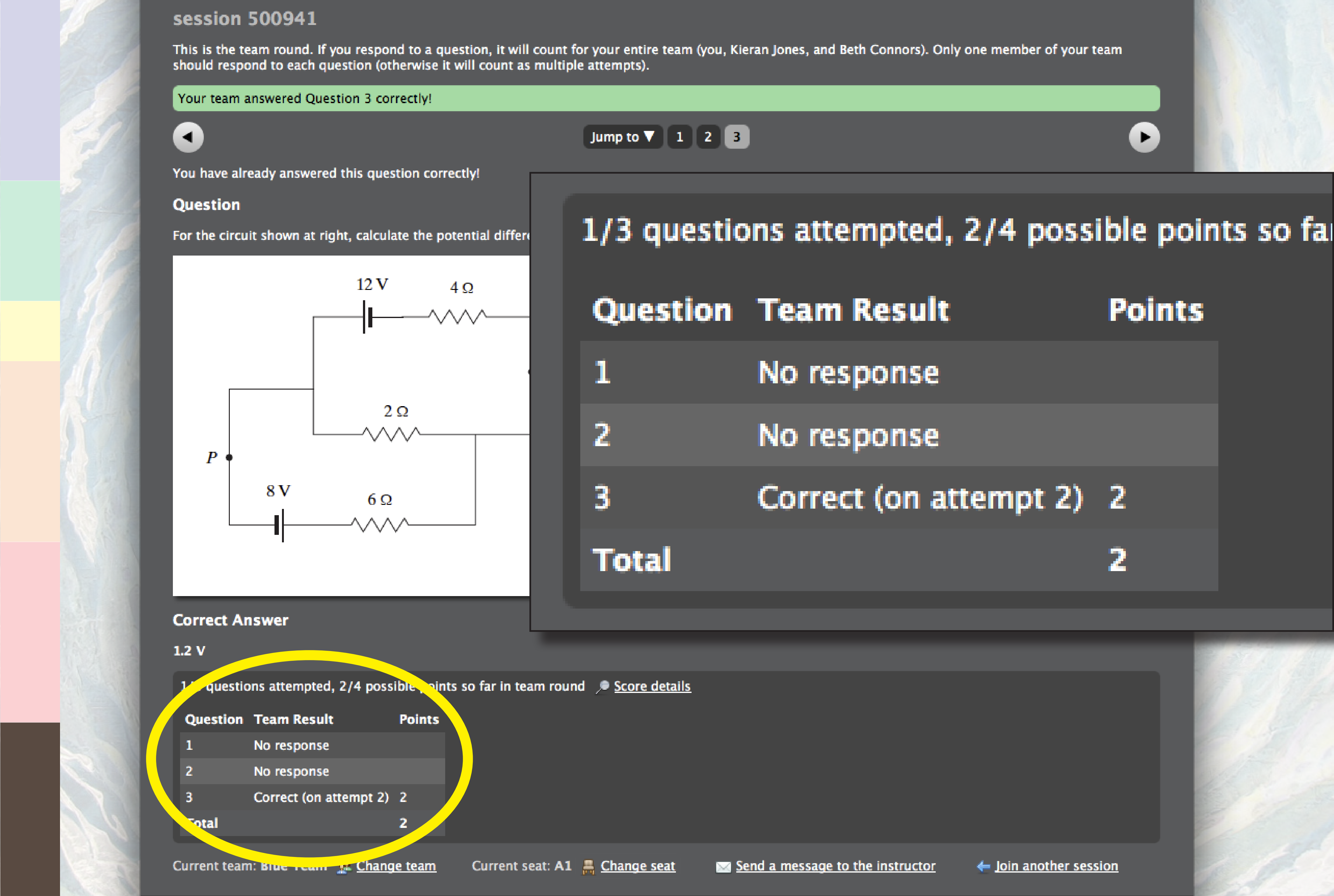
1.2 V

1 questions attempted, 2/4 possible points so far in team round Score details

Question	Team Result	Points
1	No response	
2	No response	
3	Correct (on attempt 2)	2
Total		2

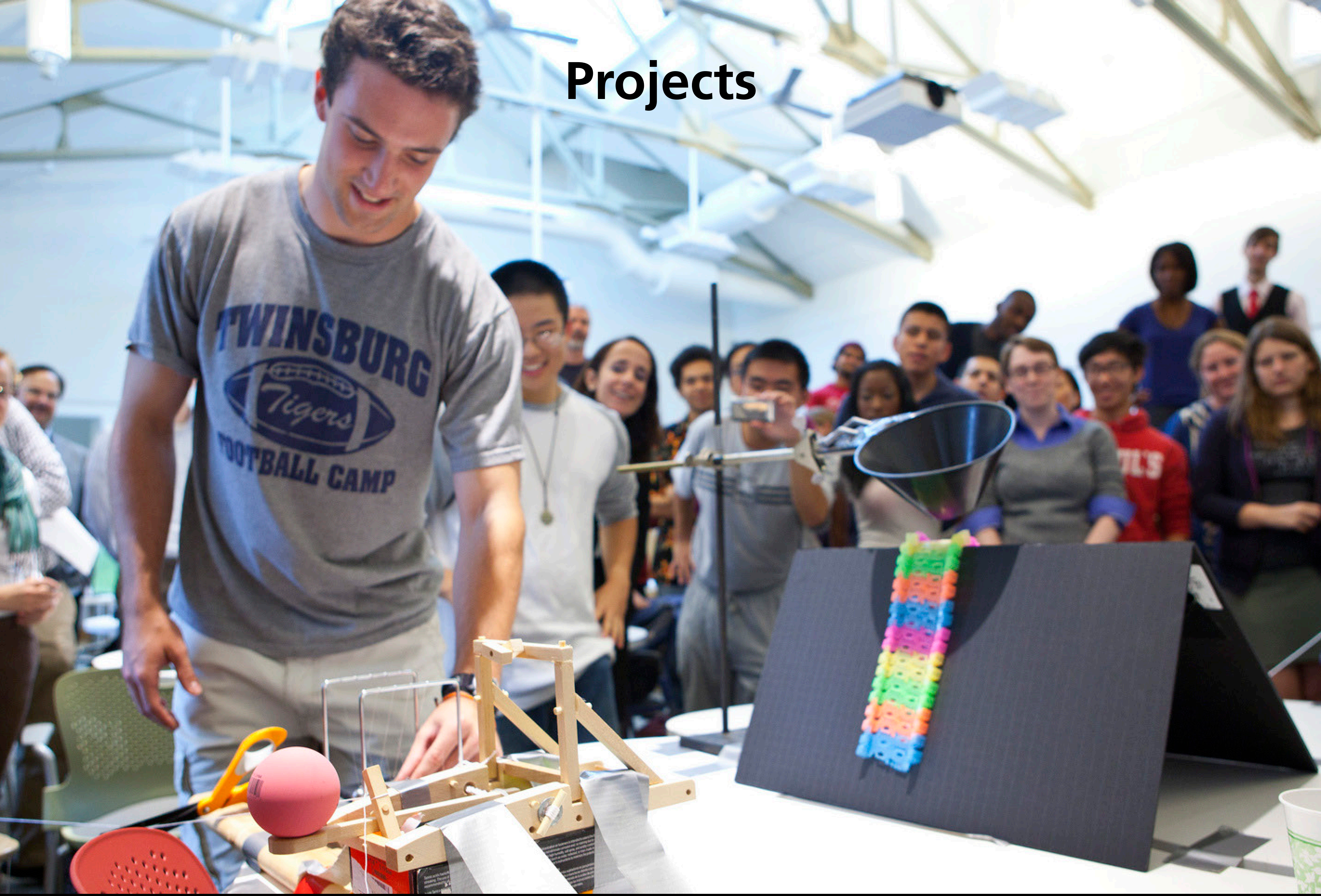
Current team: Blue Team Change team Current seat: A1 Change seat Send a message to the instructor Join another session

1 design **2 approach**



1 design 2 approach

Projects



1 design

2 approach

Projects

- 3 projects/semester
- each project roughly one month long
- different team formation for each project
- projects not prescriptive, but open-ended
- 3 types of project "fairs"

Projects

Project fair types:

- design competition
- oral presentation
- poster presentation

Projects

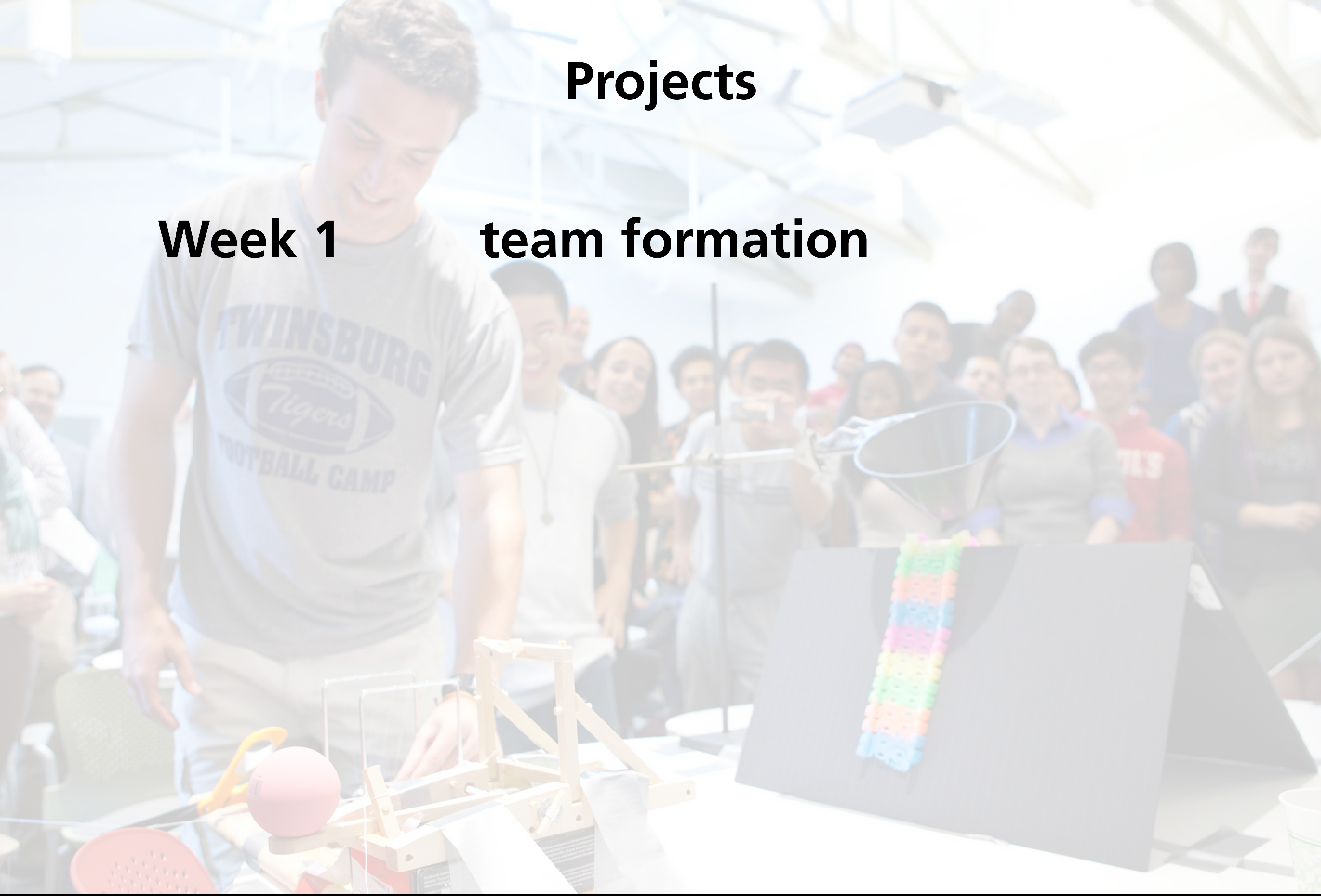
To be successful, the projects must

- require practical application of skills
- be linked to real world problems
- have compelling narrative (help/do good)

Projects

Fall	Spring
Rube Goldberg	Environment
Mission to Mars	Safe cracking
Musical Instrument	Energy

Projects



Week 1 team formation

❶ design ❷ approach

Projects

Week 1 team formation
project brief

❶ **design** ❷ **approach**

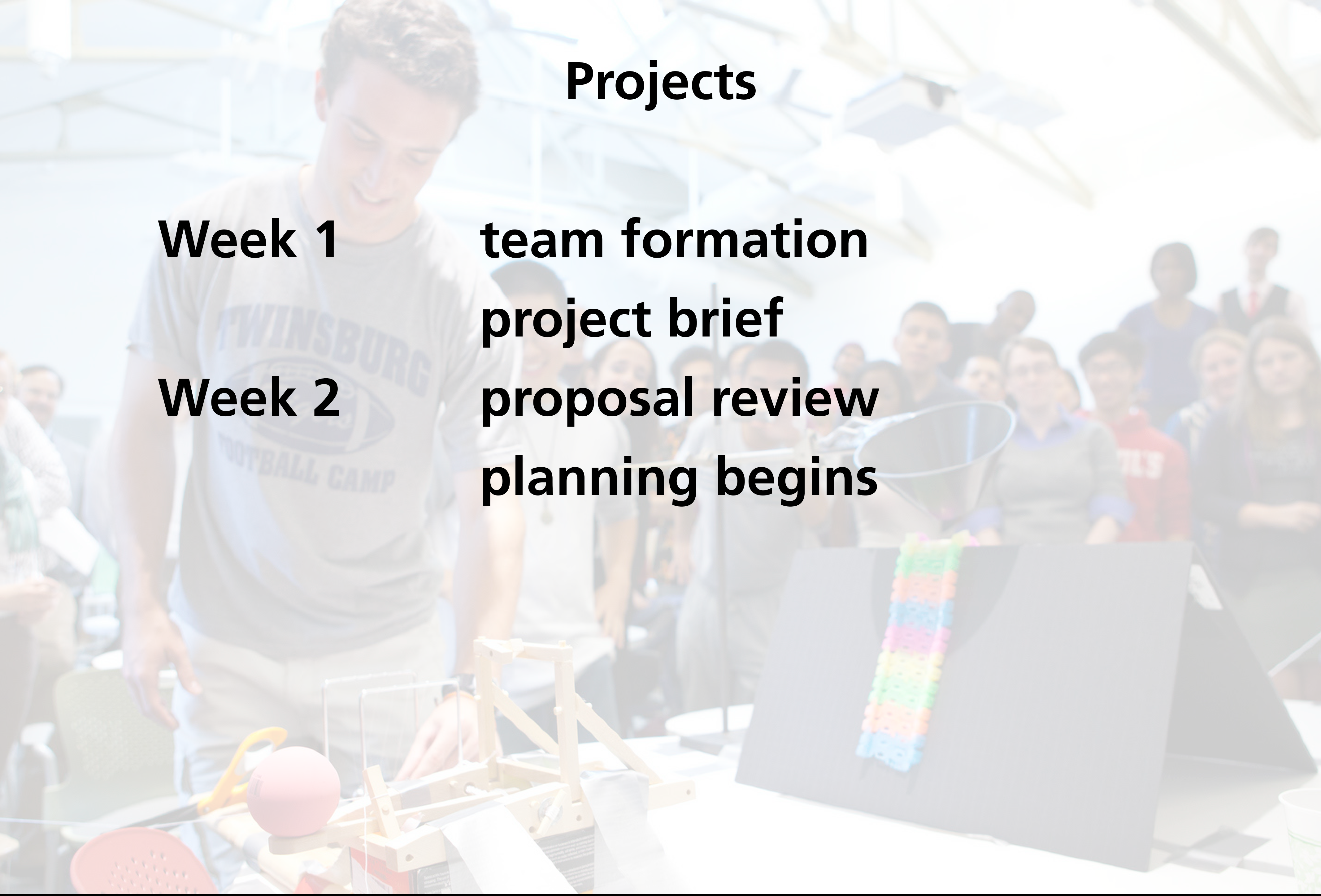
Projects

Week 1	**team formation**
	project brief
Week 2	**proposal review**

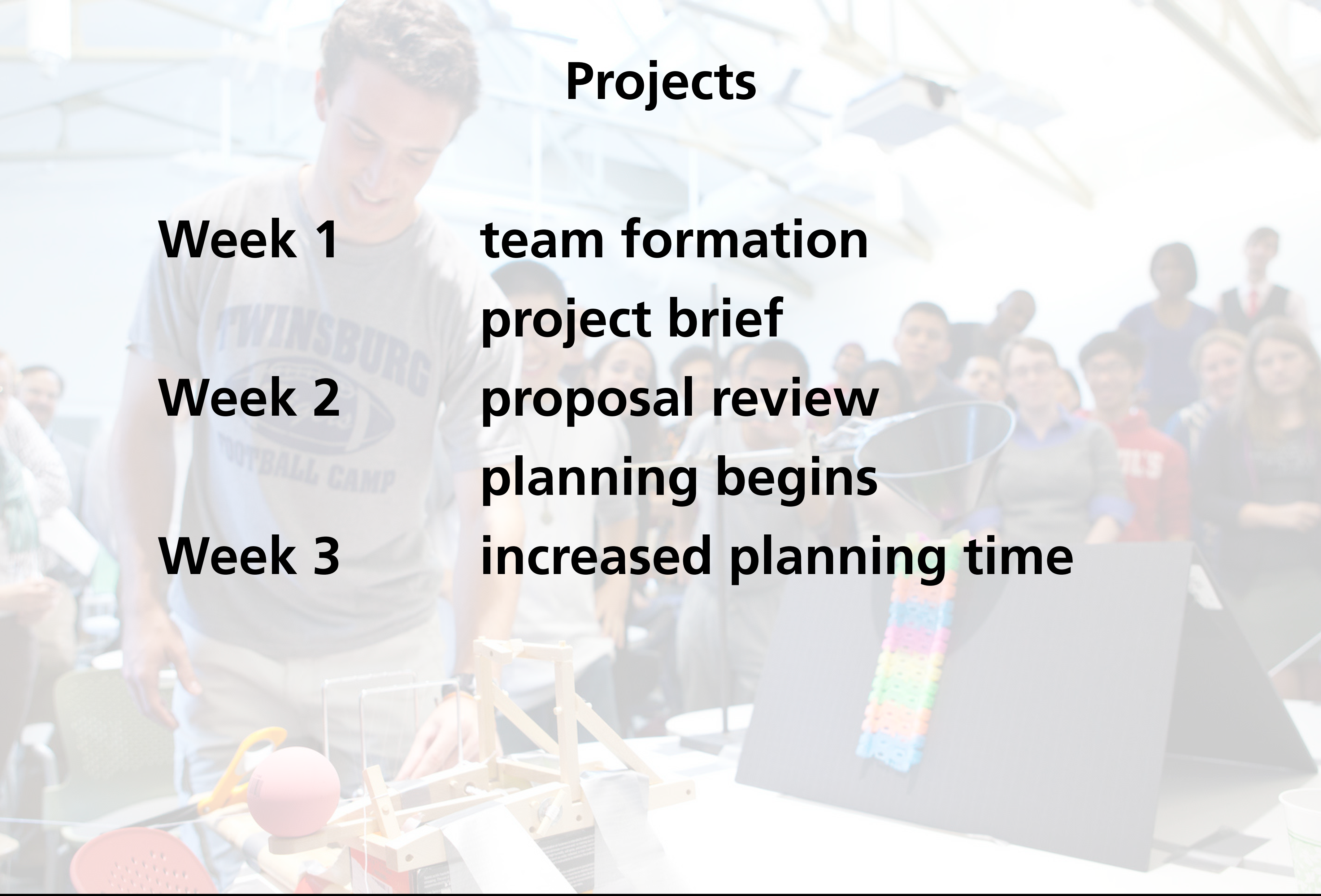
1 design **2** approach

Projects

Week 1	team formation
	project brief
Week 2	proposal review
	planning begins



❶ design ❷ approach



Projects

Week 1	team formation
	project brief
Week 2	proposal review
	planning begins
Week 3	increased planning time

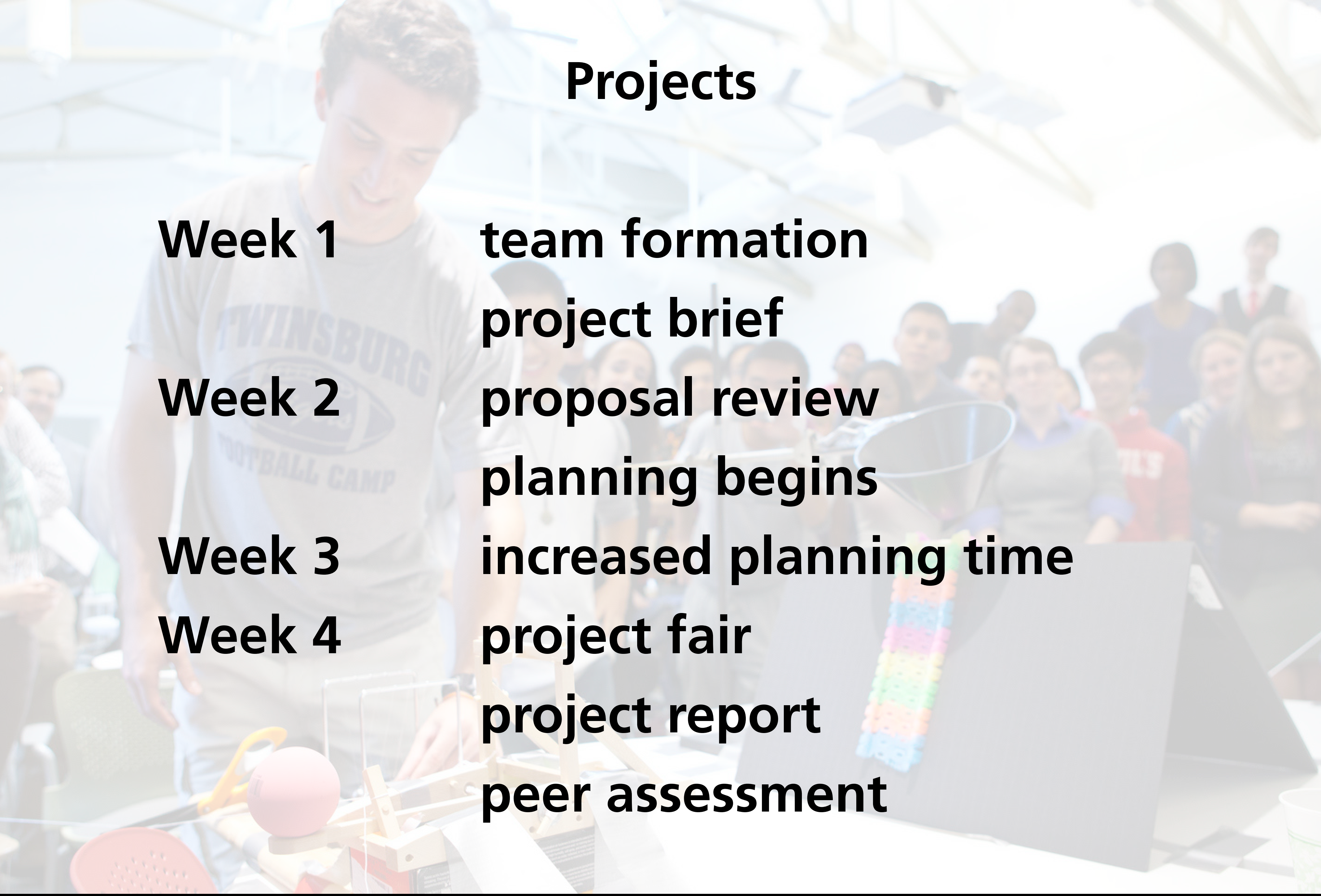
1 design　2 approach

Projects

Week 1	team formation
	project brief
Week 2	proposal review
	planning begins
Week 3	increased planning time
Week 4	project fair

Projects

Week 1	**team formation**
	project brief
Week 2	**proposal review**
	planning begins
Week 3	**increased planning time**
Week 4	**project fair**
	project report



Projects

Week 1	**team formation**
	project brief
Week 2	**proposal review**
	planning begins
Week 3	**increased planning time**
Week 4	**project fair**
	project report
	peer assessment

Wee

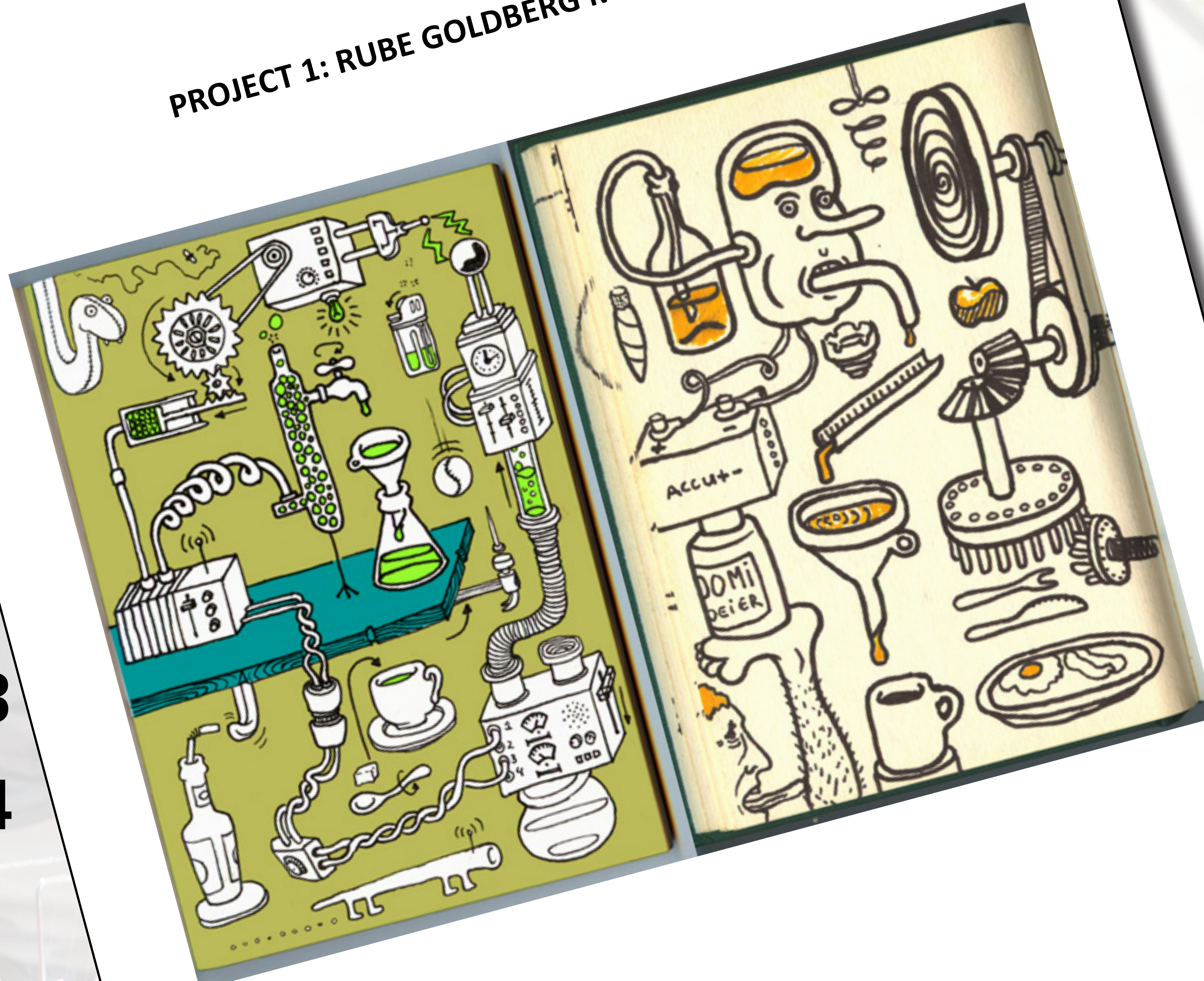
Week

Week 3

Week 4

AP50a FAL

PROJECT 1: RUBE GOLDBERG MACHINE



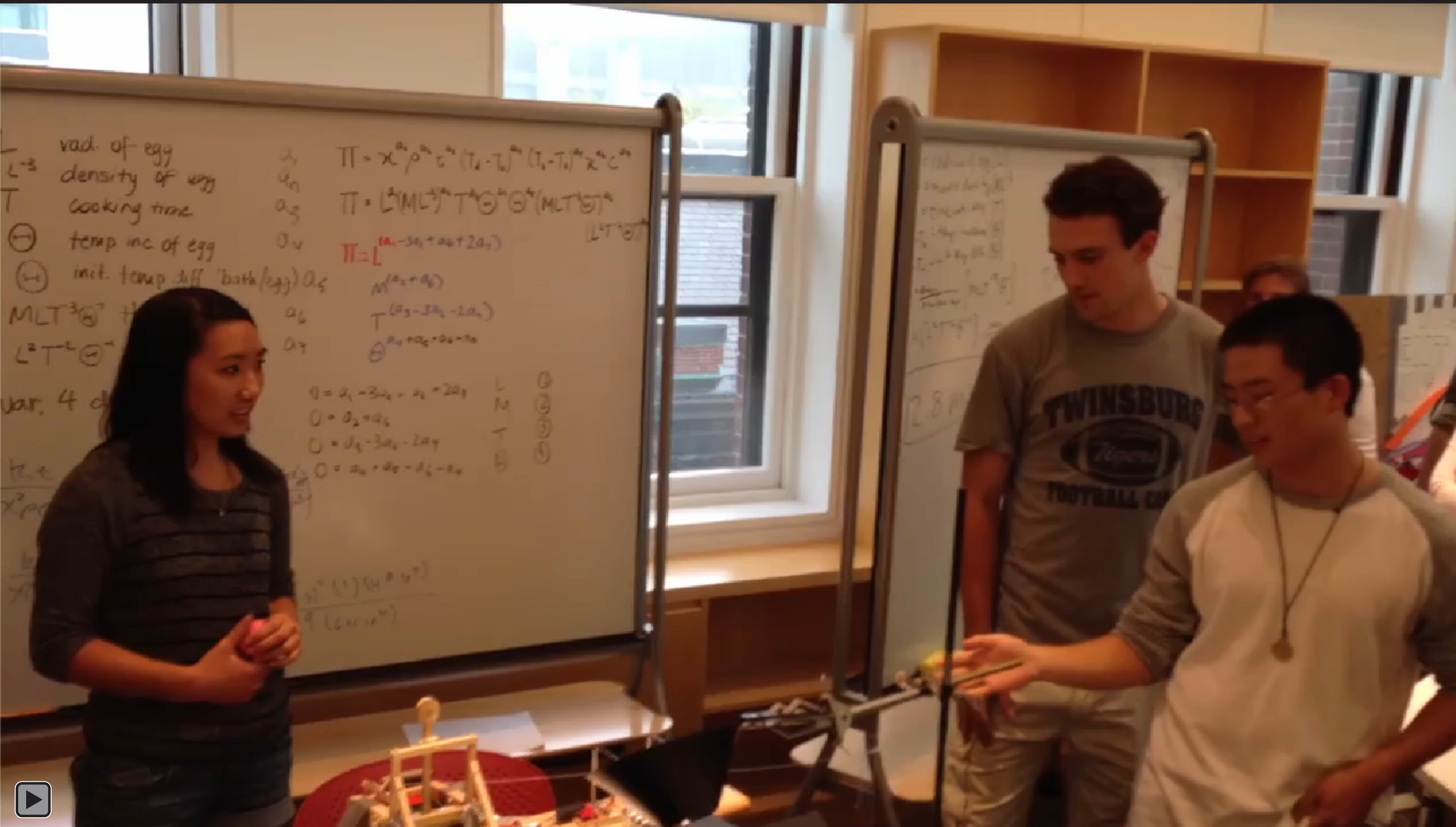
Important dates:

9/24 Project proposals due

10/10 Project reports due

?/3 Project presentations

1 design



1 design

2 approach

CRACK-A-THON

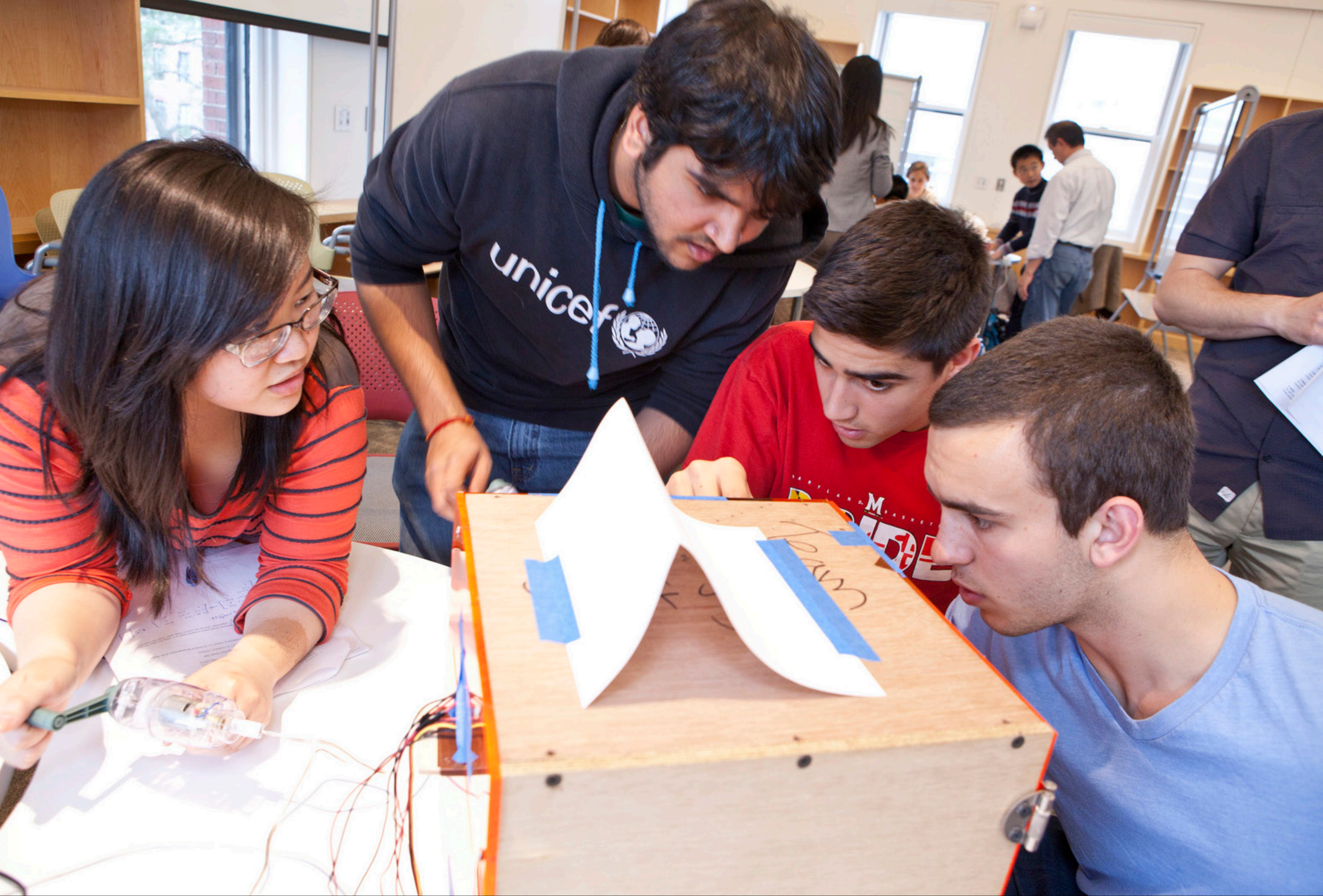
AP50

Wed Apr 10 • 2–5 pm • Pierce 301

1 design   2 approach

1 design 2 approach

1 design 2 approach



1 design

2 approach

1 design 2 approach

AP50b Fall 2013

Peer Assessment

Team work is central in your projects and it is important to provide positive feedback to people who truly worked hard for the good of the team and to also make suggestions to those you perceived not to be working as effectively on team tasks. You may want to review the sections entitled on Teamwork and Peer Assessment in the syllabus to refresh your memory on why we stress teamwork and how to maximize the benefit from work together. Please complete the form below to assess your own contributions and those of your team members.

Complete the paper based form, then enter the data online at: http://bit.ly/AP50Teameval

How we will use your evaluation: In computing the (multiplicative) weight we give to your team scores, we will take into account:

1. Your team members' assessment of your contributions,
2. the quality of your self assessment (that is, how well it matches that of your team members' evaluation of your contribution), and
3. the quality of your assessment of your team members (that is, how well it matches the evaluations of that team member's contribution by the remainder of the team).

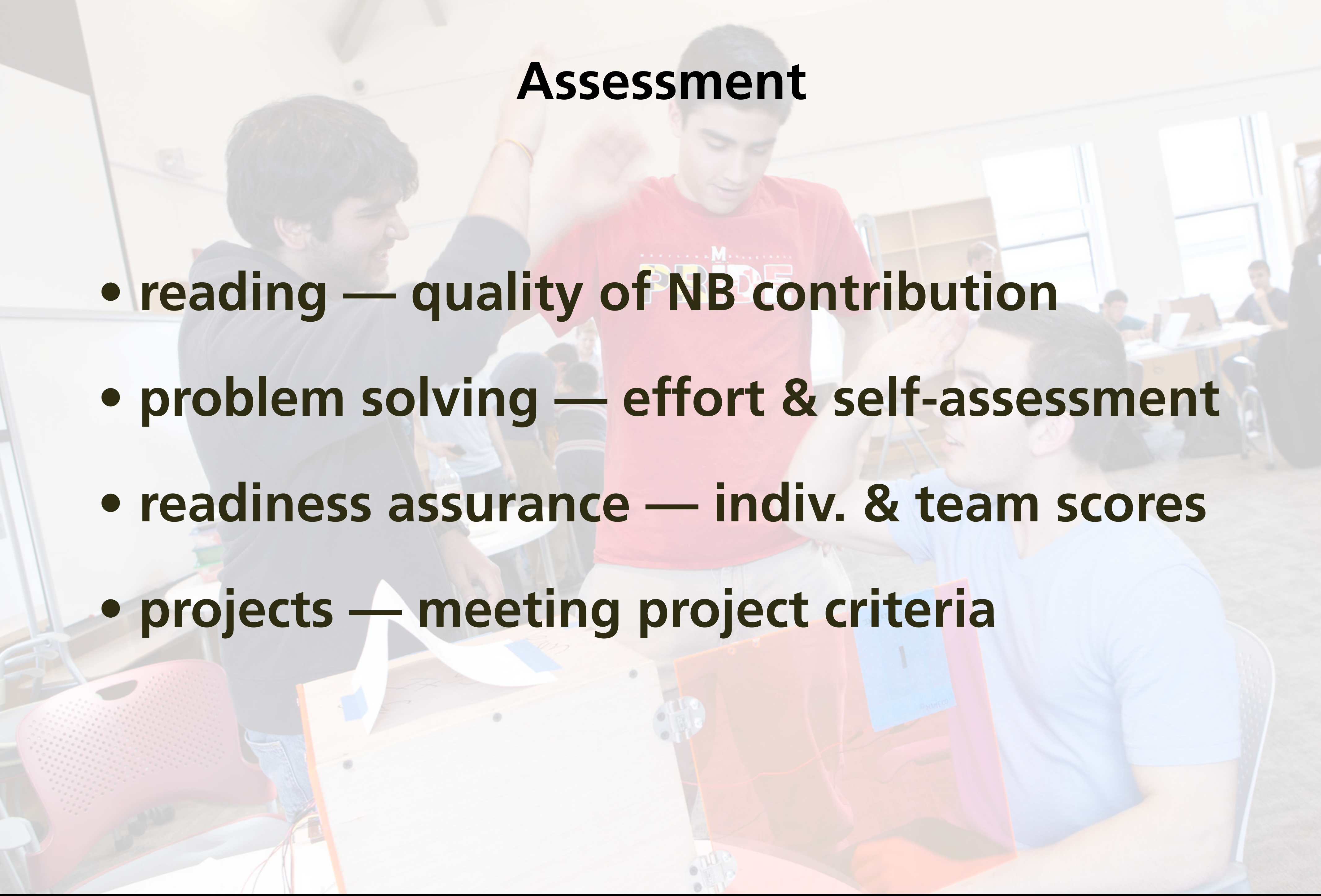
Please first complete the individual forms for each team member (including yourself), then complete the table below. When completing the table below, be sure that the **total of all relative contributions must be zero**.

		RELATIVE CONTRIBUTION Total must equal **ZERO**						
		Below Average			Average	Above average		
	Name	−3	−2	−1	0	1	2	3
Me								
Member 1								
Member 2								
Member 3								
Member 4								

1 design

2 approach

Assessment



- reading — quality of NB contribution
- problem solving — effort & self-assessment
- readiness assurance — indiv. & team scores
- projects — meeting project criteria

1 design   2 approach   3 results

Ownership

Ownership

Course evaluation: 4.2/5

Ownership

"The structure of the class made what was my least-favorite subject into one of my favorites.

Ownership

"The structure of the class made what was my least-favorite subject into one of my favorites. I was worried that people, including myself, would just slack off and do the bare minimum, but you really need to be on top of your readings and concepts in order to contribute to your team. GREAT CLASS!!!!!!"

Ownership

“Dear Harvard students, this class will be unlike any class you’ve taken at Harvard, and it will, hopefully, shift the entire foundation upon which you’ve based your education. I truly believe everyone should take this course; prepare to take full ownership of your learning.”

Ownership

Attendance: 94% (AP50a), 97% (AP50b)

Ownership

Attendance: 94% (AP50a), 97% (AP50b)

3 hours and they don't *leave*!

Ownership

"I don't think I am well enough to make it through class. I feel terrible because I don't want to let my team down by not being there, but I don't think I'd be very helpful in my current state."

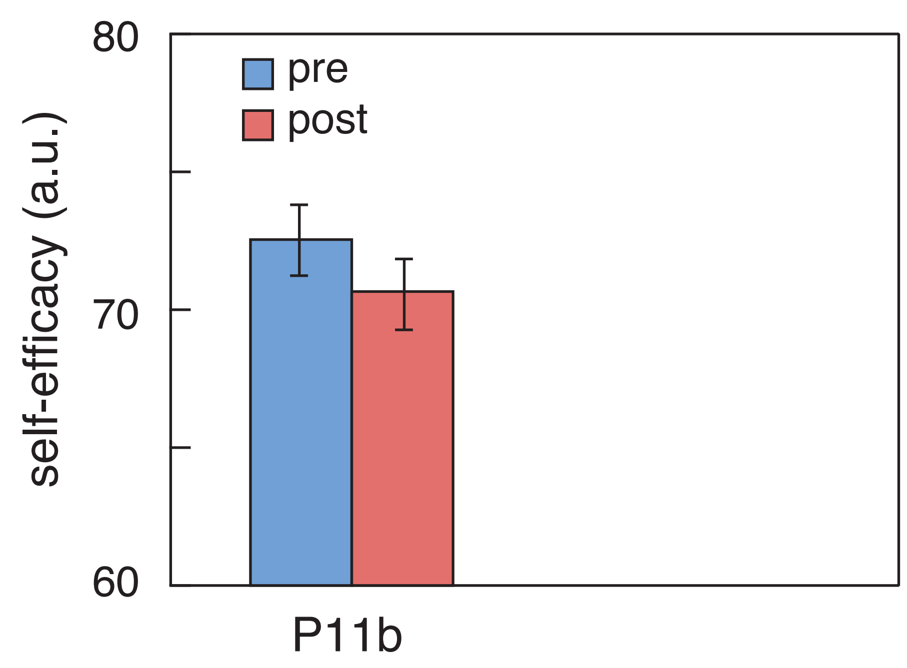
(via email)

Self-efficacy

Self-efficacy

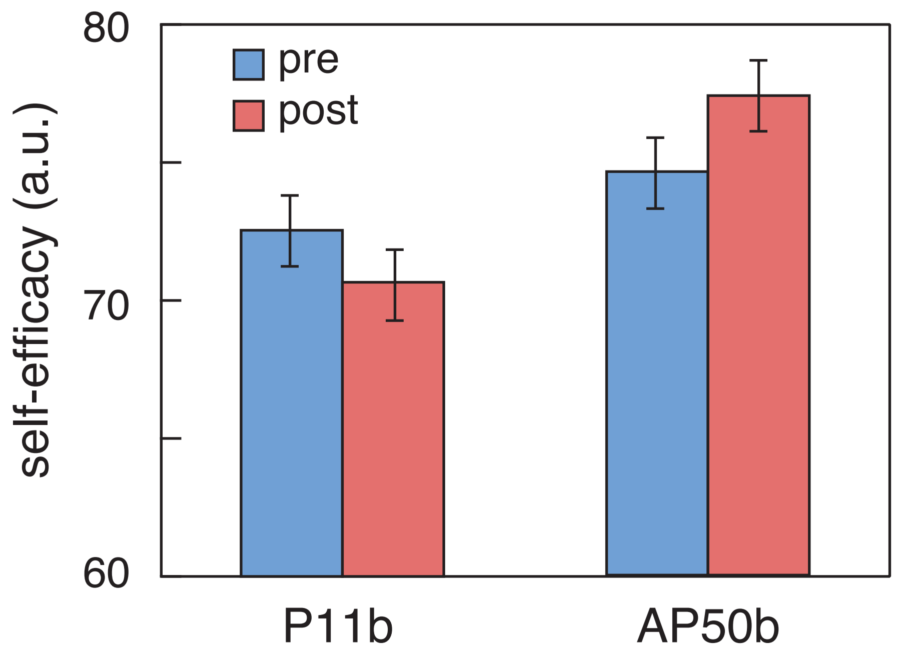
(students' belief in their ability to succeed)

Self-efficacy



1 design
2 approach
3 results

Self-efficacy



❶ design ❷ approach ❸ results

Self-directed learning

1 design

2 approach

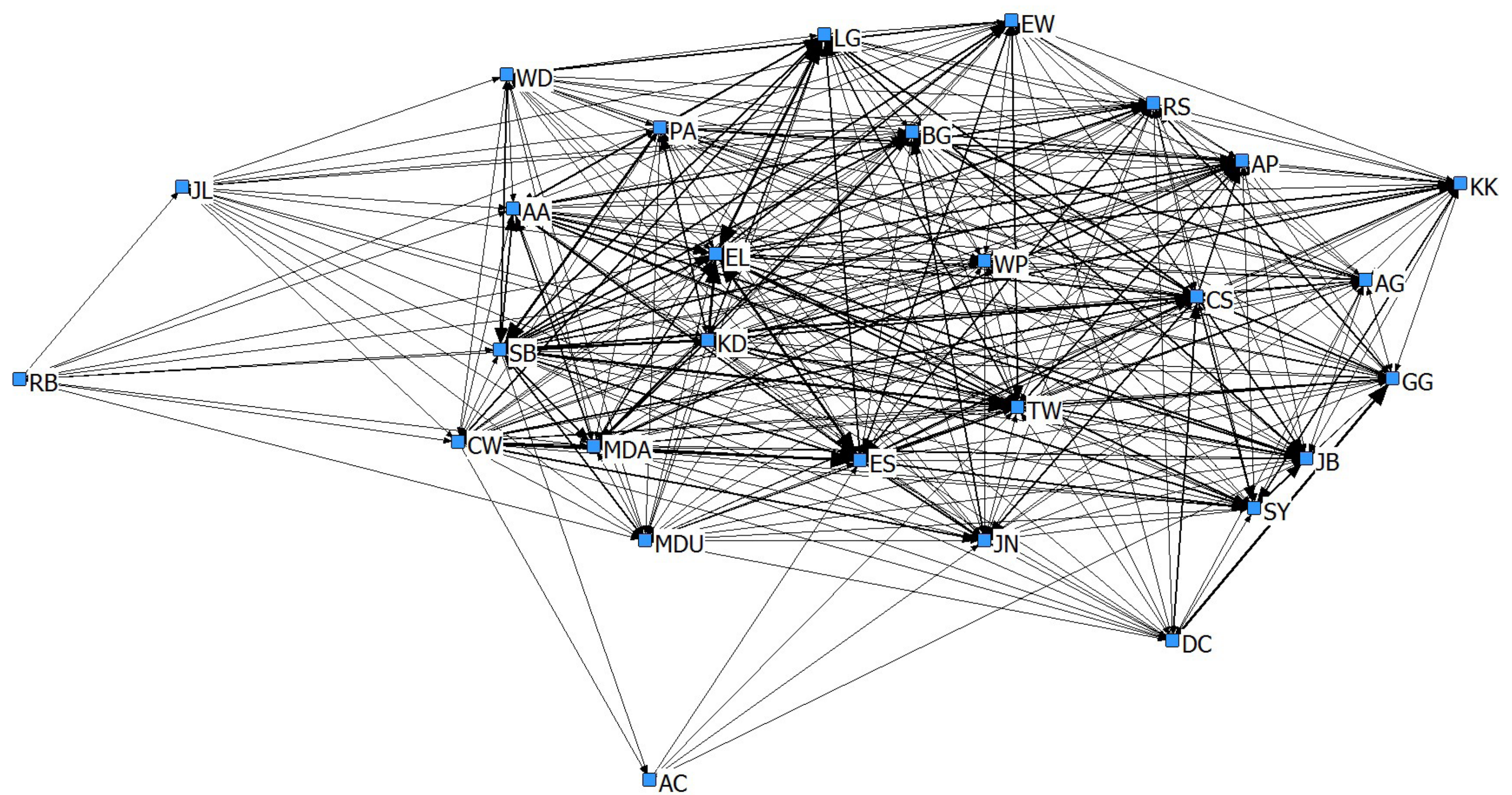
3 results

Self-directed learning

NB data shows:

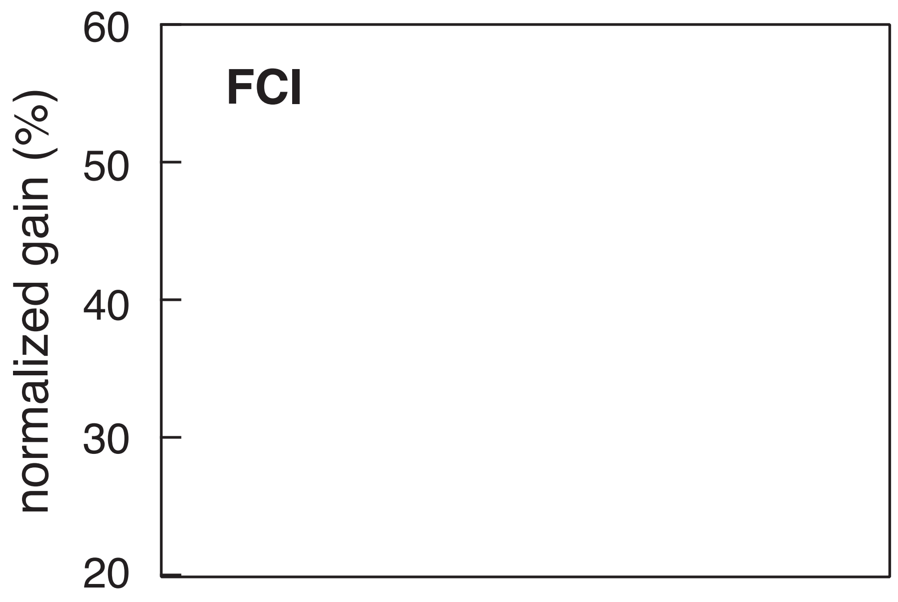
- student spend on average 2.3 hrs/chapter
- 160–230 annotations/chapter (5–7/stu)

Self-directed learning



1 design 2 approach 3 results

Conceptual Mastery



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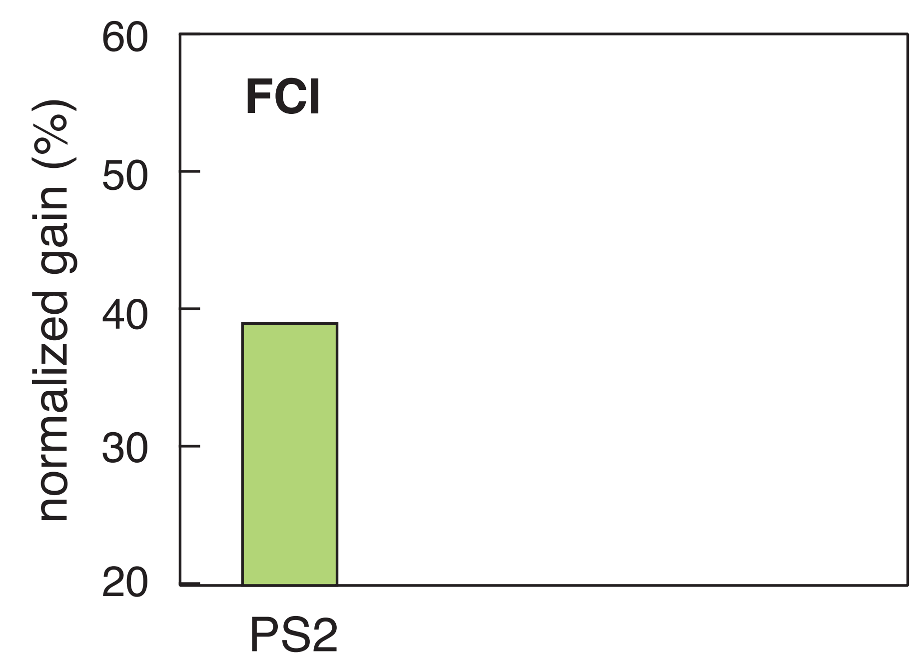
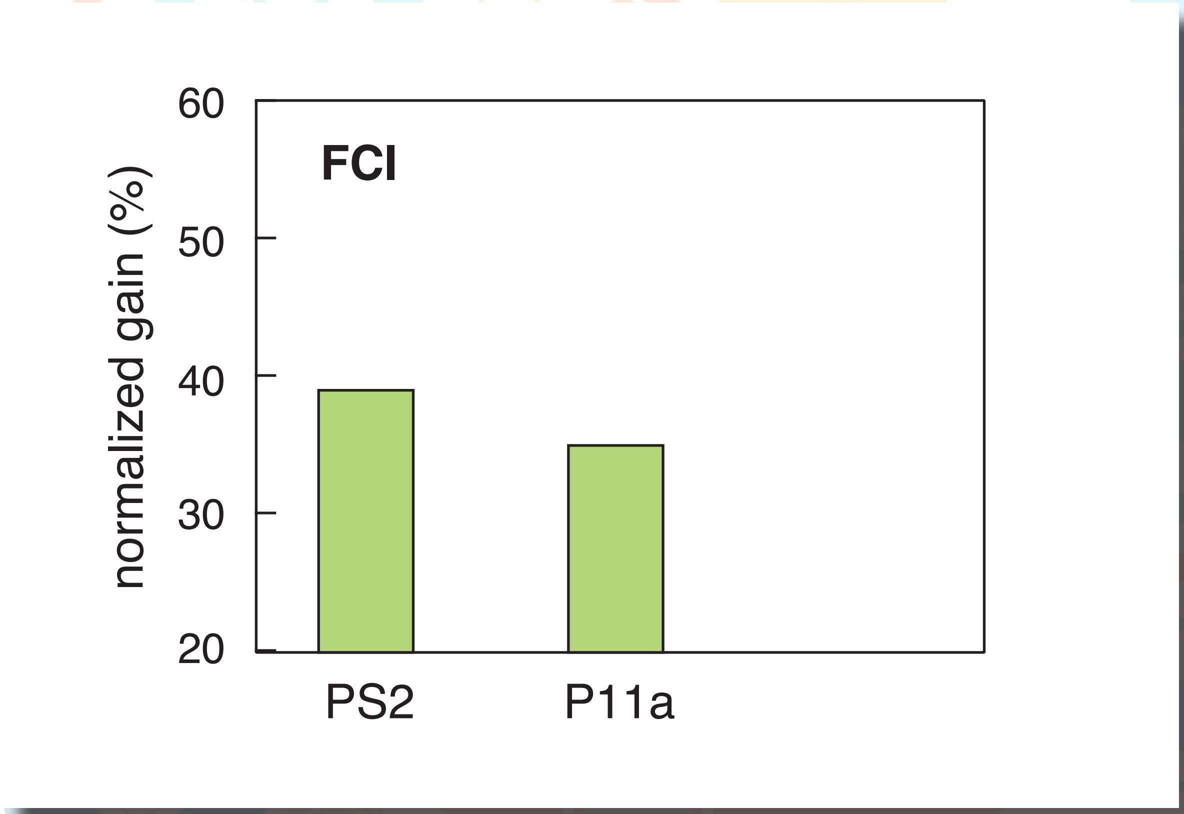
Conceptual Mastery

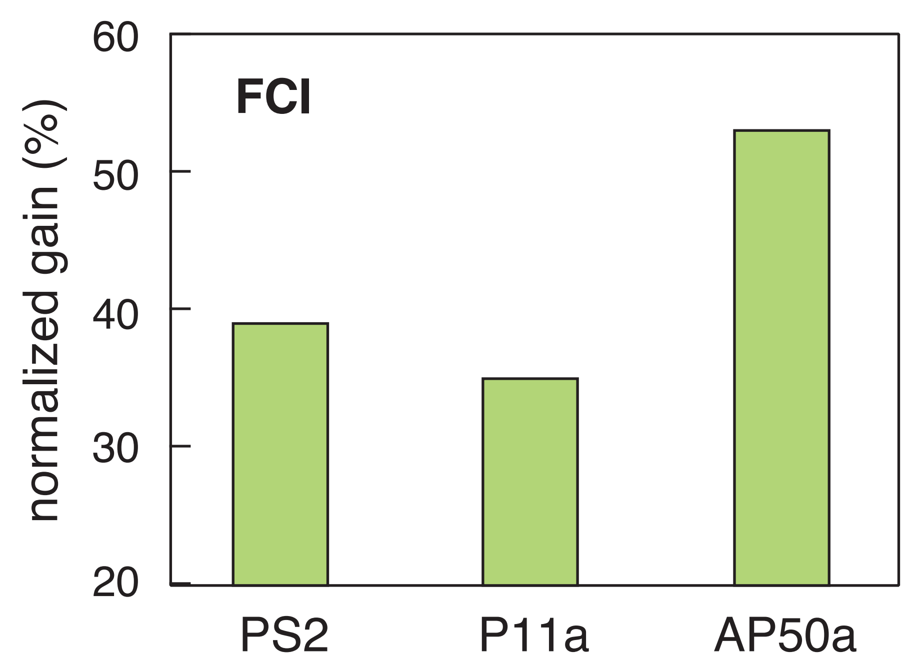


Conceptual Mastery



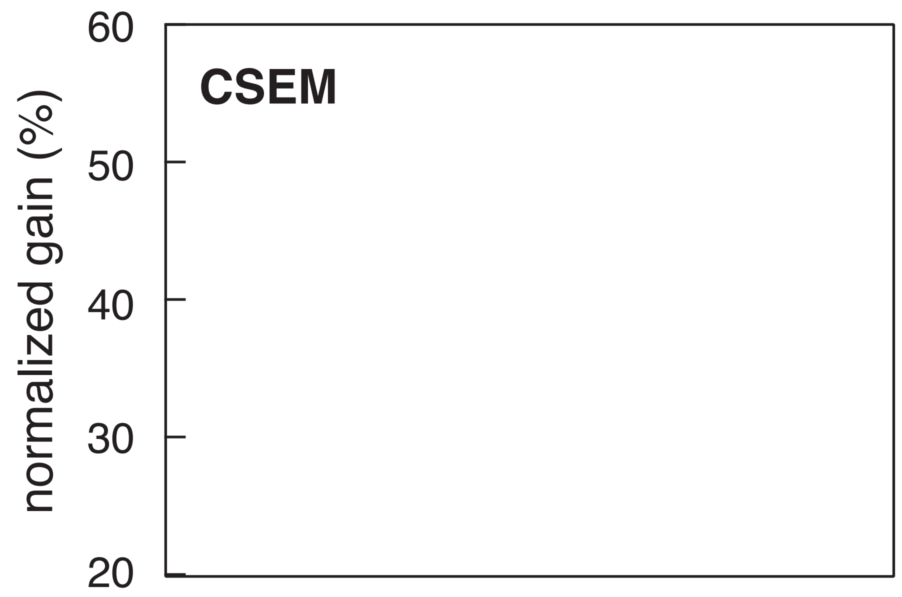
1 design 2 approach 3 results

Conceptual Mastery



1 design 2 approach 3 results

Conceptual Mastery



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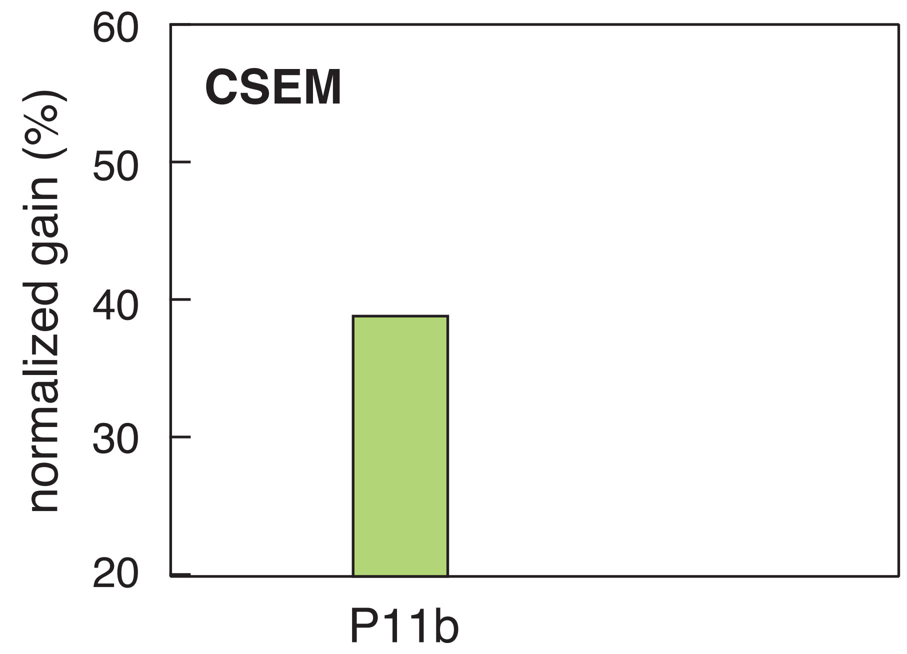
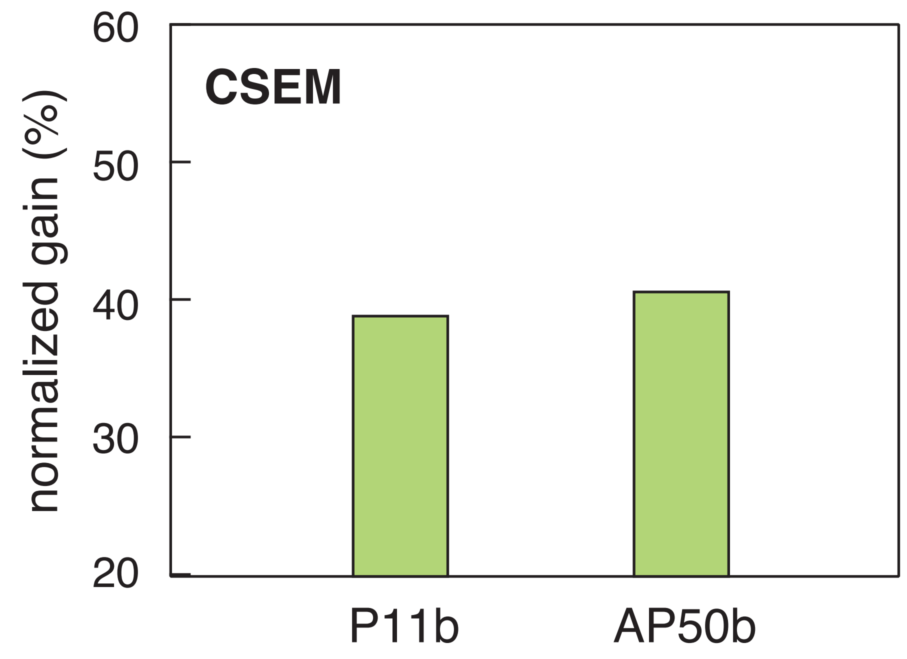


1 design 2 approach 3 results

Conceptual Mastery



1 design 2 approach 3 results

“Problem-solving” ability

1 design

2 approach

3 results

“Problem-solving” ability

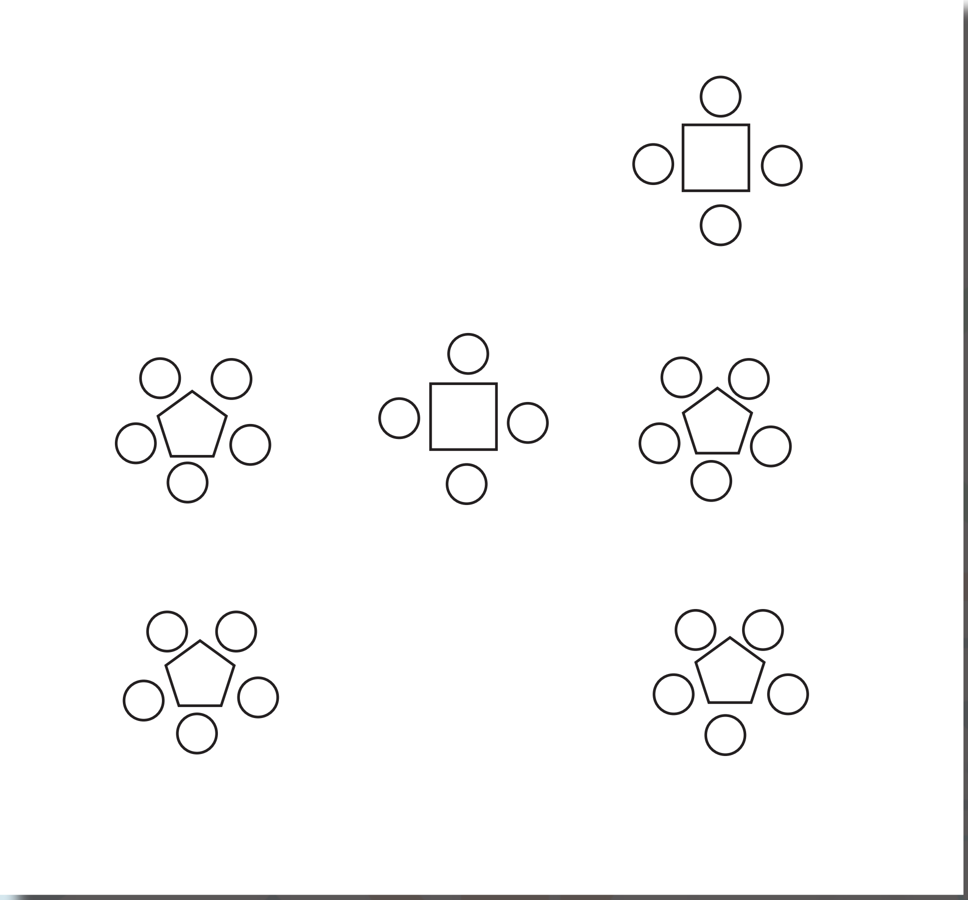
(very preliminary)

“Problem-solving” ability

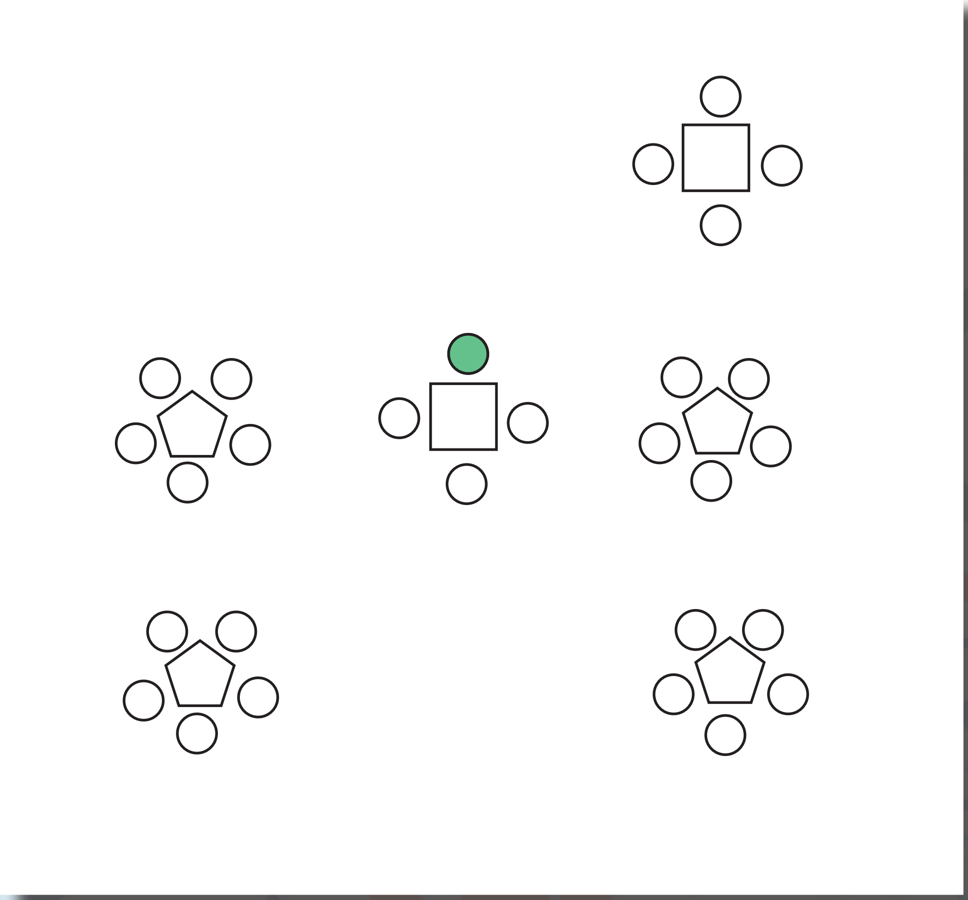
(very preliminary)

AP50b students do *twice as well* as Phys11b!

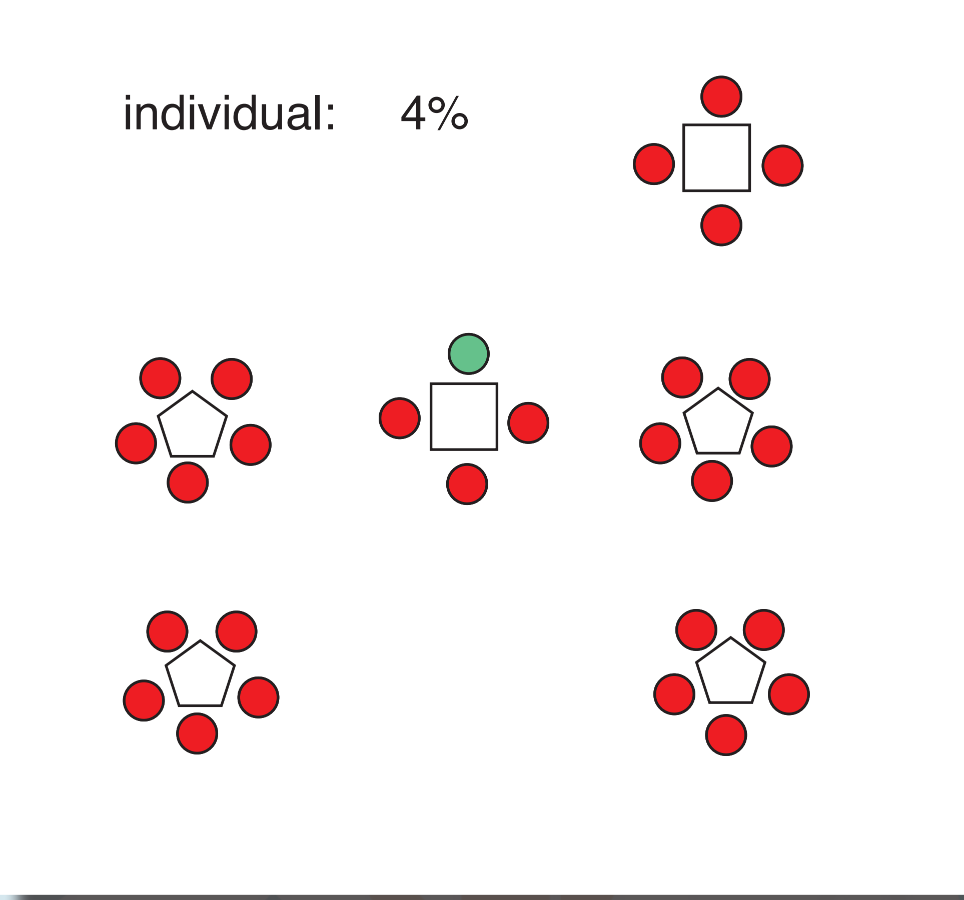
Team skills



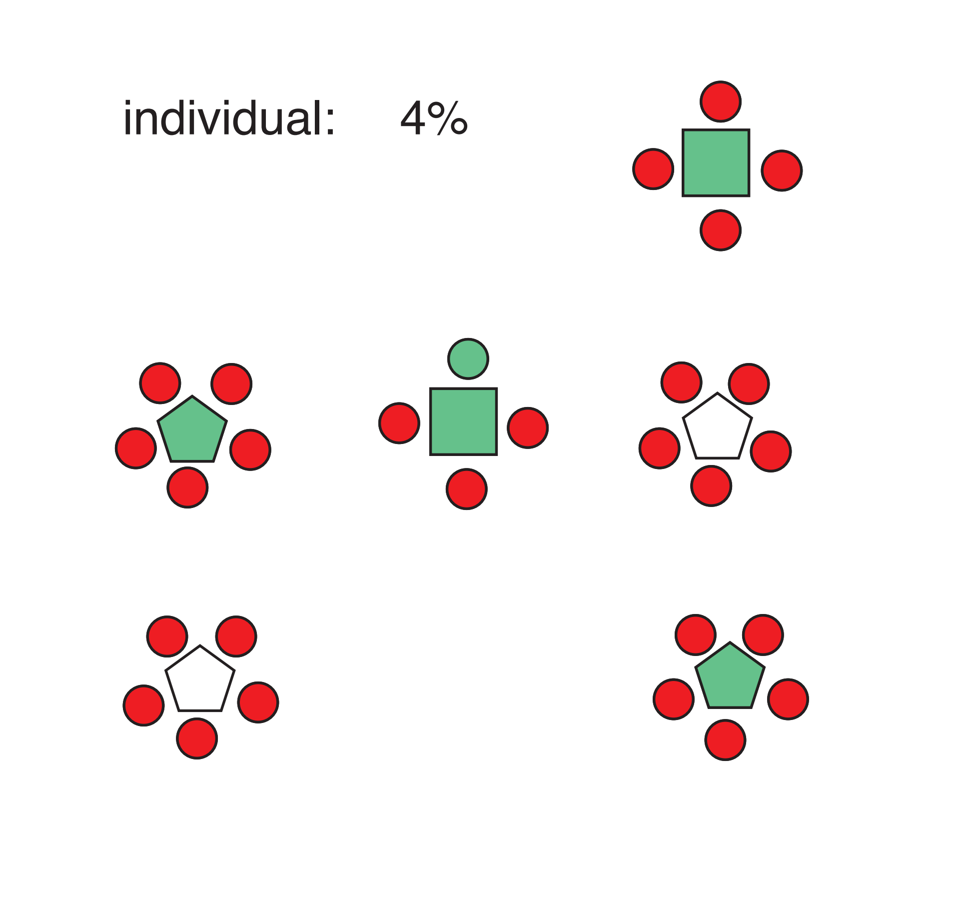
Team skills



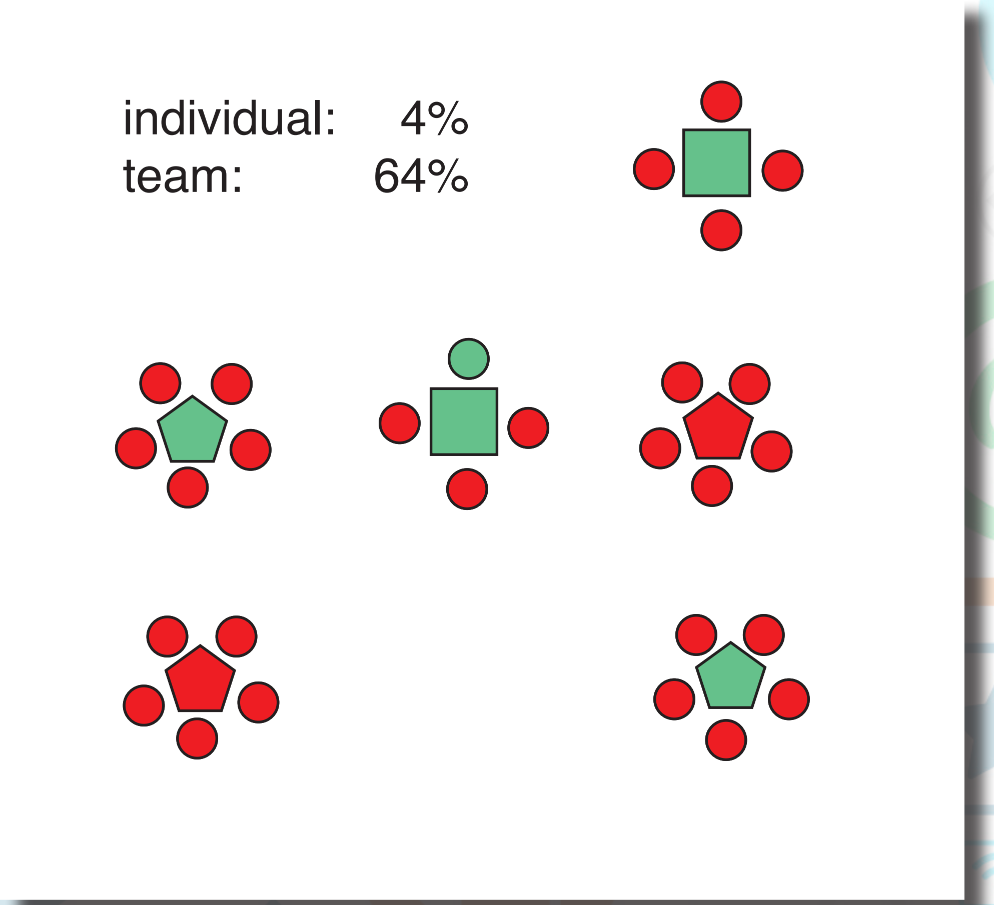
Team skills



Team skills



Team skills



1 design   2 approach   3 results

Can create ownership of learning physics!

Can **create ownership of learning physics!**

"you come out with so much know-ledge and experience and fun"

Support

Cherry Murray

Course planning

Kelly Miller
Orad Reshef

Co-instructor

Carolann Koleci

Teaching staff

Kelly Miller
Orad Reshef
Michael Moebius
Sally Kang

Logistical support

Anas Challah
Peter Kjeer
Jordan Stephens
Wolfgang Rueckner
Nils Sorensen

Education Research

Marcelo Barros
Messias Borges-Silva
Brian Lukoff
Kelly Miller
Alvaro Neves
Julie Schell
Laura Tucker
Fauzy Wan
Junehee Yoo

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Junehee Yoo

and the students pioneers in AP50!

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mazur.harvard.edu

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