Meeting Minutes

Southeastern Association of Electrical and Computer Engineering Department Heads (SECEDHA) Annual Meeting

November 11-12, 2012

Georgia Tech Hotel and Conference Center

Atlanta, Georgia

Southeastern Association of Electrical and Computer Engineering Department Heads (SECEDHA) Annual Meeting

November 8-9, 2012 - Georgia Tech Hotel and Conference Center

Thursday Evening (11/8/12)

[Reception in Conference Break Station, followed by dinner in Conference Room E]

5:30pm: Reception in the conference Break Area

6:00-6:40: Dinner (Conference Room E)

6:40-7:30: Dinner speaker

"Hands-on Learning: Stimulating Student Engagement and Understanding"

Kathleen Meehan
Bradley Department of Electrical & Computer Engineering, Virginia Tech

7:30-8:00: SCEEE membership meeting (in the dinner conference area): Paul Devgan, Tennessee State

(See separate agenda)

8:00-8:45: SCEE Board of Directors meeting. (in the dinner conference area):

Paul Devgan, Tennessee State
(See separate agenda)

Friday (11/9/12): Room: *Conference Room 4*

7:30 -- 8:00 Continental Breakfast in Conference Break Area

8:00 – 9:00 Special Session: *"Flipping the Classroom: successes, techniques, and challenges"*

Brian Lukoff,
School of Engineering and Applied Sciences
Harvard University

9:00 – 10:00 Flipping the Classroom: Chair: Mark Nelms, Auburn University
Presenters: John Harris – University of Florida, Shekhar Bhansali – Florida International University, Dan Sayre – John Wiley & Sons, Inc.

10:00 - 10:15 Break

10:15-11:00 Remote Laboratories*:* Chair, John Kelly, NC A&T
Presenters: Dan Stancil – North Carolina State University, Shekhar Bhansali – Florida International University

11:00-11:45 Roundtable Topics: Mark Nelms, Auburn University
ABET, MOOCs, and other topics

11:45-12:45 Lunch, *Conference Dining Room: Private Dining Room 1*

12:45-1:00 ECEDHA 2013 planning update – John Peeples, The Citadel

1:00 - 2:00 SECEDHA Business Meeting/Survey: Mark Nelms, Auburn University

2:00 Adjourn

Impact of Traditional Online Courses and MOOCs on Engineering Education

Our Thursday evening speaker, Dr. Kathleen Meehan, presented a rich variety of ideas and experiences for nontraditional delivery of circuits and electronics laboratories. The progress her group has made is the result of collaborations with industry and academic collaborations. The current generation of students we face benefits from hands-on experiences even more than previous students. The cost to students for the system she presented was less than $275. This approach showed a profound impact on the students' comfort and confidence with circuits and electronics—especially among women and minorities. The growth of "hackerspaces" mirrors the value of these take-home laboratories.

Flipped Classroom

An interesting use of the technologies used for online learning is the Flipped Classroom. In the Flipped Classroom, the instructor develops lecture material that the student reviews outside of class. Class time is used to apply that learning—homework during class. Brian Lukoff, School of Engineering and Applied Sciences at Harvard University, presented concepts that greatly increase the students' role in their learning. Strategies like collaborative annotation, just-in-time-teaching, collaborative Q&A, and collaborative learning were discussed.

Dr. Shekhar Bhansali from Florida International University, presented another dimension of efforts to flip the classroom. Their experience showed mixed results. For some students it was hard to change from the traditional learning model. Students were not watching the videos or reading the notes. They are developing strategies to counteract this, including carefully identifying those who should learn using this mode of instruction.

Remote Laboratories

Dan Stancil presented a system developed to provide remote access to the antennae measurement laboratory at North Carolina State University, REAL. A technician mounts the user's sample and the user has control of the chamber measurements and can download the test results

Georgia Tech Hotel and Conference Center

11/9/12
SECEDHA meeting attendees

~~SECEDHA~~ ~~SECEDHA~~ meeting.

Name	School	email
SATINDERPAUL DEVGAN	TSU	sdevgan@tnstate.edu
Dan Stancil	NCSU	ddstancil@ncsu.edu
John Ventura	CBU	jventura@cbu.edu
Tim Haskew	Univ. of Alabama	thaskew@eng.ua.edu
Shekhar Bhansali	FIU	sbhansa@fiu.edu
Roger Dougal	USC	dougal@cec.sc.edu
John Gowdy	Clemson	jgowdy@clemson.edu
Dan Fleetwood	Vanderbilt	dan.fleetwood@vanderbilt.edu
SIMON FOO	FAMU-FSU	sfoo@fsu.edu
Zhihua Qu	UCF	QU@UCF.EDU
Bob Lindquist	Univ. of Alabama in Huntsville	lindquis@eng.uah.edu
Larry Holloway	Univ Kentucky	holloway@uky.edu
John Harris	UF	harris@ece.ufl.edu
TIM WILSON	ERAU	wilsonti@erau.edu
PRATUL AJMERA	Louisiana State Univ.	ajmera@lsu.edu
Sam Kozaitis	Florida Inst. Tech	Kozaitis@fit.edu
Sacharia Albin	Norfolk State	salbin@nsu.edu
JOHN PEEPLES	The Citadel	peeplesj@citadel.edu
Ian Ferguson	UNC CHARLOTTE	IANF@UNCC.EDU
John Kelly	NC A&T	jcke@ncat.edu
21 Mark Nelms	Auburn	nelmsrm@auburn.edu
Mohammad Alam	Univ South Alabama	malam@southalabama.edu

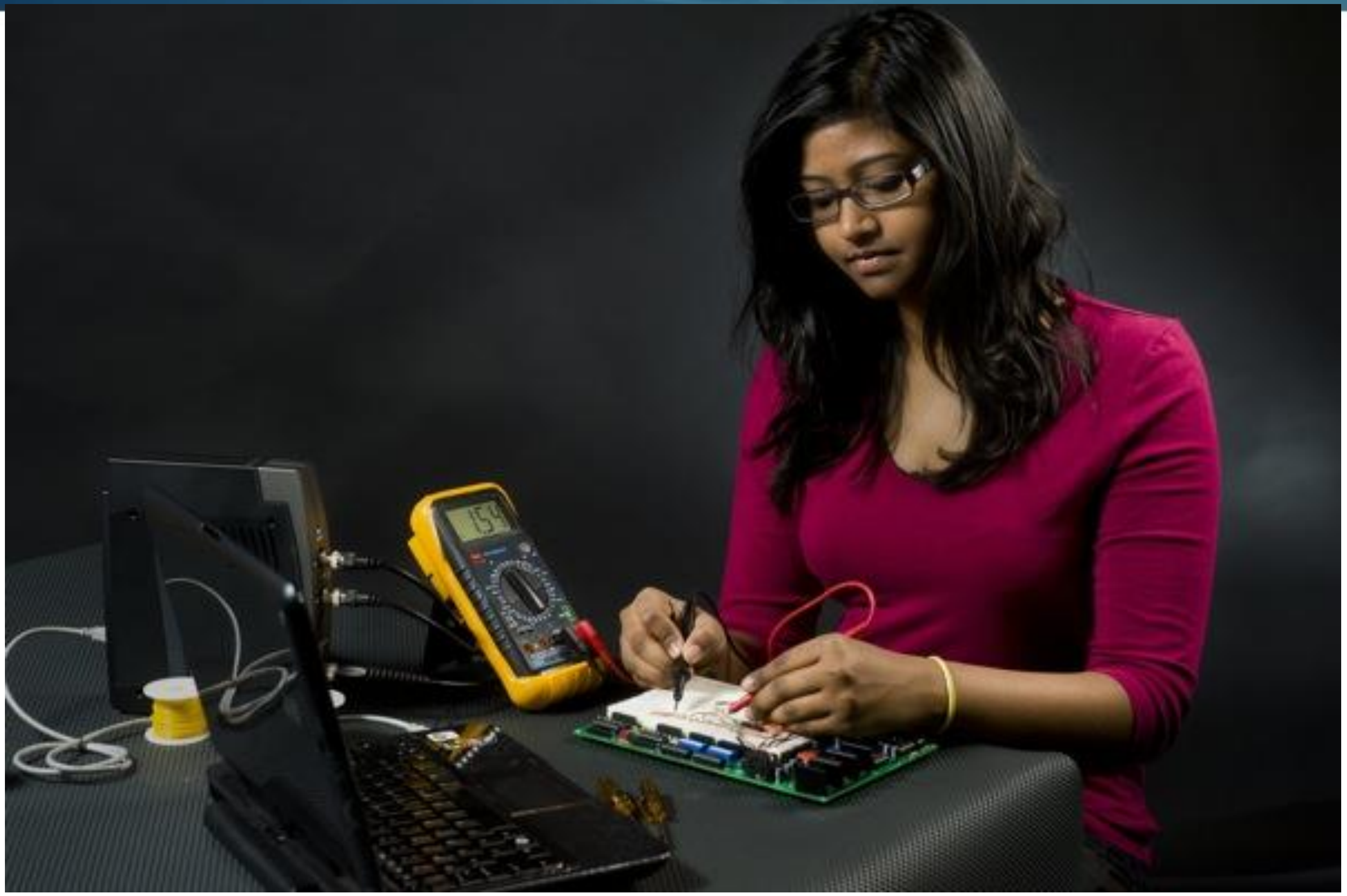
SECEDHA ANNUAL MEMBERS SURVEY -- 2012

November 9, 2012, SECEDHA ANNUAL MEETING, Atlanta Georgia

Total Members Participating in Survey	19							
Starting Salary for Ph.D. Granting Schools (9 mo fac.)		$65-$69 1	$70-$75 1	$75 - 80K 1	80-85 9	85-90 2	>90 0	
Starting Salary for non Ph.D. Granting Schools	<$60	$60-$64 0	$65-$69 1	70-75 2	>75			
Faculty Vacancies	None 4	1 7	2 4	3 2	>3 2			
% of research overhead returned (dept)	None 5	1-9% 0	10-19% 7	20-29% 3	>30% 1			
Undergrad EE Enrollment	Up 14	Same 4	Down 1					
Undergrad CpE Enrollment	Up 13	Same 2	Down 1					
Graduate Enrollment	Up 12	Same 5	Down 0					
Monthly Stipend (20 hrs/week, takehome)	<1k 0	1k-1.2k 2	1.2-1.4k 9	1.4k-1.6K 3	1.6-1.8 1	>1.8K 2		
FE Exam Requirement	Not Req'd 18	Req'd 1	Must Pass 0	Encouraged (Not req'd) 12				
% buyout returned to department	100% 7	80-99% 2	60-79% 0	<60% 6				
Combined BS/MS	yes 10	no 9	maybe 0					
Adjunct Salary / course	<5k 8	5k-8k 10	>8k 0					
Line Item Equipment Budget**	Yes 5	No 14						
Lab Fees	Yes 14	No 5						
% Lab Fees returned to Dept	100% 3	75-99 2	50-74 2	25-49 0	<25 1	0% 6	Unknown	
Differential fee for engineering	Yes 1	No 18						
Graduate Tuition Fee Charged to Contract	100% in 14 out 0	50-99 in 0 out 0	<50 in 2 out 0					
Grad TA's / faculty	0 0	<1 8	1-1.5 9	1.5-2 0	>2 0			
Grad RA's / faculty	0-2 3	2-4 9	4-6 4	>6 0				
Research Expenditures / Faculty	<50k 1	50k-100k 1	100-150k 5	150-200k 6	>200k 250 0	>250K 3		
Credit Hours	<120 0	120-123 0	124-127 9	128-131 9	>131 1			

**just for lab equipment

Hands-on Learning:
Stimulating Student Engagement and Understanding



Support received from the Virginia Tech Bradley Department of Electrical and Computer Engineering and the National Science Foundation Department-Level Reform of Undergraduate Education (DLR) Award #0343160, Course, Curriculum, and Laboratory Improvement Phase II Award # 0817102, and Transformation of Undergraduate Education in STEM Award # 1226011

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Virginia Tech

- Robert Hendricks
- Richard Clark, Jr.

  Director of Engineering, Virginia Western Community College
- David Fritz
- Al Wicks
- Yong Xu
- Louis Beex
- Cortney Martin
- Peter Doolittle
- **And more than 45 undergraduate students**

Other Colleagues

- Kenneth Connor, RPI
- Bonnie Ferri, Georgia Tech
- Deborah Walter, Rose-Hulman
- Mohamed Chouikha, Howard
- Yacob Astatke, Morgan State

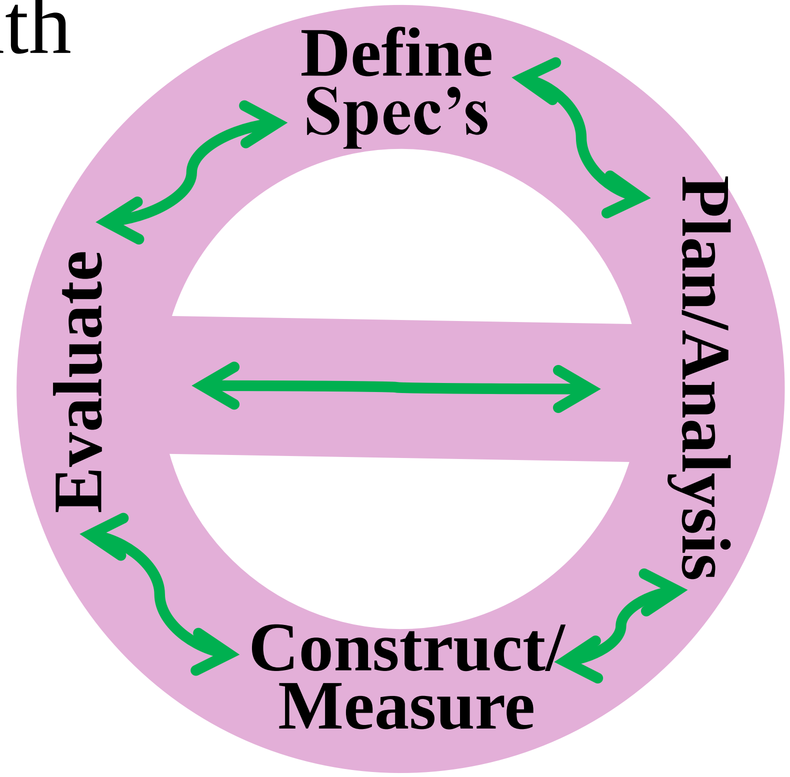
- We are looking to build other relationships

Industrial Collaborators

- Analog Devices
- Digilent, Inc.
- Electronix Express
- MathWorks
  - Developed MATLAB interfaces for the oscilloscopes.
- National Instruments
- Texas Instruments

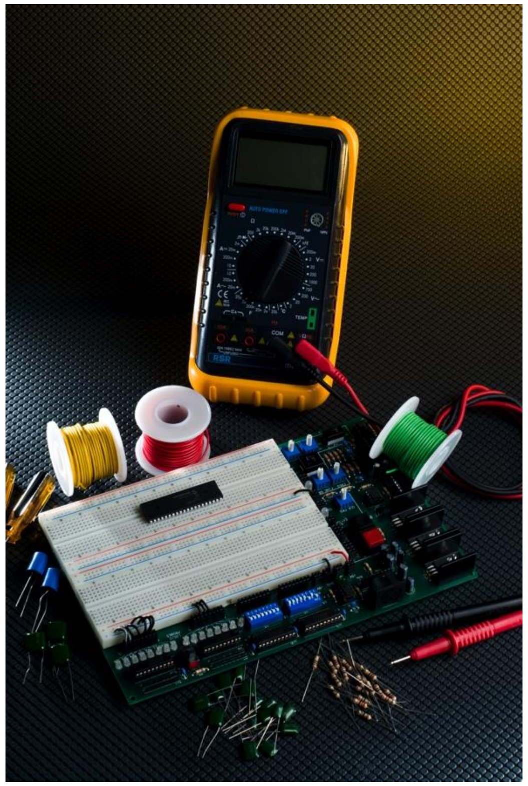
Pedagogical Goals

- Provide concrete examples of abstract concepts for visual learners via hands-on laboratory exercises.
- Address students’ lack of prior experience as interest in ham radio has waned, sales of home electronics kits are almost nonexistent, and motivation to assemble computers has been reduced.
- Attract/retain women and underrepresented minorities by strengthening relationships with community college programs.
- Complete the design cycle.



Lab-in-a-Box (LiaB)

- Analog/Digital Trainer Board
  - Virginia Tech design
  - Manufactured and sold by Electronix Express
- USB 2-channel oscilloscope and function generator
  - Velleman PCSGU250 or Digilent Analog Discovery
- Digital Multimeter
- Parts Kit
- Laptop or Tablet PC



Cost to VT student: less than $275

Hands-On in the Curricula

- Nontraditional circuits laboratory course and hands-on projects in digital, and microcontroller courses.

  Students conduct experiments/projects outside of the classroom and demonstrate the operation of the circuits in an open lab environment.
  - 10 experiments (EE) and 5 projects (CpE) per semester
  - Circuits lab manual, lecture materials, on-line tutorials, and podcasts/video clips have been developed to support the students.
    - PSpice and MatLAB are incorporated extensively in analysis and simulation components of experiments.
      - Supplemental materials are available at **www.lab-in-a-box.ne**t or **filebox.ece.vt.edu/~LiaB/** and on the course Sakai Scholar site.
      - Send an email to kameehan@vt.edu to enroll in a Sakai Scholar site.
    - Verilog and C used in CpE projects.
- Hands-on projects in electromagnetics and signals/systems courses.

Extension into Other Disciplines

- In Spring 2009, Virginia Tech ECE department was approached by ME faculty members with a request to revise the circuits and electronics courses taken by the ME students.
  - Stronger background in electrical and computer engineering theory and practice before ME students enrolled in the two-semester senior ME laboratory course sequence and the mechatronics and robotics technical electives.
  - More in-depth instruction on digital circuits with practical applications, which would support the ME capstone design projects and several of the senior technical elective courses.
    - Typical mechanical systems today employ at least one electronic sensor or electronic control system along with a microprocessor.

Resource Issues

Laboratory Space

- Outfitting a two-person laboratory bench costs ~$10k
- Each laboratory classroom is updated every 5 years.
  - At VT, each of three general purpose lab classrooms has 8 benches for our core curriculum lab courses.
    - About a quarter of a million dollars must be invested every 5 years to keep the current laboratory classrooms functional and up-to-date.
- To schedule additional lab course for 275-300 ME students per year, options were:
  - Repurpose a classroom into lab space
  - Schedule lab sections on weekends
  - Increase number of students per lab station

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Resource Issues

Personnel

- Laboratory classes are scheduled for 16 students for 2-3 hours per section and one GTA is assigned to teach 3 sections of lab.
  - Core lecture courses have 40-150 students enrolled.
- ECE offers 10 required lecture courses that have companion lab courses, 8 for EE and CpE majors and 2 for ME majors.
  - With addition of new lab, a total of **79** lab sections per semester would have to be scheduled and staffed by **27** GTAs.
    - This would allocate **85%** of all departmental GTAs to staff laboratory courses. Instead, we are running these labs with **15** GTAs and **5** graders.

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Instructional Framework at Virginia Tech

- Develop experiment after identifying set of abstract concepts that provoke significant student consternation and poor assessment of student learning on homework and exams.
- Experiments are performed outside of a traditional laboratory classroom.
  - Optional lectures to support the independent learning.
  - Powerpoints slides are posted on course Sakia Scholar site.
- Emphasis is placed on identifying the operating limits of the components in the circuits, testing the limits of the theory, and understanding the effect of the resolution of the equipments on the measurement accuracy.
- Design projects: The work builds to open design projects for ECE students while there are limited circuit designs for the ME students.
- Few formal report writing is expected.
  - Grading of laboratory reports is performed using home-build automated grading programs (Sakai Scholar quizzes, Visual Basic, MATLAB)

Experimental Format

1. Learning Objectives

   One-to-two concepts explored in the experiment.

2. Preparation

   Sections of the textbook are identified.

3. Background

   Brief explanation of theory with discussion of the applications of the in day-to-day life, products used commonly by students, and/or in areas of research

4. References
5. Materials
6. Experimental Procedure

   (a) Analysis – hand calculations and MatLAB programs

   (b) Modeling – simulations to be perform using software packages

   (c) Measurements – instructions on construction and measurements.

   (d) Evaluation – review the results of the measurements, compare with analysis and simulation, and explain the causes of differences.

Questions are placed in the experimental procedure and short tutorials on issues are provided to guide the students as they analyze the results and to spur thoughts on why differences may exists when comparing the measured results with those obtained from the Analysis and Modeling sections

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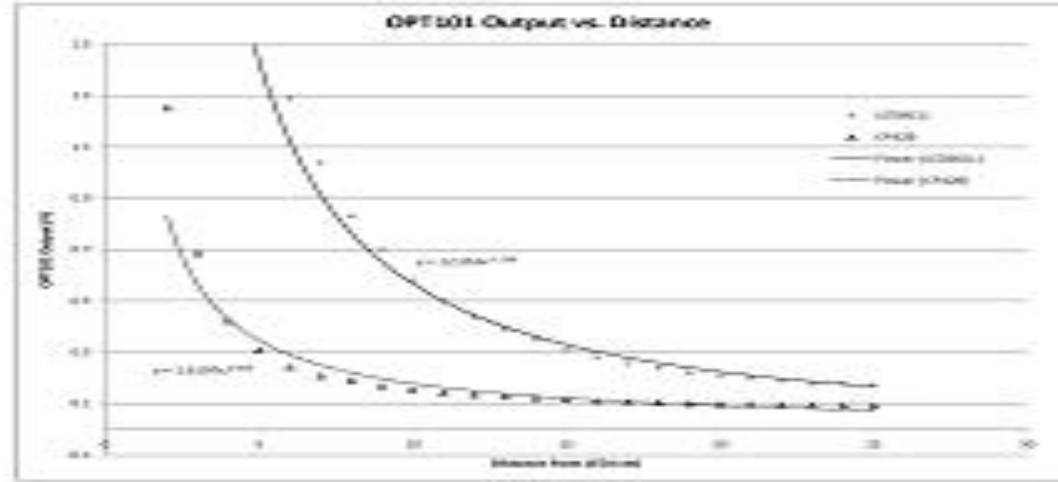
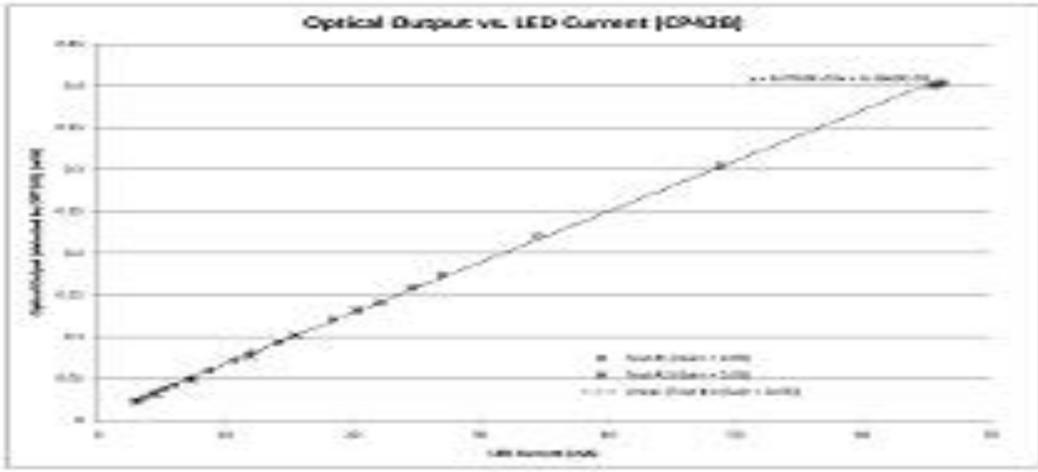
Non-traditional course: Electromagnetic Fields

- Few undergraduate students look forward to taking the EM fields courses required during the junior year.
  - Abstract in nature and translation of theory to practice occurs in senior undergraduate technical electives, which almost none of our students decide to take.
    - Students viewed two courses on electromagnetic fields as rigorous math courses without useful purpose in the technical field that they elect to pursue.
- Concerns expressed by faculty about the student interest and depth of learning in the EM courses.
  - Neither students or faculty were confident that abstract concepts could be demonstrated in an experimental format.


OPT101 Output vs. Distance

a)



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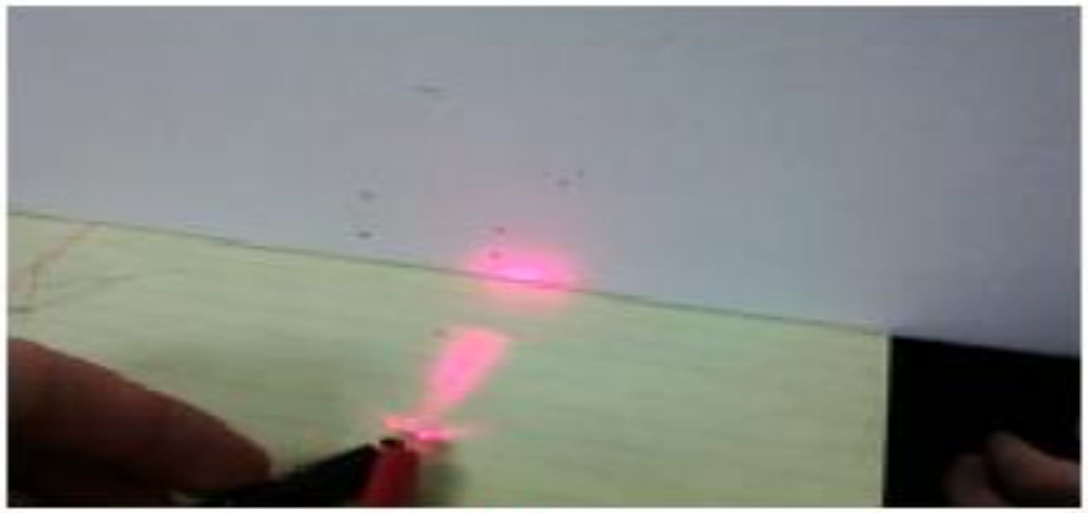
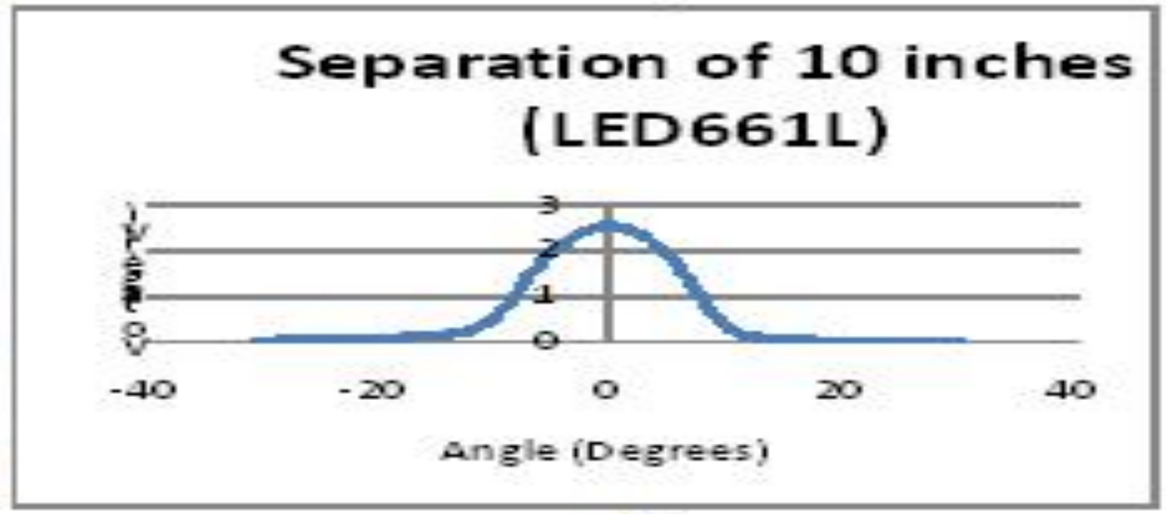


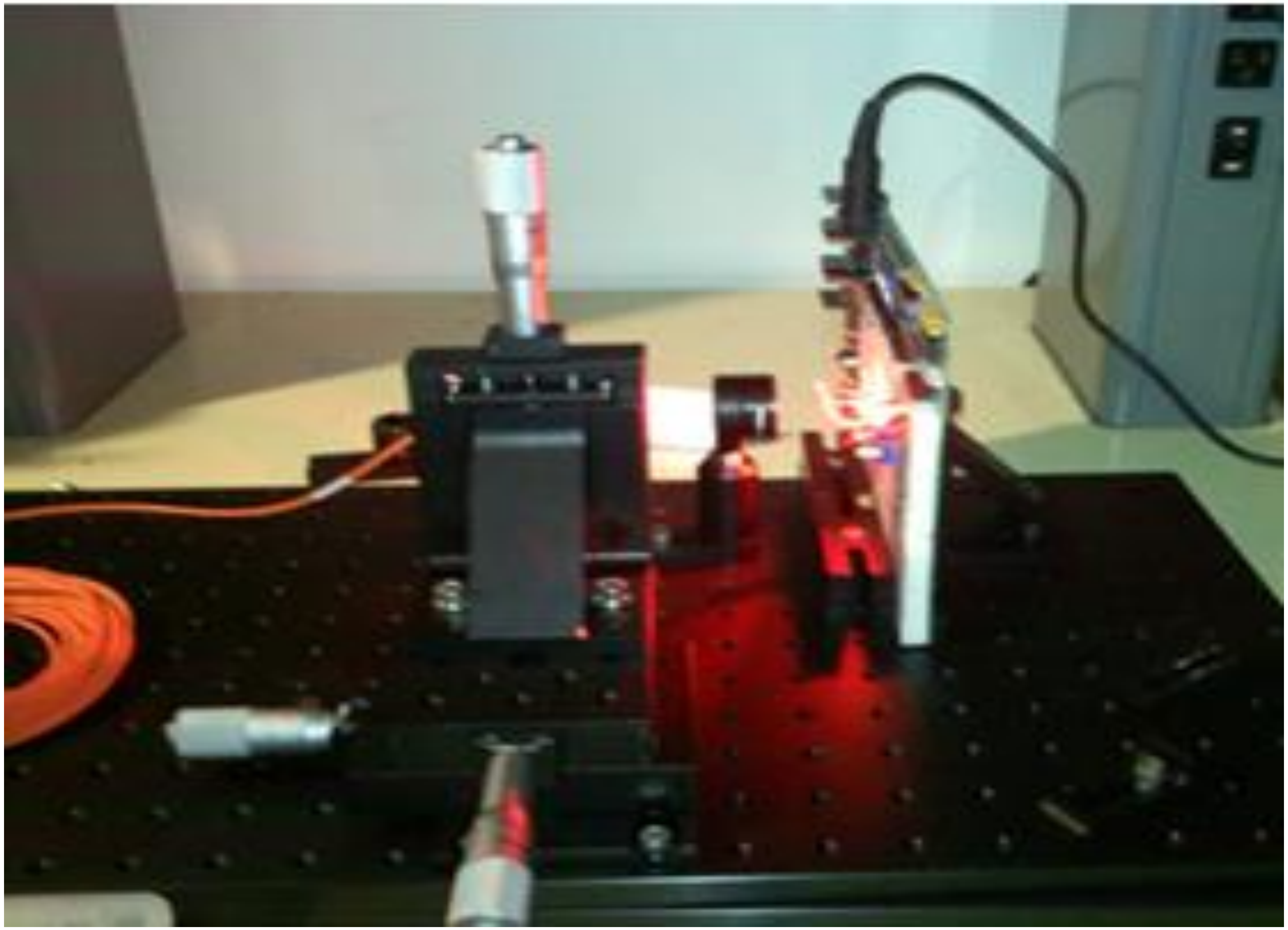
c)


Separation of 10 inches
(LED661L)
3
2
1
0
-40
-20
0
20
40
Angle (Degrees)

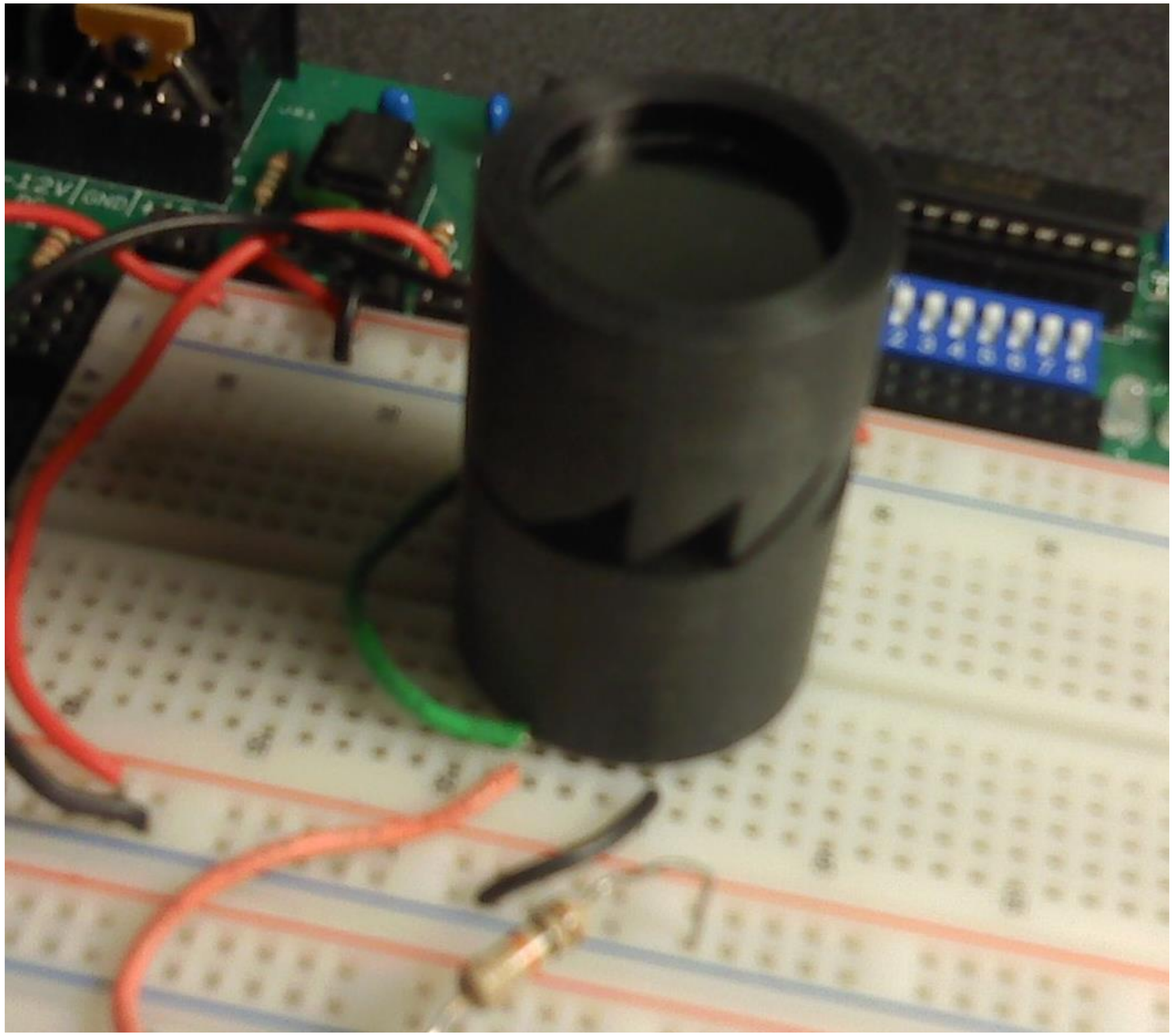
d)

e)

Challenge: Optomechanical Mounts



Injection Moldable Fixtures



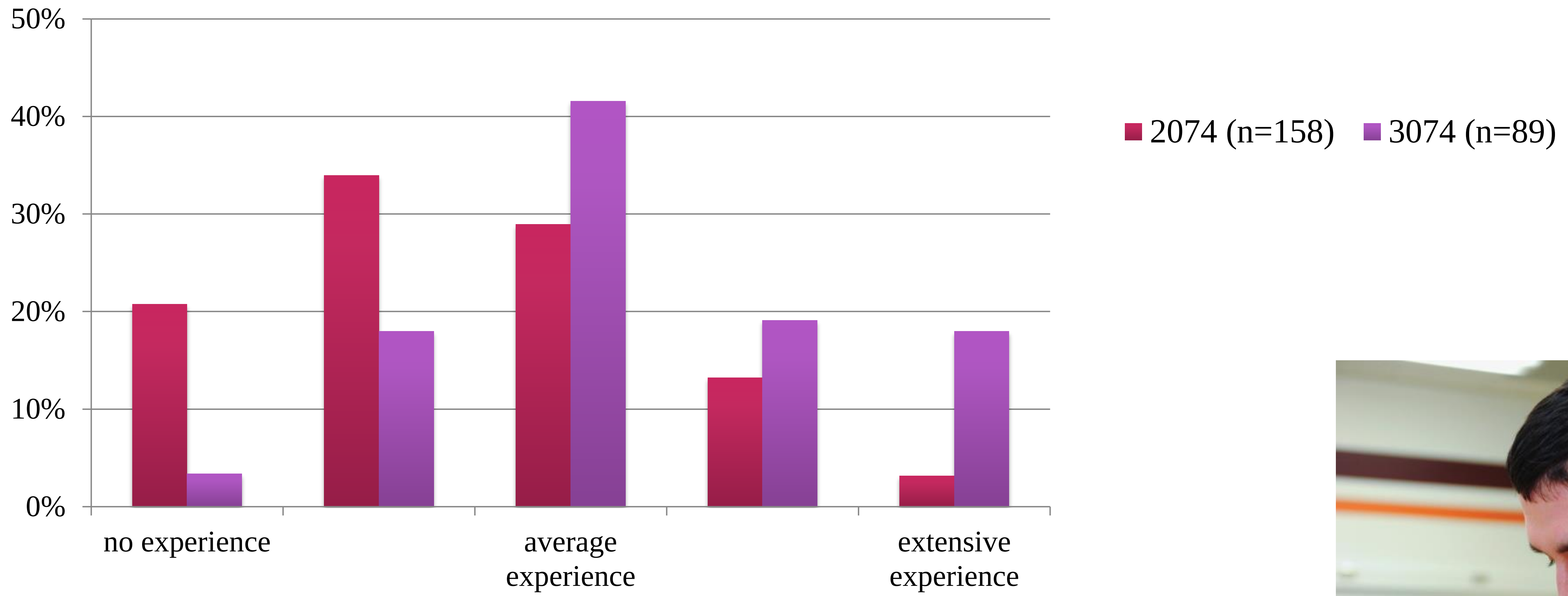
Assessment method

- Pre- and Post- surveys at beginning and end of the semester
- Fall 2010, Spring 2011, ongoing
- Survey Instrument
  - Confidence
  - Contributions of LiaB to understanding of material
  - Impact on career preparation
  - Time on Task
  - Motivated Strategies for Learning (MSLQ)
    - Task Value
    - Self-Efficacy for Learning and Performance
  - Free response

- Sample
  - 159 students in ECE 2074
    - 65% sophomore, 33% juniors
    - 54% EE; 33% CpE
  - 89 students in ECE 3074
    - 70% juniors, 22% seniors
    - 93% EEs
  - 16 students in ECE 4234
    - 100% seniors
    - 100% EEs

RESULTS - Prior Experience

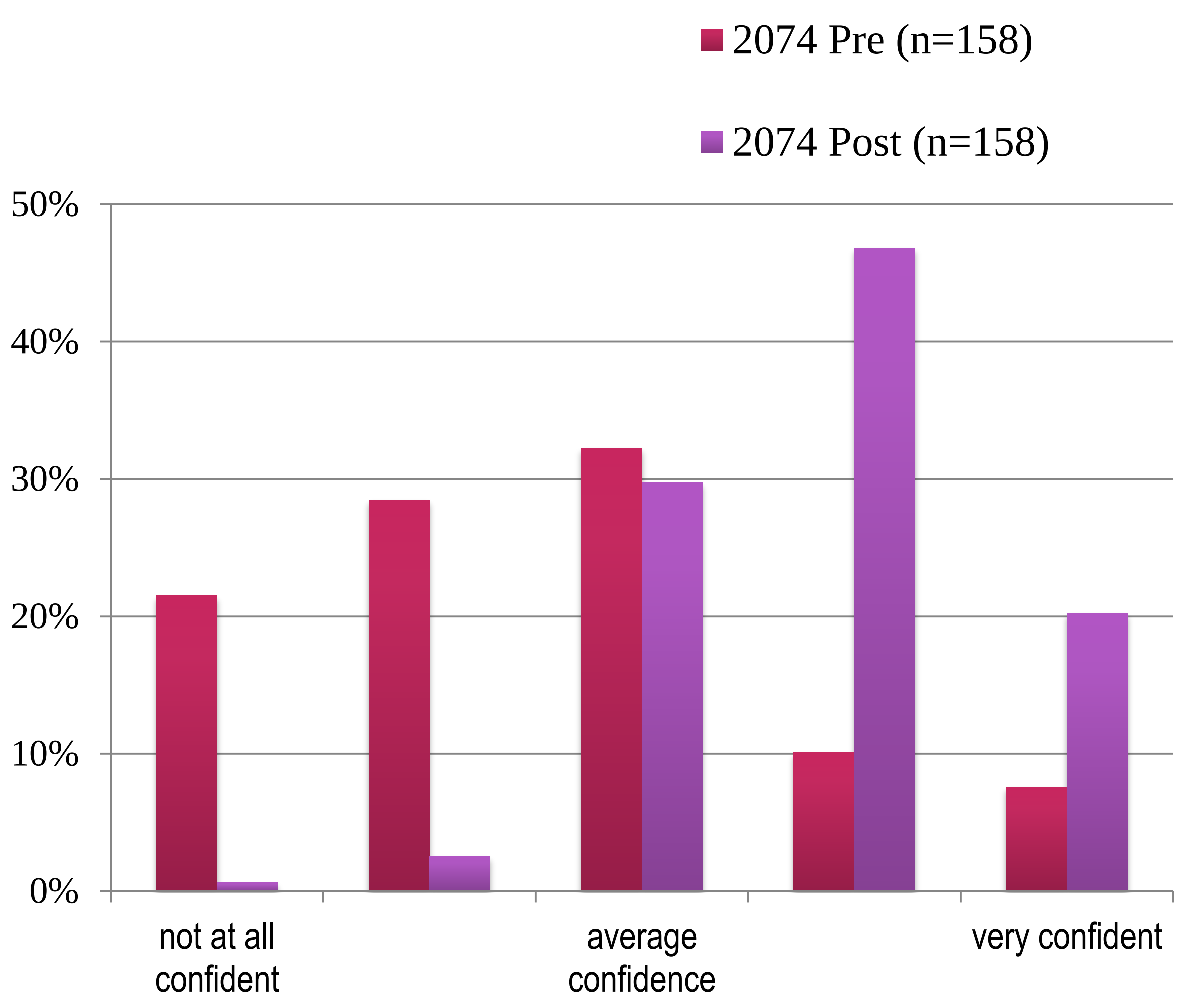
How much experience have you had with hands-on building, troubleshooting, or repairing electronic circuits?

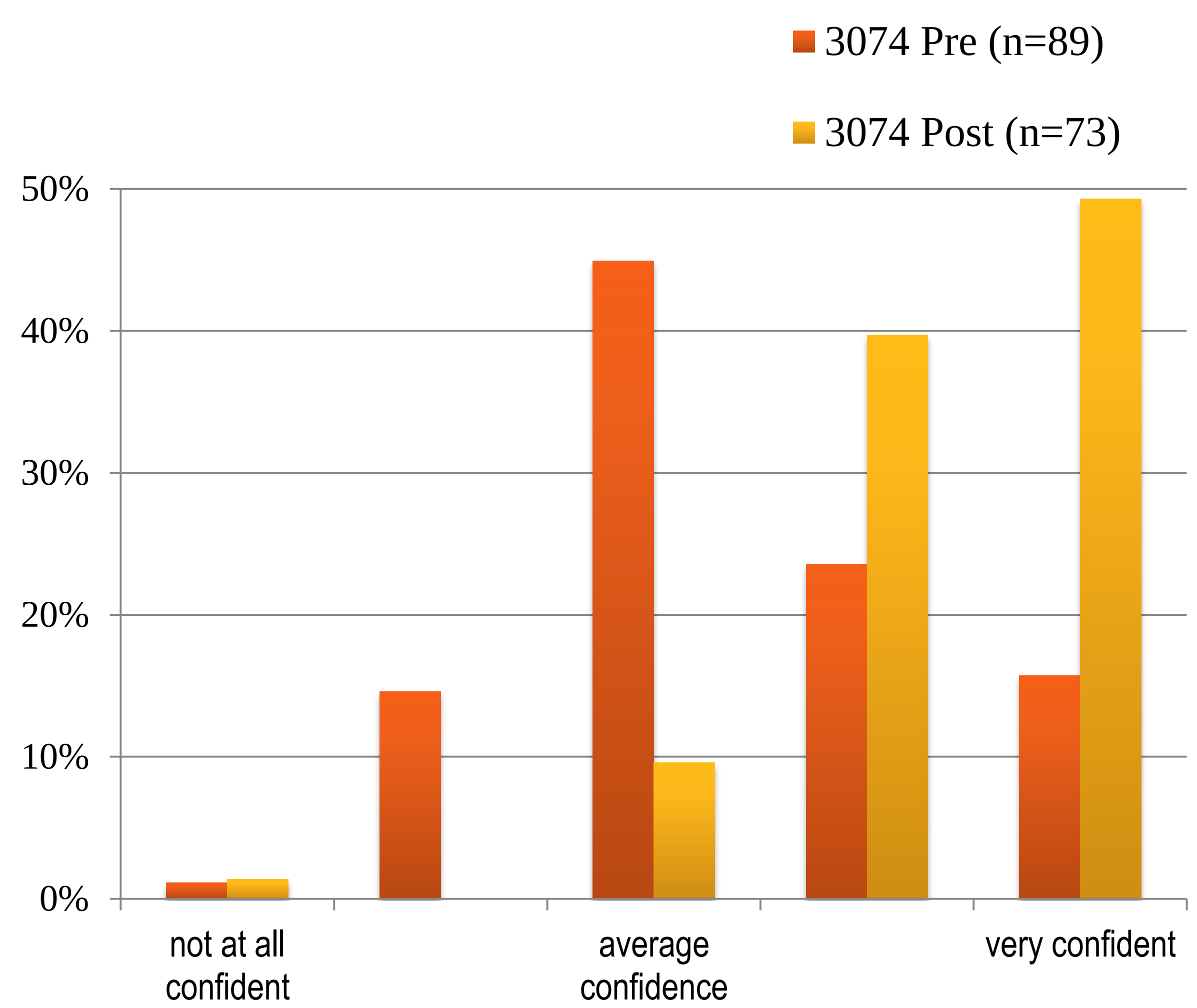


Kathleen Meehan, Robert W. Hendricks, Cortney V. Martin, Peter Doolittle, and Richadr Lee Clark, Jr.,
"Lab-in-a-Box: Assessment of Materials Developed to Support Independent Experimentation on Concepts from Circuits", 2011 ASEE Annual Conference, Paper AC 2011-1821.

RESULTS - Confidence

How confident are you in your ability to build a variety of ac and dc circuits?





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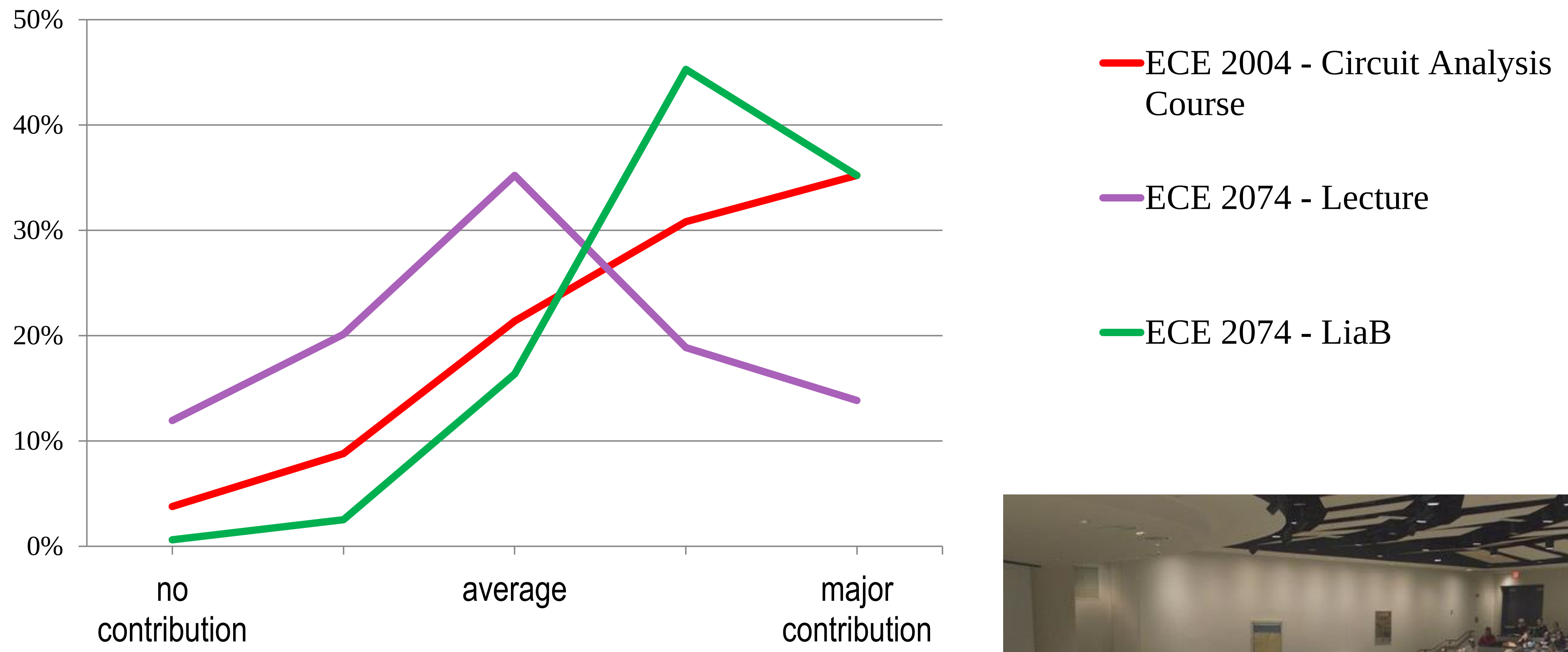
RESULTS - Contributions to learning:
What are the relative contributions to your personal understanding of circuit design?



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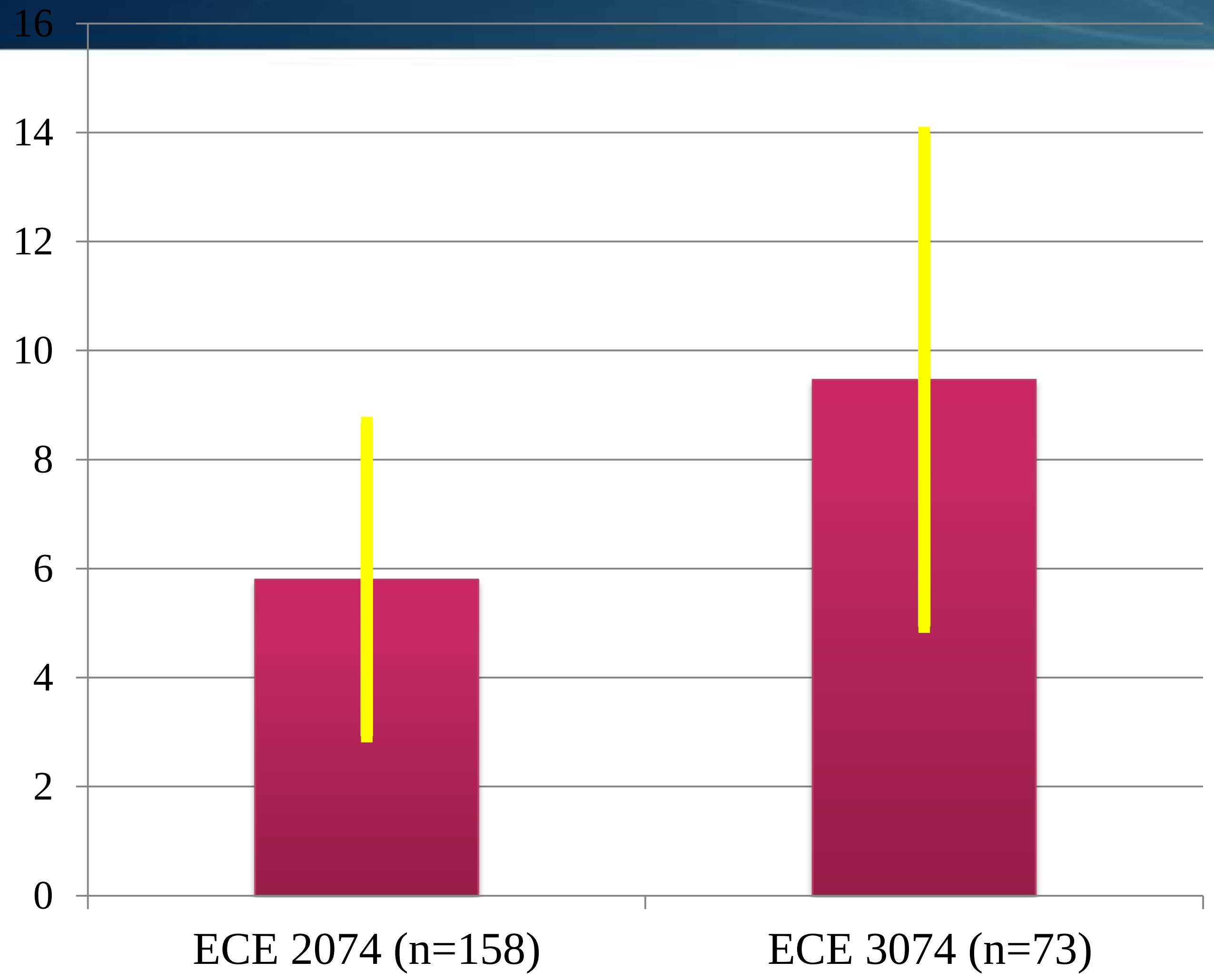
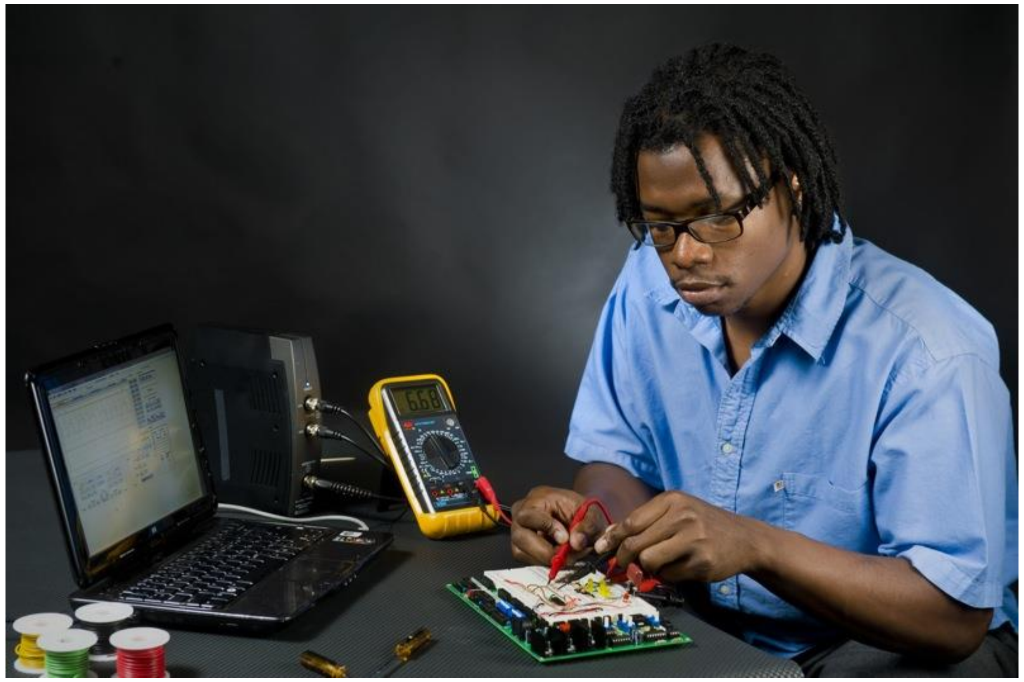
Virginia Tech
Invent the Future

RESULTS - *Time to complete LiaB project*





ece
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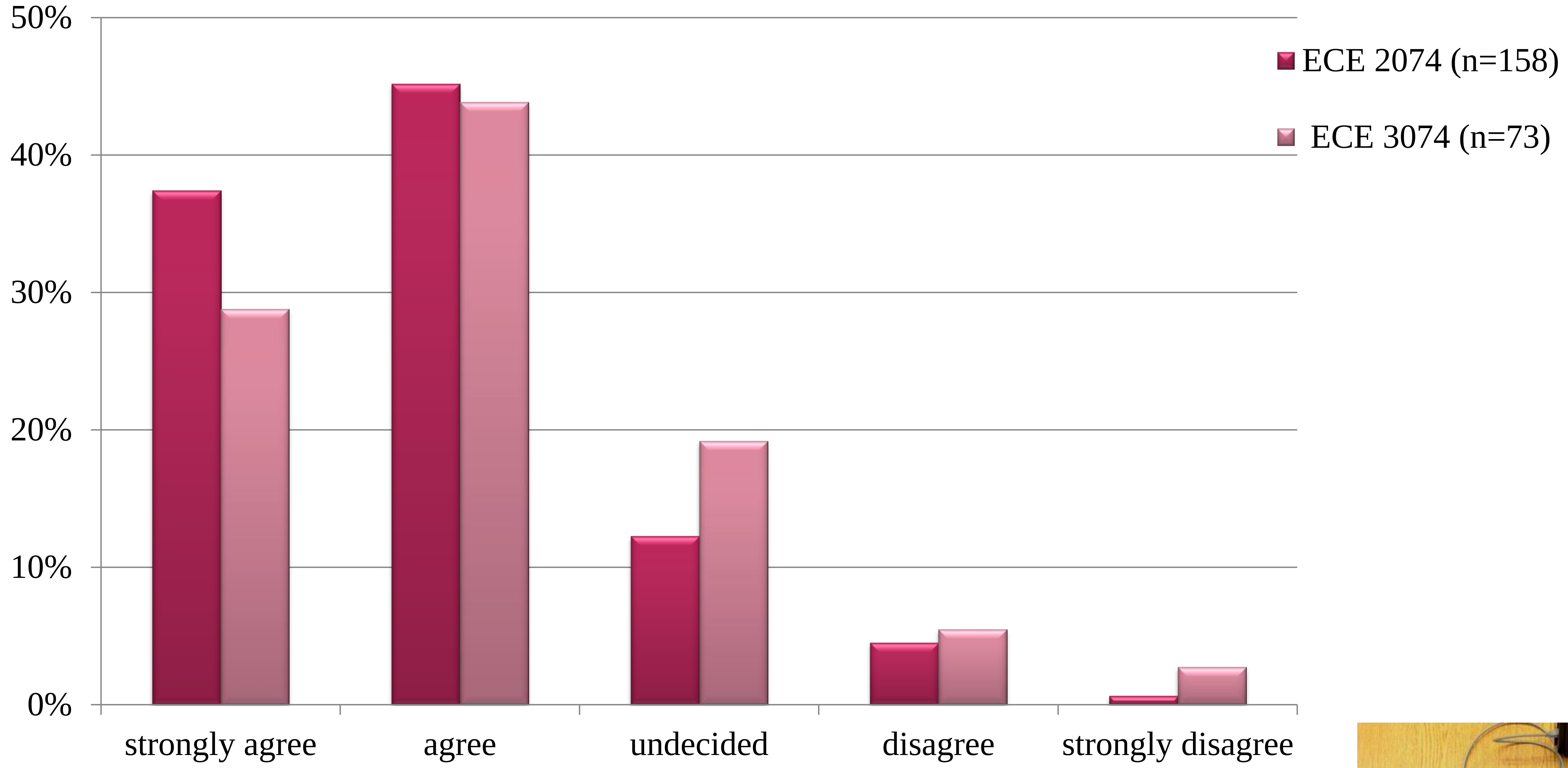
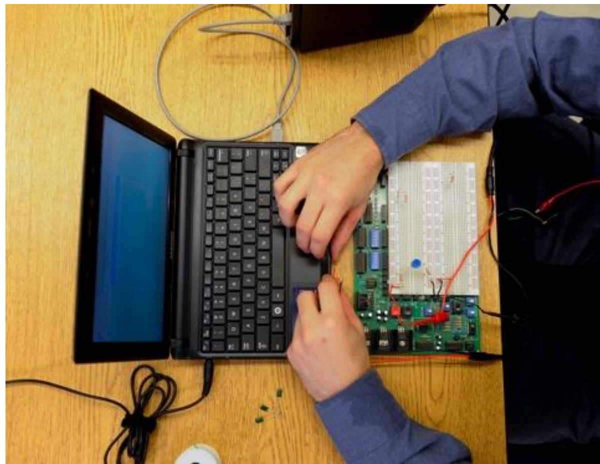
RESULTS - Career Preparation:
LiaB projects are very important in my preparation as an engineer





Assessment by RPI and U. Albany

Hands-on during lecture

Specific Content Learning Outcomes	Deep Learning— All Forms $n=39$		Deep Learning— Autonomous $n=83$		Deep Learning— Collaborative $n=52$		Surface Learning $n=13$		Significant ANOVA p<.01 **
	$\bar{x}$ *	*sd*	$\bar{x}$ *	*sd*	*$\bar{x}$	*sd*	*$\bar{x}$	*sd*	
Knowledge increased after taking the course	5.13	0.83	5.53	0.69	4.58	1.05	4.54	1.20	yes
Reflected course content	5.18	0.79	5.66	0.55	4.87	0.74	5.00	0.82	yes
Reflected real practice	5.00	0.86	5.22	0.84	4.27	0.93	4.85	0.80	yes
Helped students think graphical/pictorial or practical ways	4.72	0.92	4.89	0.88	4.25	1.10	4.08	1.19	yes
Helped students recall course content	4.54	0.76	4.70	0.86	3.87	1.09	4.08	1.32	yes

mean ratings based on a six point Likert-type scale (1=Strongly Disagree, 6=Strongly Agree)
** *Analysis of Variance significant at an alpha level of p<.01*

Autonomous means that each student worked on the hands-on activity independently, Collaborative means that they worked in teams on the activity, and Surface Learning were students who did not participate in the hands-on activities.

Kenneth A Connor, Dianna L. Newman, and Meghan Morris Deyoe, "Mobile Studio Pedagogy, Part 2: Self-regulated Learning and Blended Technology Instruction ", 2012 ASEE Annual Conference, Paper AC 2012-4521.

Current Affective Learning Outcomes	Deep Learning-- All Forms		Deep Learning— Autonomous		Deep Learning— Collaborative		Surface Learning		Significant ANOVA p<.01 **
	n=39		*n*=83		*n*=52		*n*=13		
	$\bar{x}$ *	*sd*	$\bar{x}$ *	*sd*	$\bar{x}$ *	*sd*	$\bar{x}$ *	*sd*	
Outcomes reflecting a positive learning affect related to course specific content									
Developed confidence in content area	4.79	0.80	4.99	0.74	4.12	1.06	4.46	0.88	Yes
Developed interest in content area	4.37	1.08	4.61	0.94	3.80	1.20	3.92	1.66	Yes
Increased confidence in content area knowledge	4.76	1.08	5.01	0.77	3.96	1.01	4.08	1.61	Yes
Outcomes reflecting a positive learning affect related to general learning outcomes									
Become motivated to learn content	4.36	1.04	4.22	1.13	3.48	1.23	3.54	1.51	Yes
Developed self-direction/ responsibility	4.74	0.94	4.30	1.11	3.71	1.07	3.92	1.32	Yes
Helped improve grades	4.59	1.14	4.29	1.18	3.67	1.34	3.54	1.51	Yes

**mean ratings based on a six point Likert-type scale (1=Strongly Disagree, 6=Strongly Agree)*

*** Analysis of Variance significant at an alpha level of p<.01*

Student Feedback

- *I like being able to work on the projects at home and I can see myself using the ANDY board for personal projects after I'm finished using it for class.* *(ECE 2074, Fall 2010)*
- *Honestly, before this semester I was scared that I wouldn't like or be any good with the hardware portion of my CPE curriculum. After taking this class, and building other circuits, I am more confident in my hardware abilities, and I do hope to have more hardware projects in the future.* *(ECE 2074, Fall 2010)*
- *"I loved the hands-on portions of this class. You can actually see things working. So often we get bogged down in all the math and virtual possibilities on the board but it doesn't come together until you actually work with the fiber optics and sensors."* *(ECE 4134, Fall 2011)*
- *Doing the Lab-in-a-Box projects is the best way to put what we have learned to the test. I believe that it puts us far ahead of students who haven't completed hands on projects like these from other schools. We have already designed, simulated, built, tested and debugged, and analyzed circuits, which is the way it is done at the professional level.* *(ECE 3074, Fall 2010)*
- *I didn't understand what gain was until I put a speaker on the output of my amplifier.* *(EE Senior involved in lab developed.)*

Pedagogical Benefits

- The **differences in performance** between real devices and the idealized components are made evident to the student through measurement and observation.
- The relationship between **design, analysis, and testing** is emphasized.
- Attention is paid to the accuracy and precision of experimental measurements, as well as to an **analysis of the errors** associated with many of the experiments.
- Students appreciate the **flexibility** to perform the experiments in a location and at a time of their choosing.
- Some students use the LiaB kit to **independently explore** circuits in other courses and by expanding their kits with additional components.

Indication of Success

- Developed online circuits laboratory course, which was offered in Summer 2012
  - Student evaluation of course was slightly higher than the on-campus offering.
- Comments from VT ME faculty members have been extremely positive.
  - ME department uses the classes as example of the hands-on learning opportunities available to students at presentations to high school students and parents during the Virginia Tech College of Engineering Open House.
  - Students have relayed comments from parents on the level of sophistication of the equipment and on the integration of the Tablet PC in the LiaB experiments.
- Other engineering departments at Virginia Tech have asked for laboratory component to be added to the other service circuit course.
  - Evaluation of hands-on homework assignments and in-class activities that do not require the oscilloscope (or GTAs to validate the circuits) in Spring 2013.

The Future

- Considerable interest in pedagogy at the National Science Foundation
- Growth of hackerspaces seems to indicate that there is an inherent desire for hands-on experimentation.

- Incomplete list of additional issues need to be addressed:
  - In-depth assessment of pedagogical approach
    - What skills are best taught through hands-on learning? What shouldn’t be?
    - Is there a group that we are losing with this approach?
  - Identify what is needed in terms of technology and support infrastructure for wide-spread adoption, particularly outside of ECE.
  - Evaluate how this approach can be integrated with other educational trends – online learning, research emphasis of tenured/tenure-track faculty, etc.

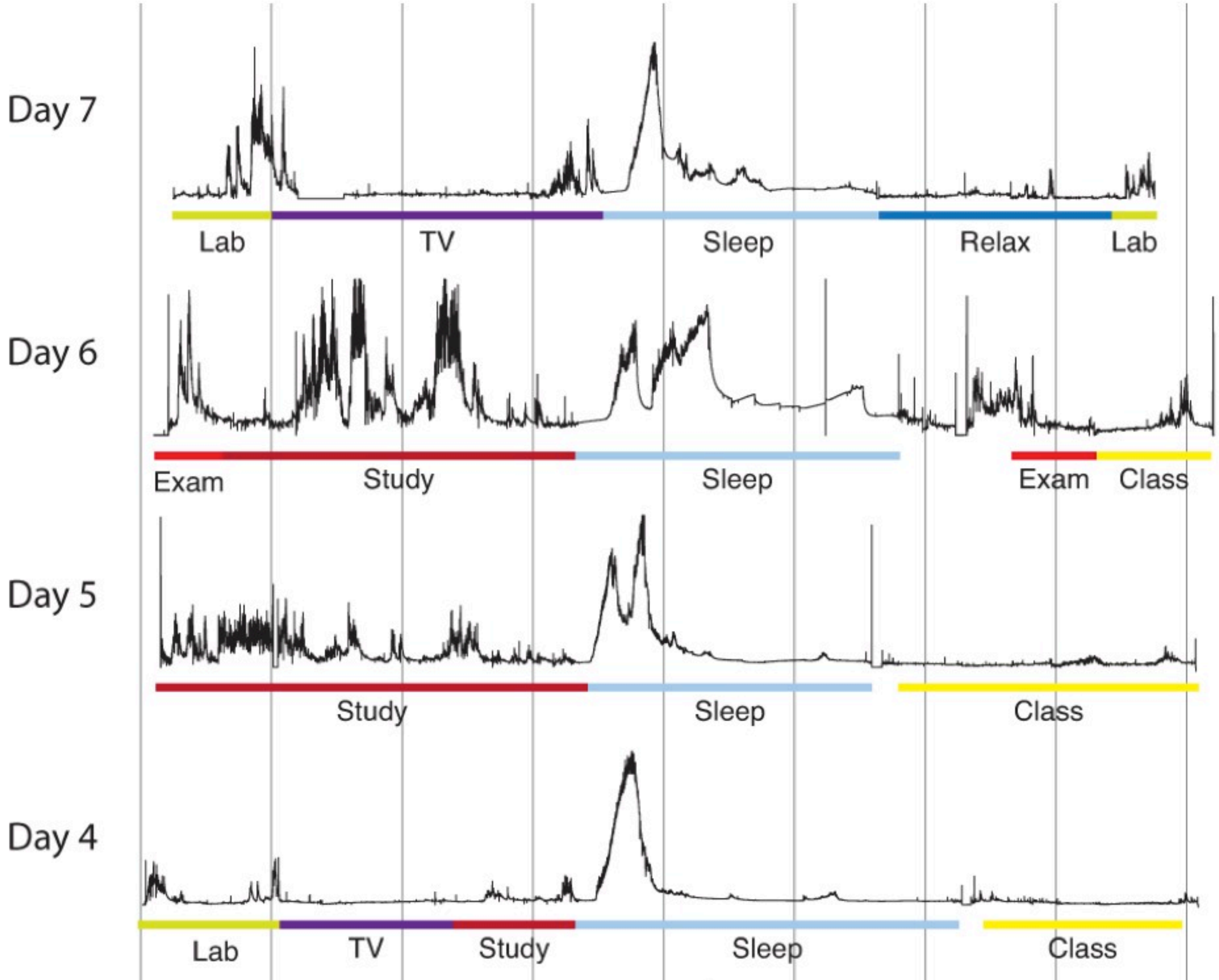
Welcome!

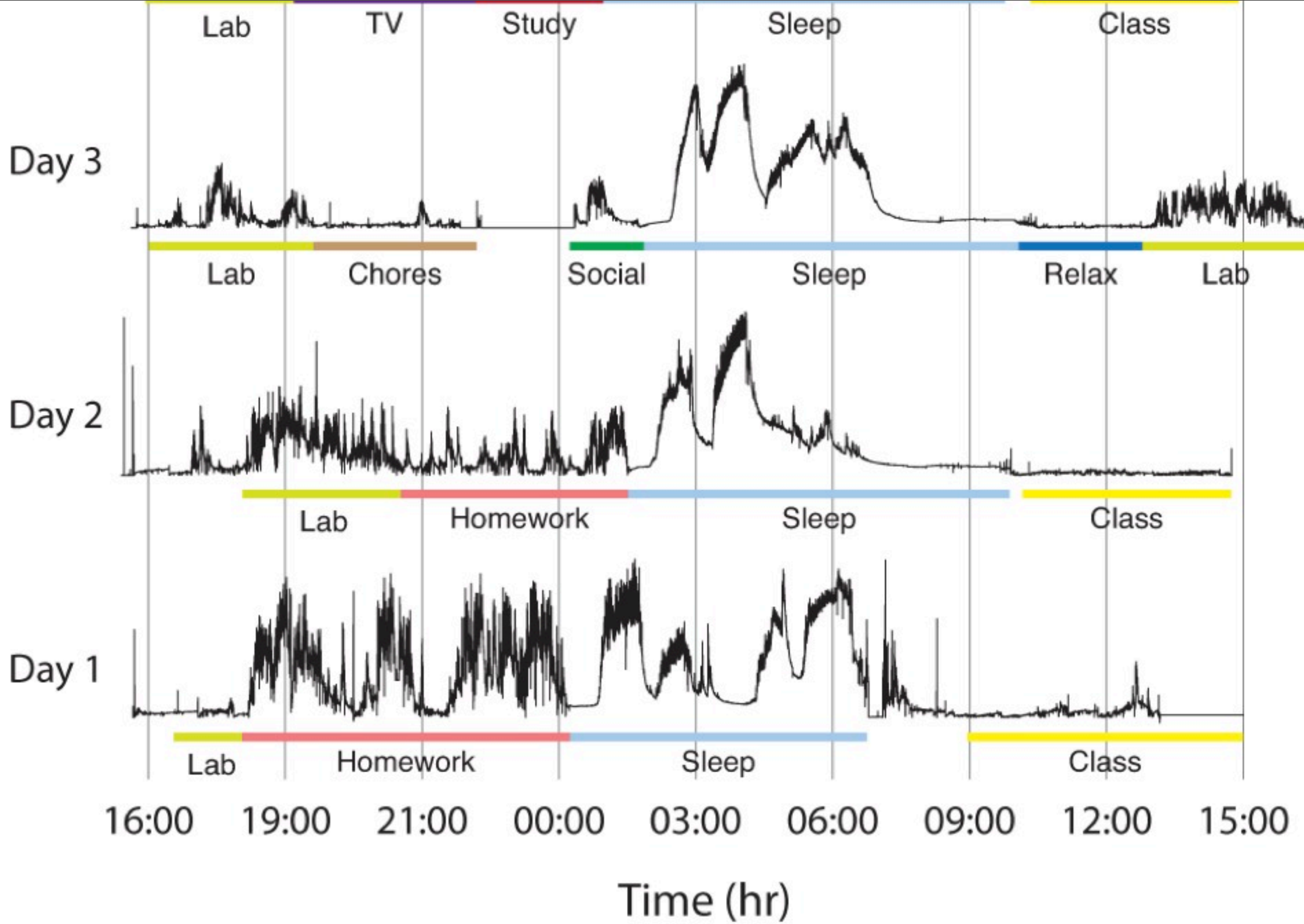
- Go to LCatalytics.com.
- Click **Create student account**.
- Click "I have a signup code," and use the signup code **DEMO** to create your account.
- Enter the class session ID **511770**.

Flipping the classroom:
Successes, techniques, and challenges

Brian Lukoff
School of Engineering and Applied Sciences
Harvard University
November 9, 2012

Think of something you are very good at.


Day 7
Lab
TV
Sleep
Relax
Lab
Day 6
Exam
Study
Sleep
Exam
Class
Day 5
Study
Sleep
Class
Day 4
Lab
TV
Study
Sleep
Class



Source: Poh, M. Z., Swenson, N. C., & Picard, R. W. (2010). A Wearable Sensor for Unobtrusive, Long-Term Assessment of Electrodermal Activity. *IEEE Transactions on Biomedical Engineering* 57(5).

So how do we change this?

In class

Content delivery

At home

Practice

At home

Content delivery

In class

Practice

At home	In class
Content delivery	Practice

At home

In class

Content delivery

Practice

Reading a textbook

At home

Content delivery

Reading a textbook

Watching a recorded lecture/screencast

In class

Practice

At home

In class

Content delivery

Practice

Reading a textbook

Watching a recorded lecture/screencast

Collaborative annotation

At home	In class
Content delivery	Practice
Reading a textbook	Practice problems
Watching a recorded lecture/screencast	
Collaborative annotation	

At home	In class
Content delivery	Practice
Reading a textbook	Practice problems
Watching a recorded lecture/screencast	Peer instruction
Collaborative annotation	

At home

Content delivery

- Reading a textbook
- Watching a recorded lecture/screencast
- Collaborative annotation

In class

Practice

- Practice problems
- Peer instruction
- Team-based learning activities

At home

In class

Content delivery

Practice

Reading a textbook

Reading a textbook

- No investment in creating content

Reading a textbook

- No investment in creating content
- How do we motivate students to do the reading?

Reading a textbook

- No investment in creating content
- How do we motivate students to do the reading?
- How do we teach students *how* to read?

Just-in-Time Teaching (JiTT)

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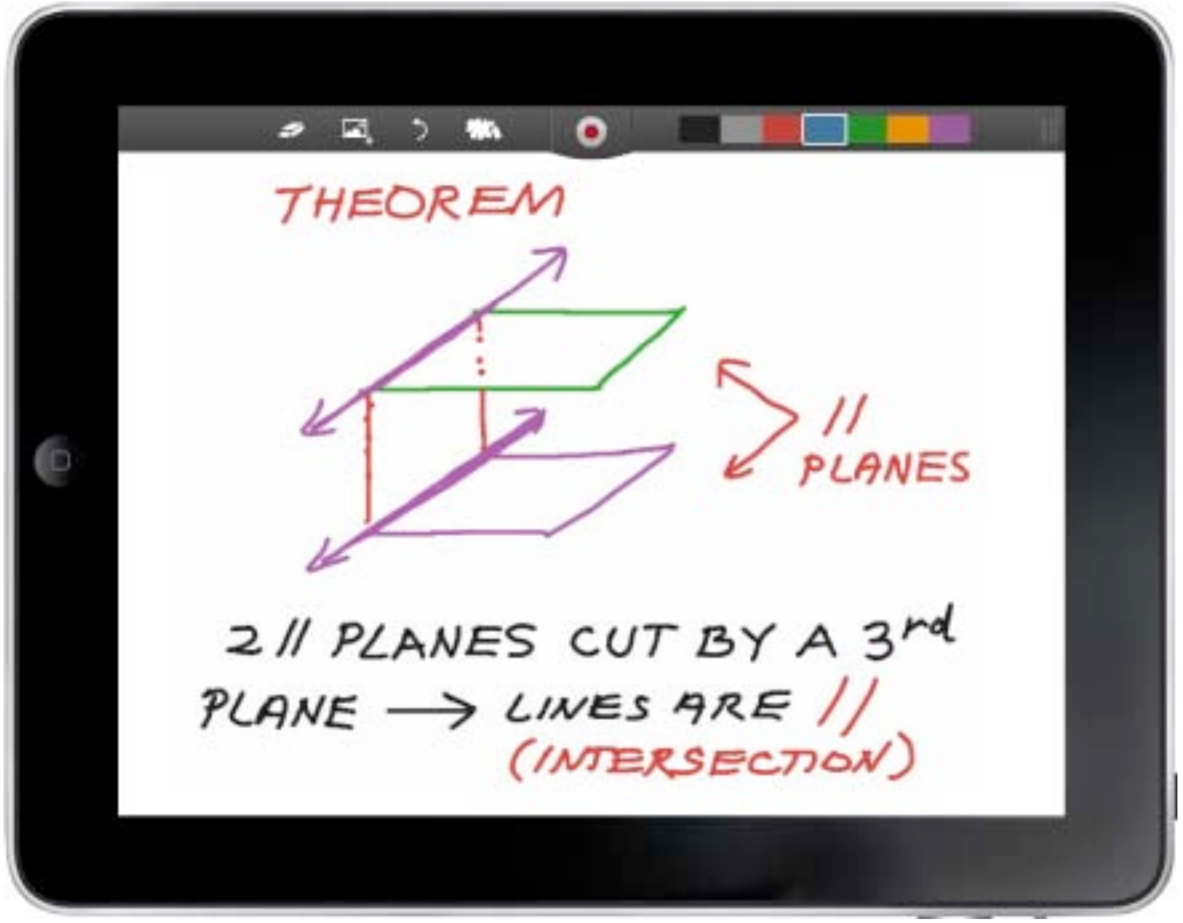
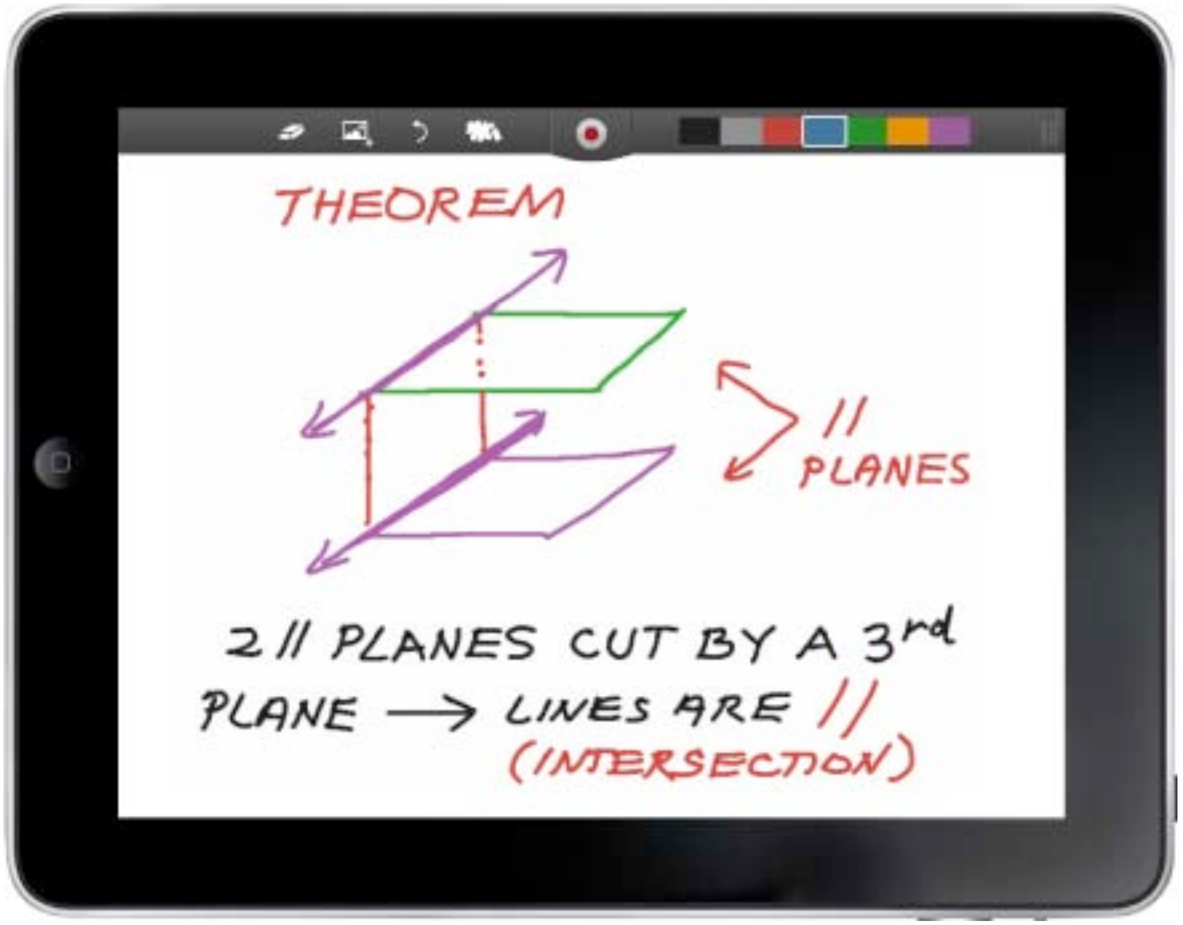
  - Comprehension questions
  - Basic application questions
  - "What was most confusing/interesting?"
- Use the results to guide classroom activities
- Provides both a carrot and a stick

Watching a recorded lecture or screencast



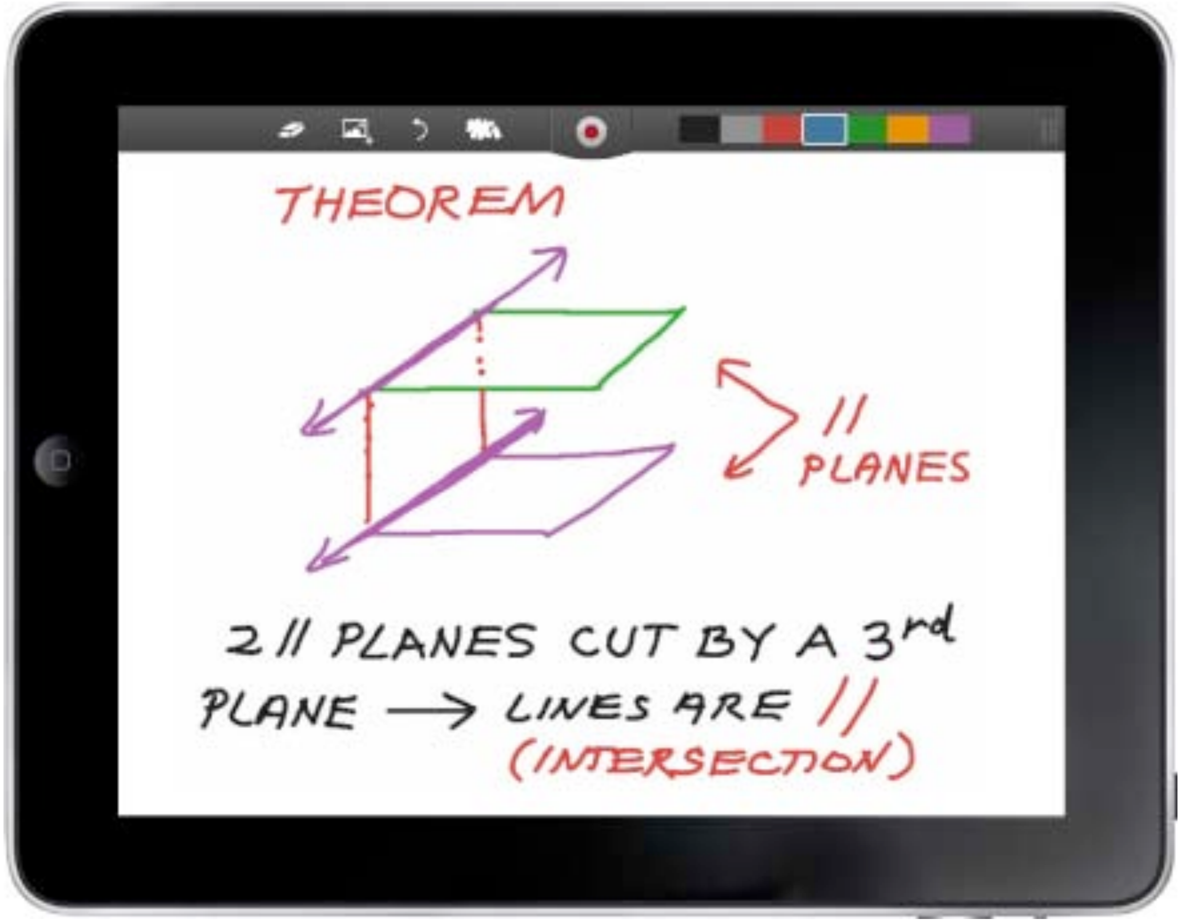
Watching a recorded lecture or screencast

- Record your lectures



Watching a recorded lecture or screencast

- Record your lectures
- Create screencasts where you work example problems (a la Kahn Academy), e.g., with ShowMe



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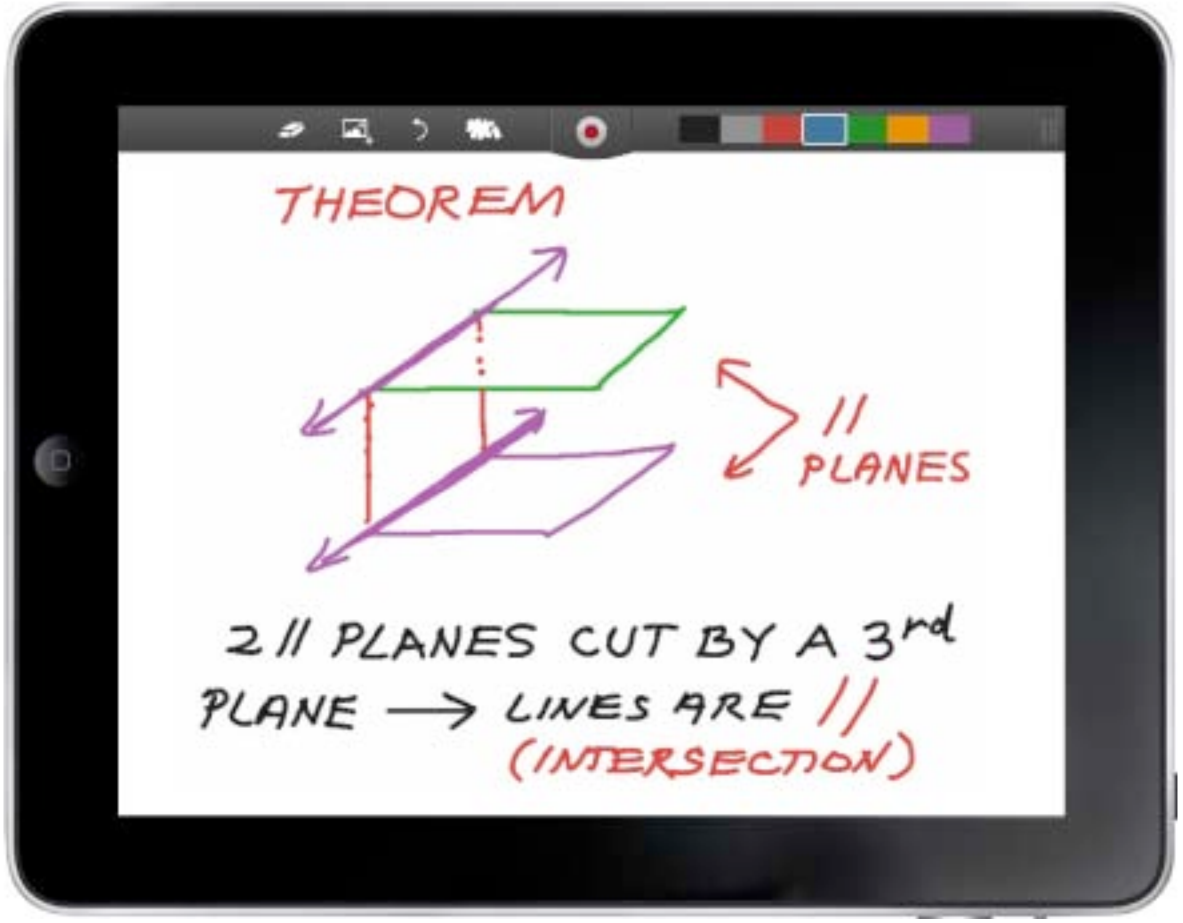
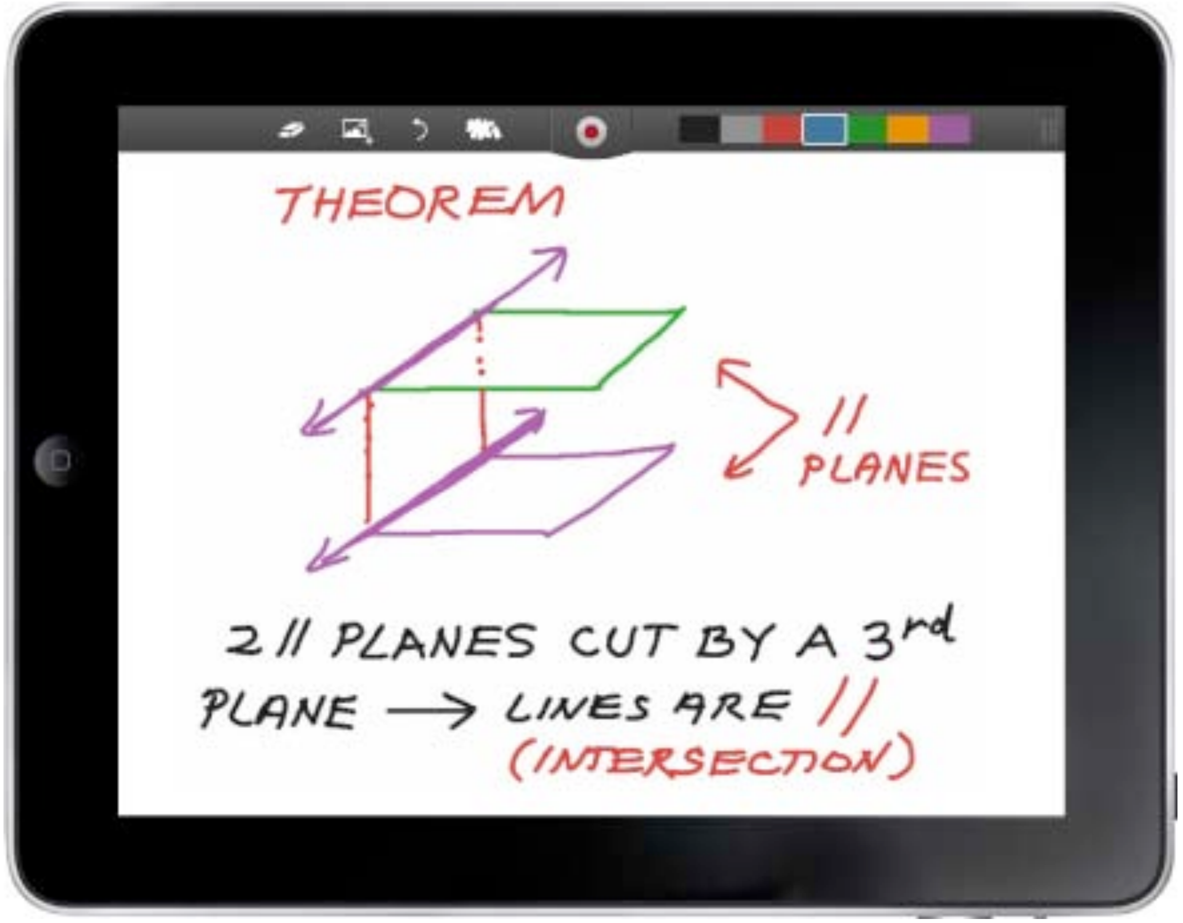


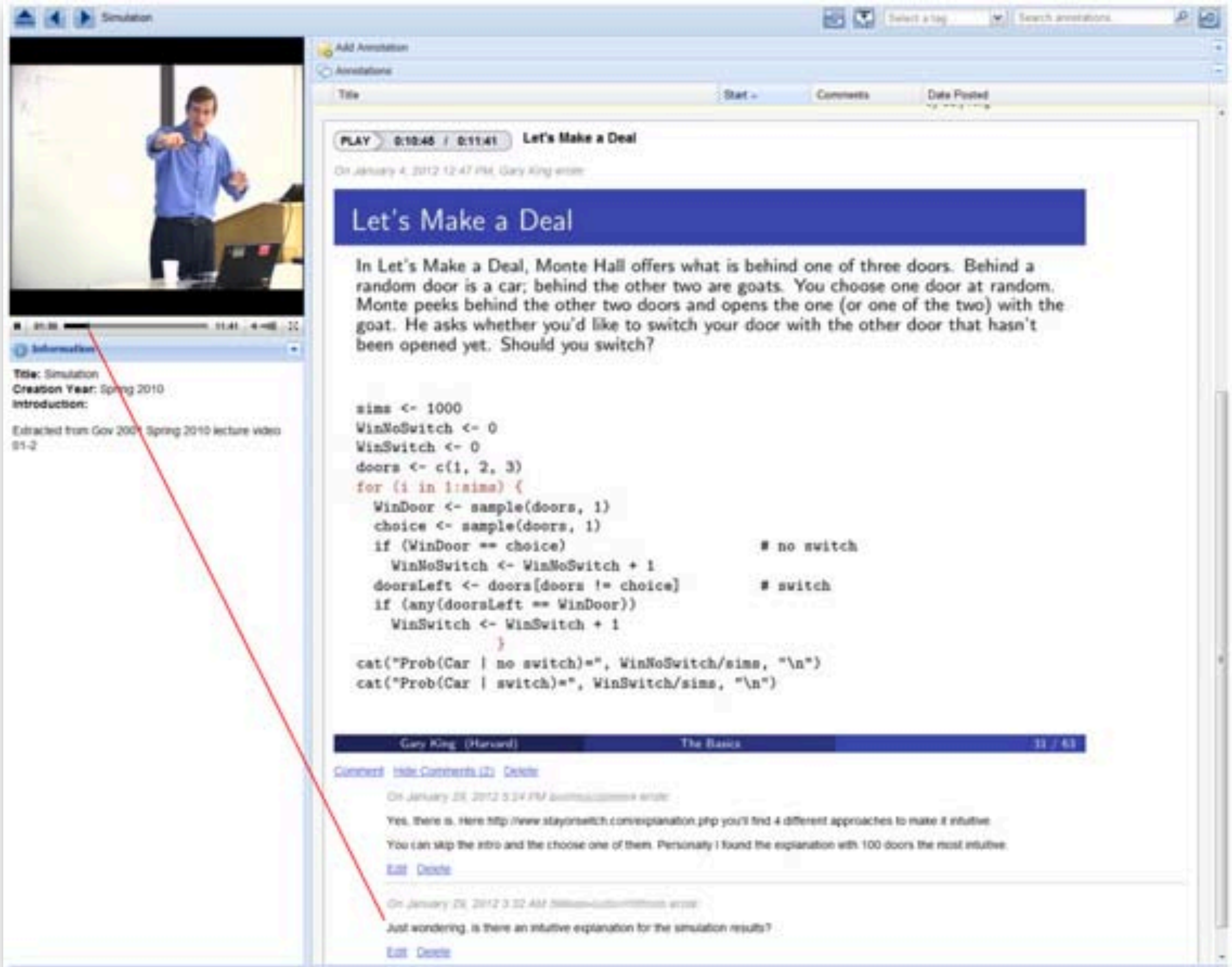
Watching a recorded lecture or screencast

- Record your lectures
- Create screencasts where you work example problems (a la Kahn Academy), e.g., with ShowMe
- Potentially more engaging for students at the cost of additional preparation time
- But how to ensure that students are not simply watching passively?

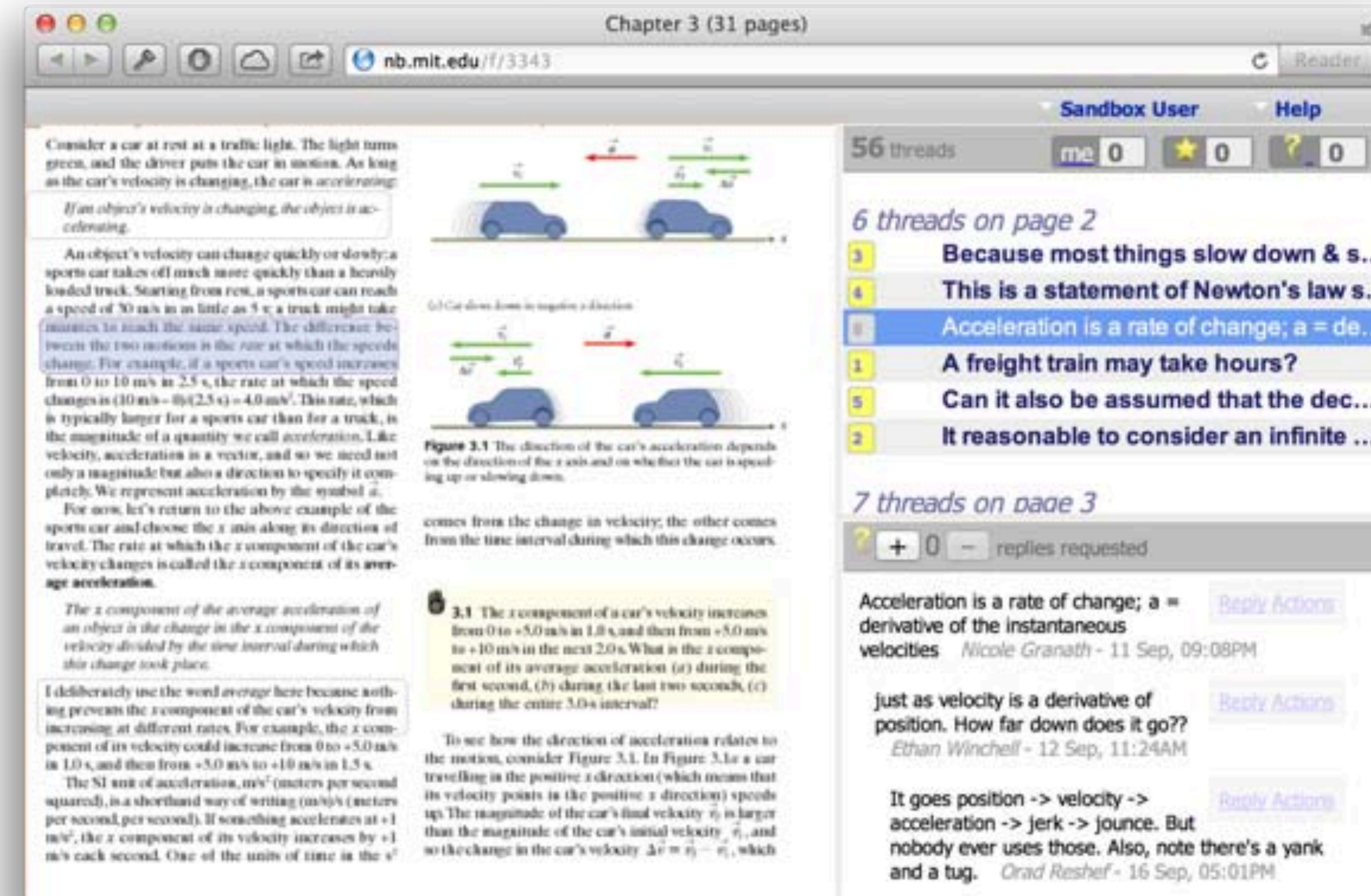


Active video watching

- Allows students to comment and add questions to specific points in the video



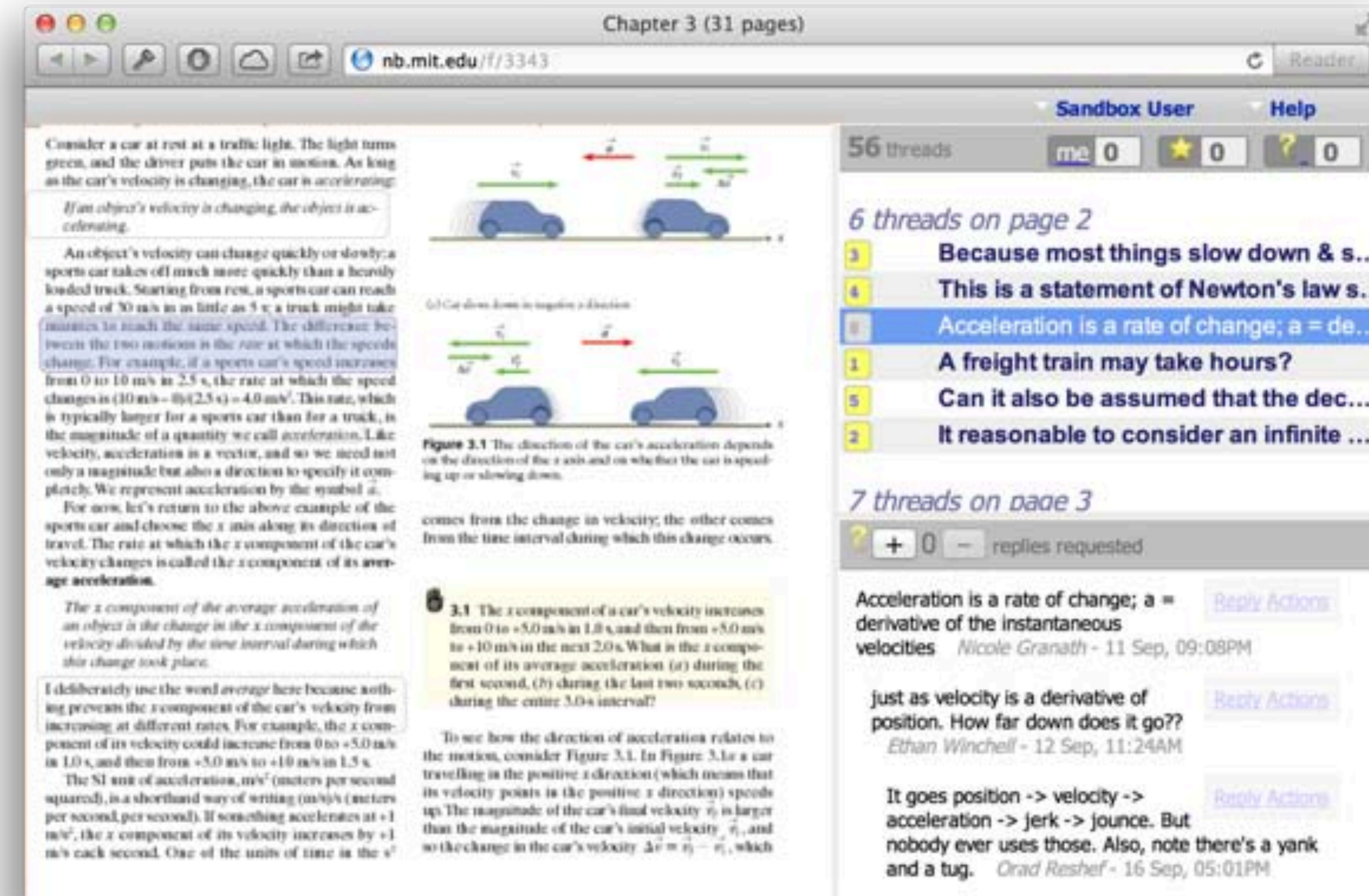
Collaborative annotation: NB



Content delivery | Practice

Collaborative annotation: NB

- Students read a document online and collaboratively annotate it



Content delivery | Practice

Collaborative annotation: NB

- Students read a document online and collaboratively annotate it
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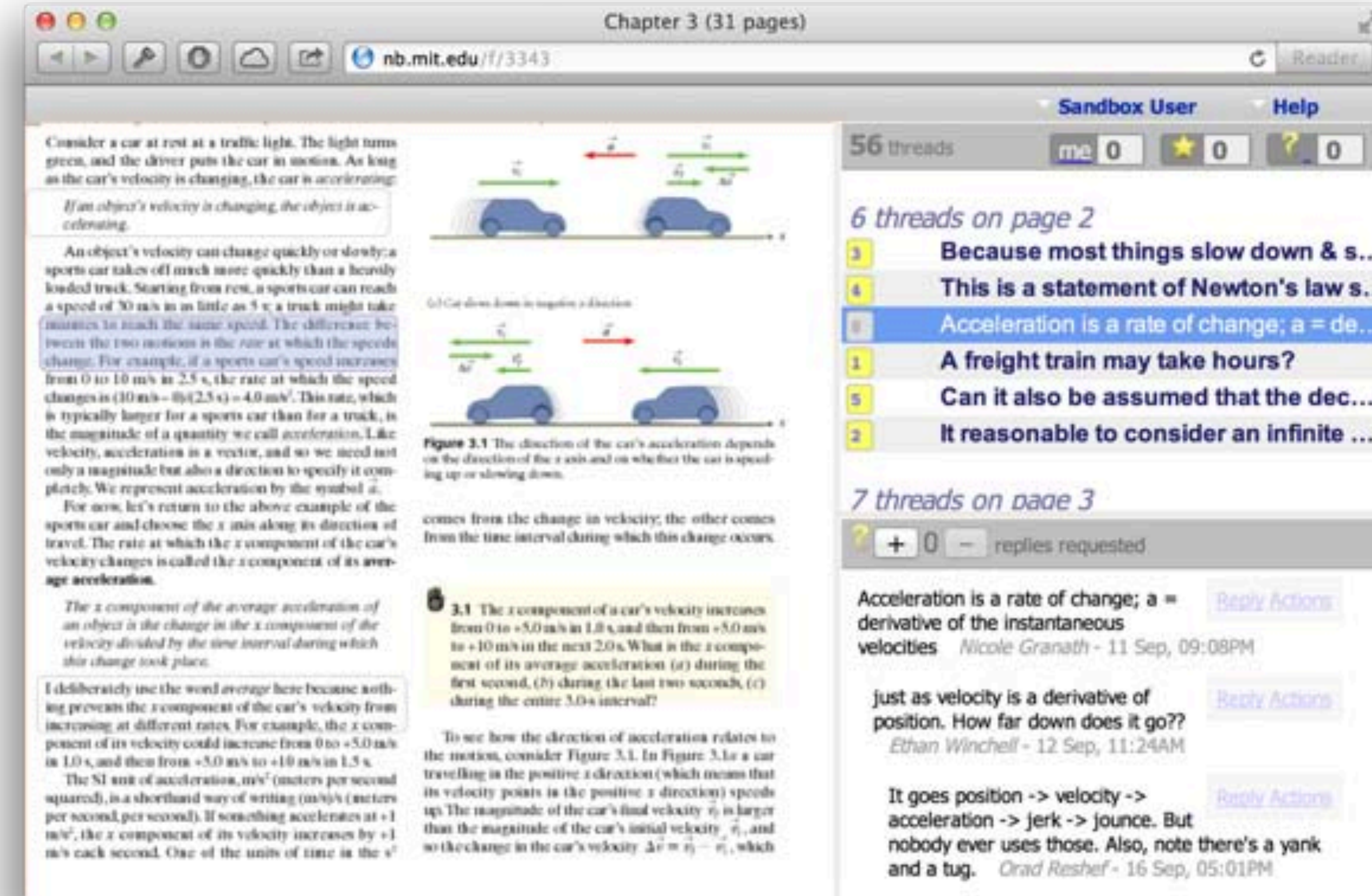

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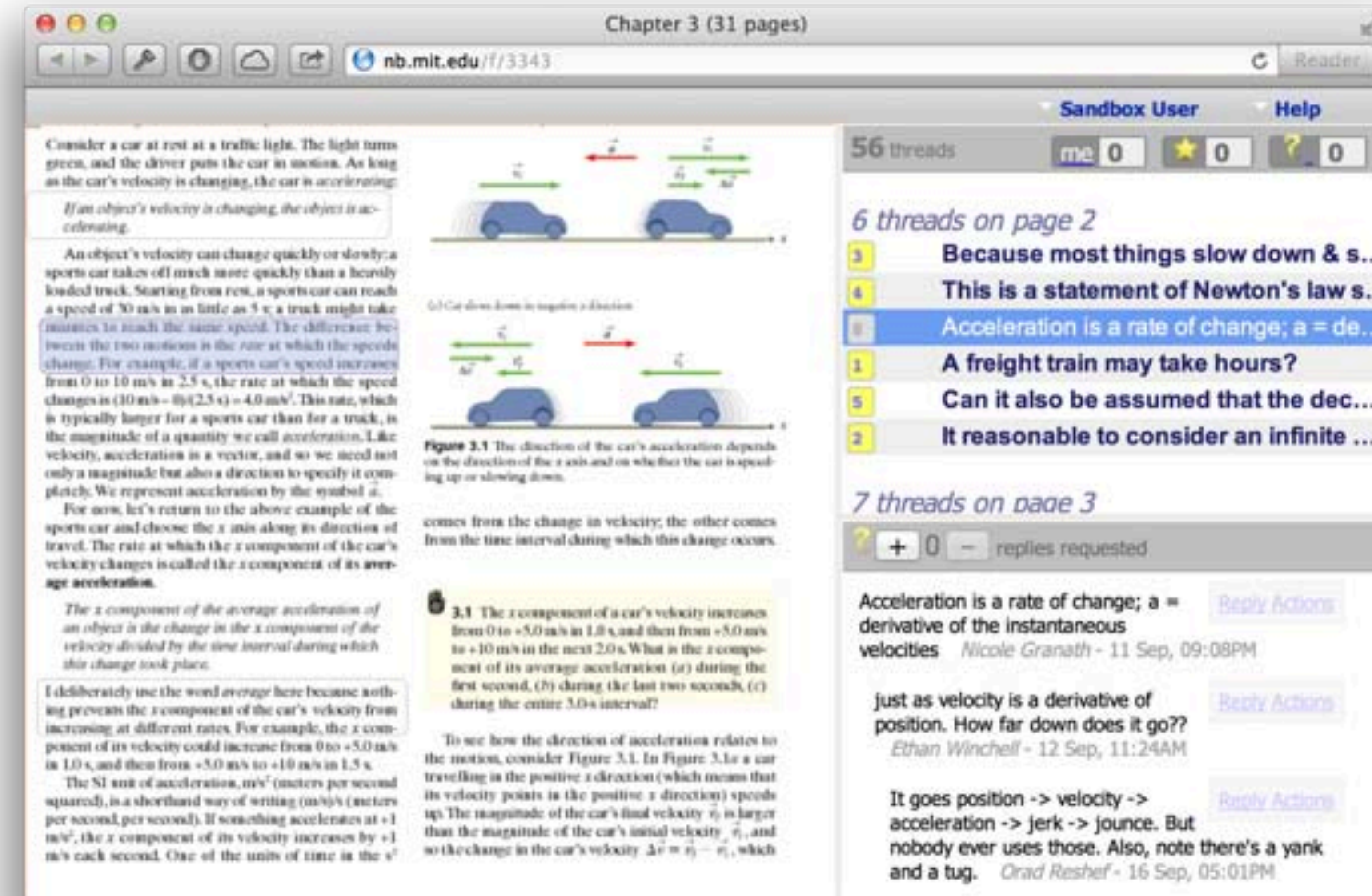
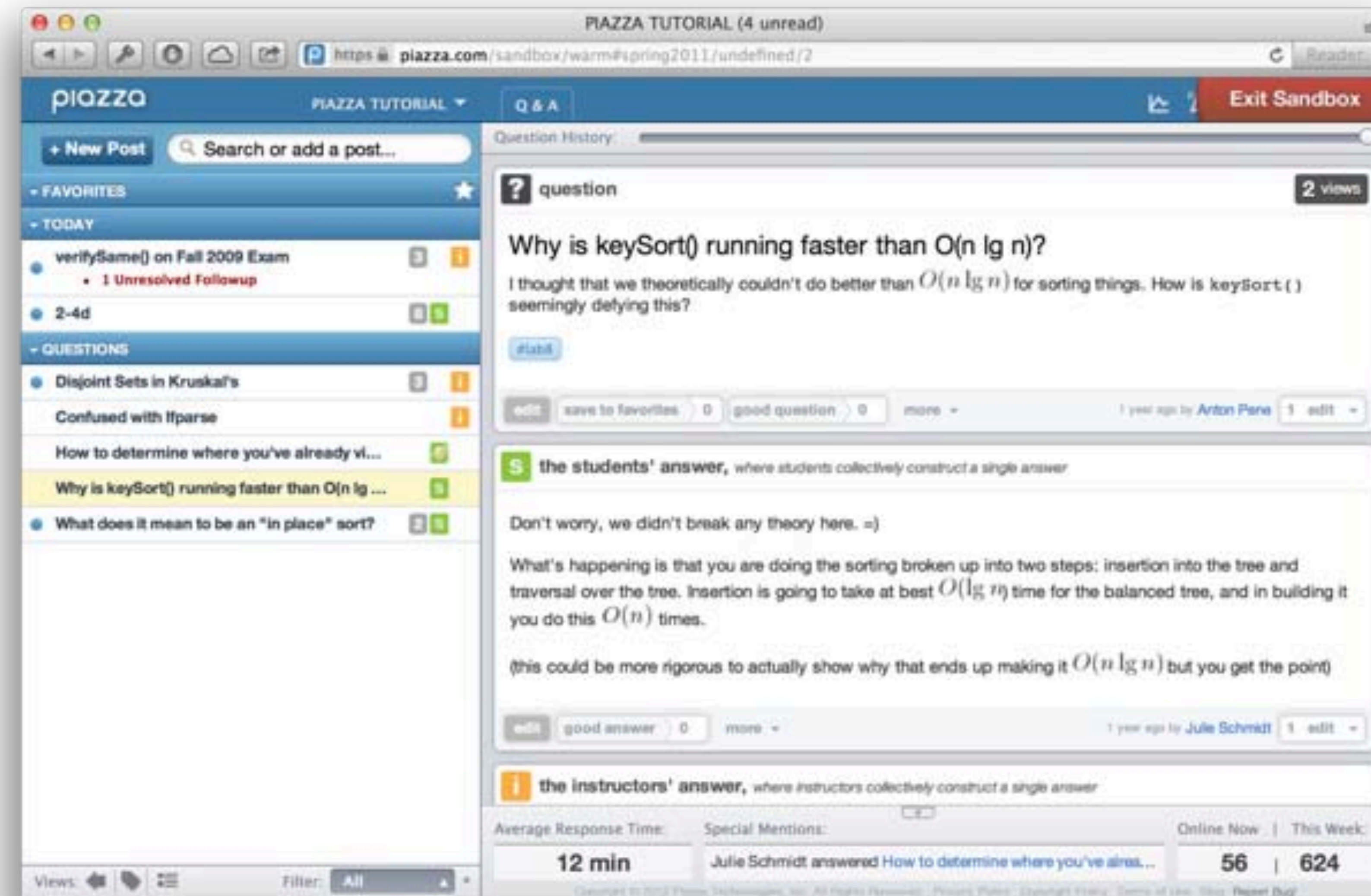


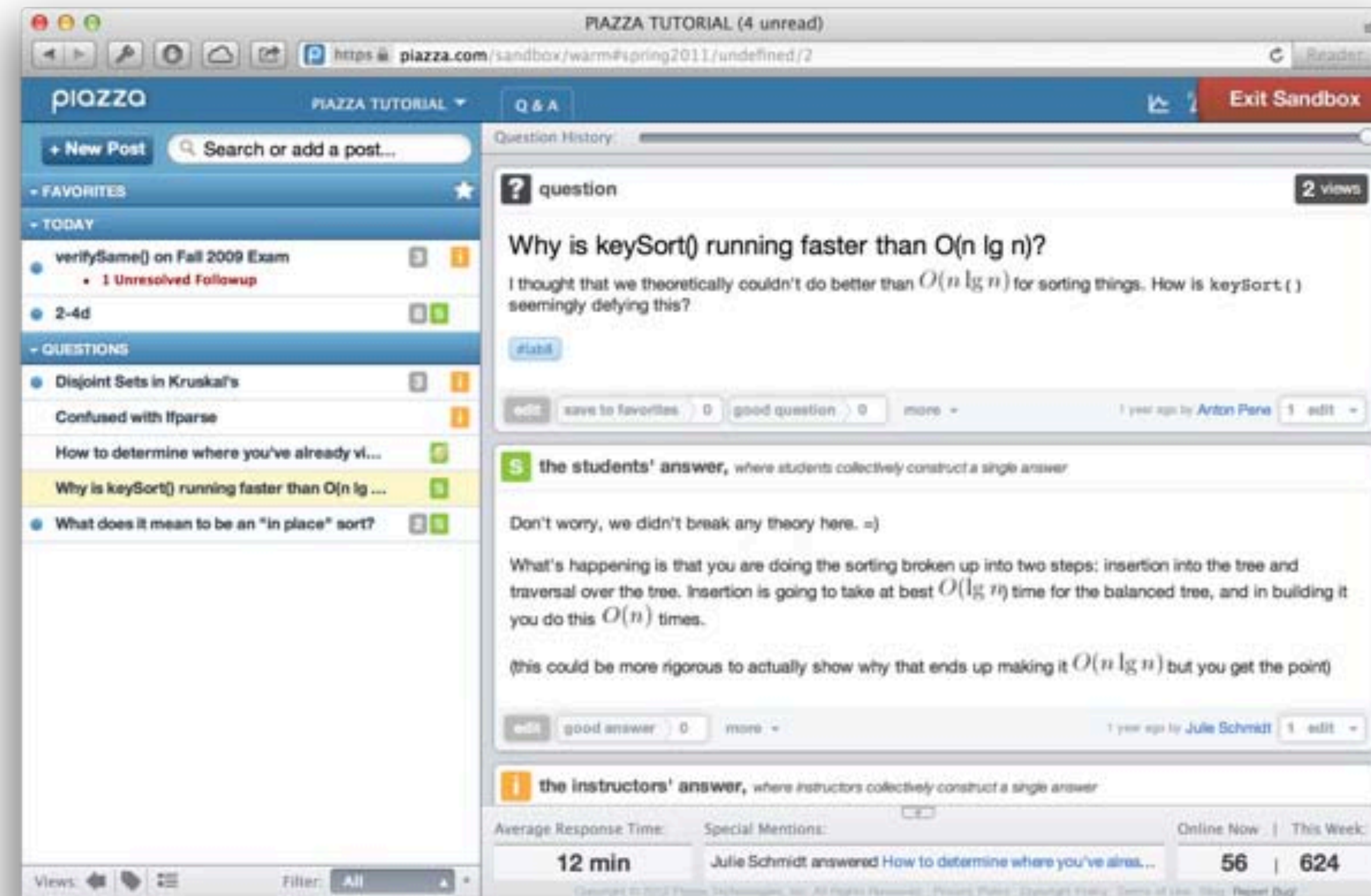
- “Hot spots” in the text provide data for classroom activities

Collaborative Q&A: Piazza



Collaborative Q&A: Piazza

- Students ask and respond to questions



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- Students ask and respond to questions
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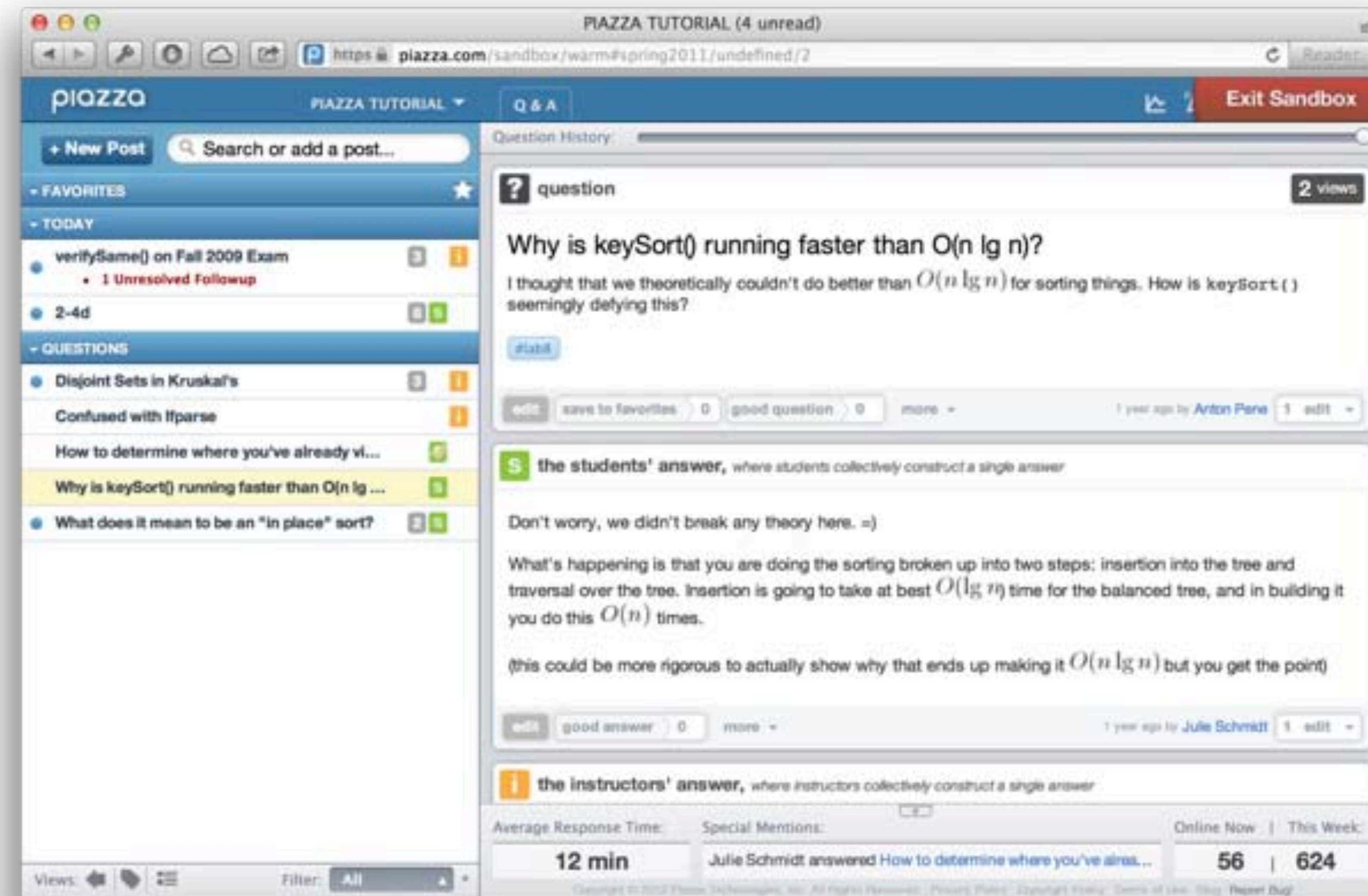

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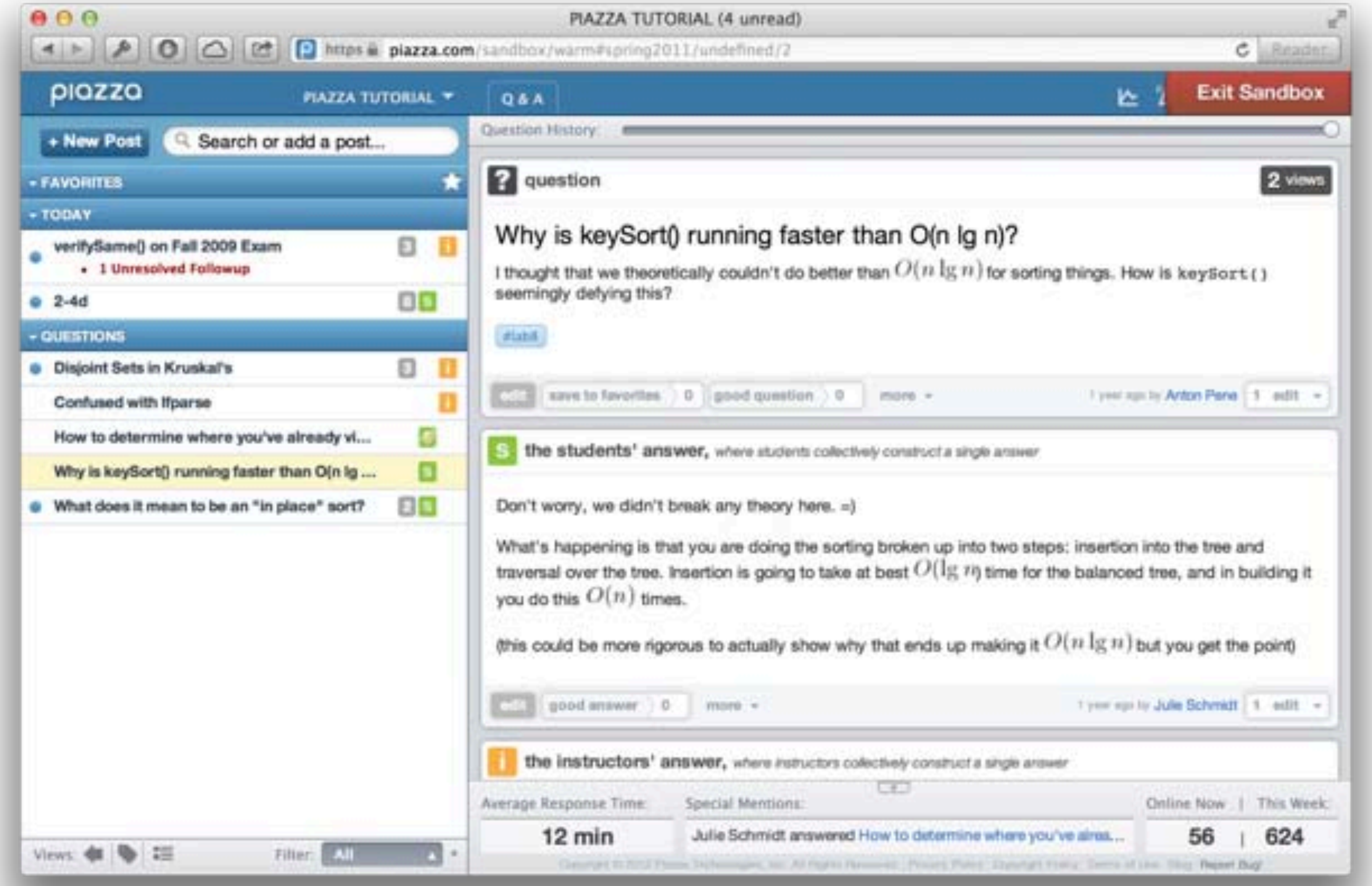

- Not a replacement for content delivery

A waterfall of data

A waterfall of data

- A tremendous amount of rich data informs your teaching

A waterfall of data

- A tremendous amount of rich data informs your teaching
- Develop strategies and workflows to handle the volume so it is not overwhelming

At home

Content delivery

In class

Practice

Practice problems

Practice problems

- Classic version of “homework in class”

Practice problems

- Classic version of "homework in class"
- Students take advantage of your expertise in class

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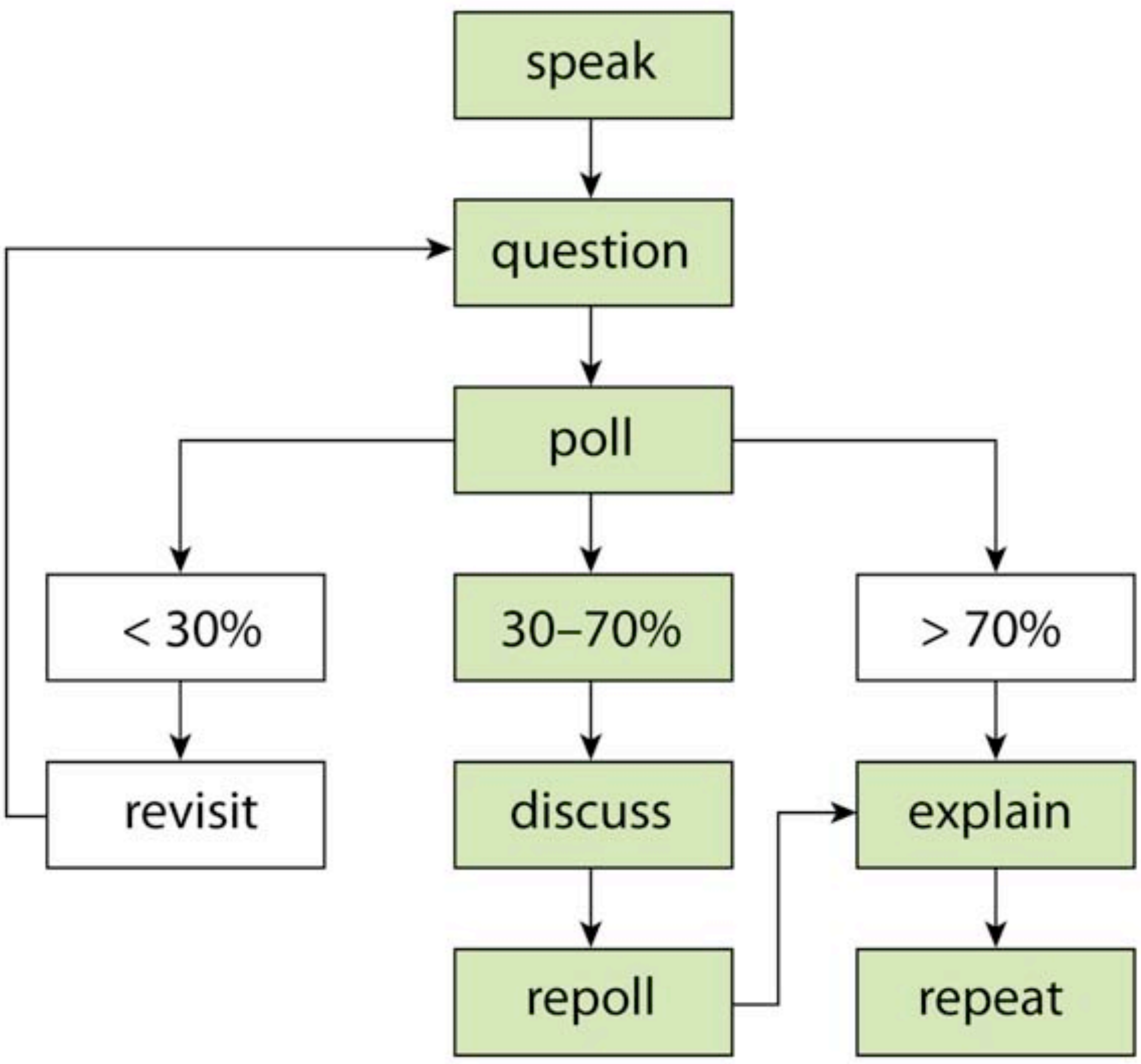
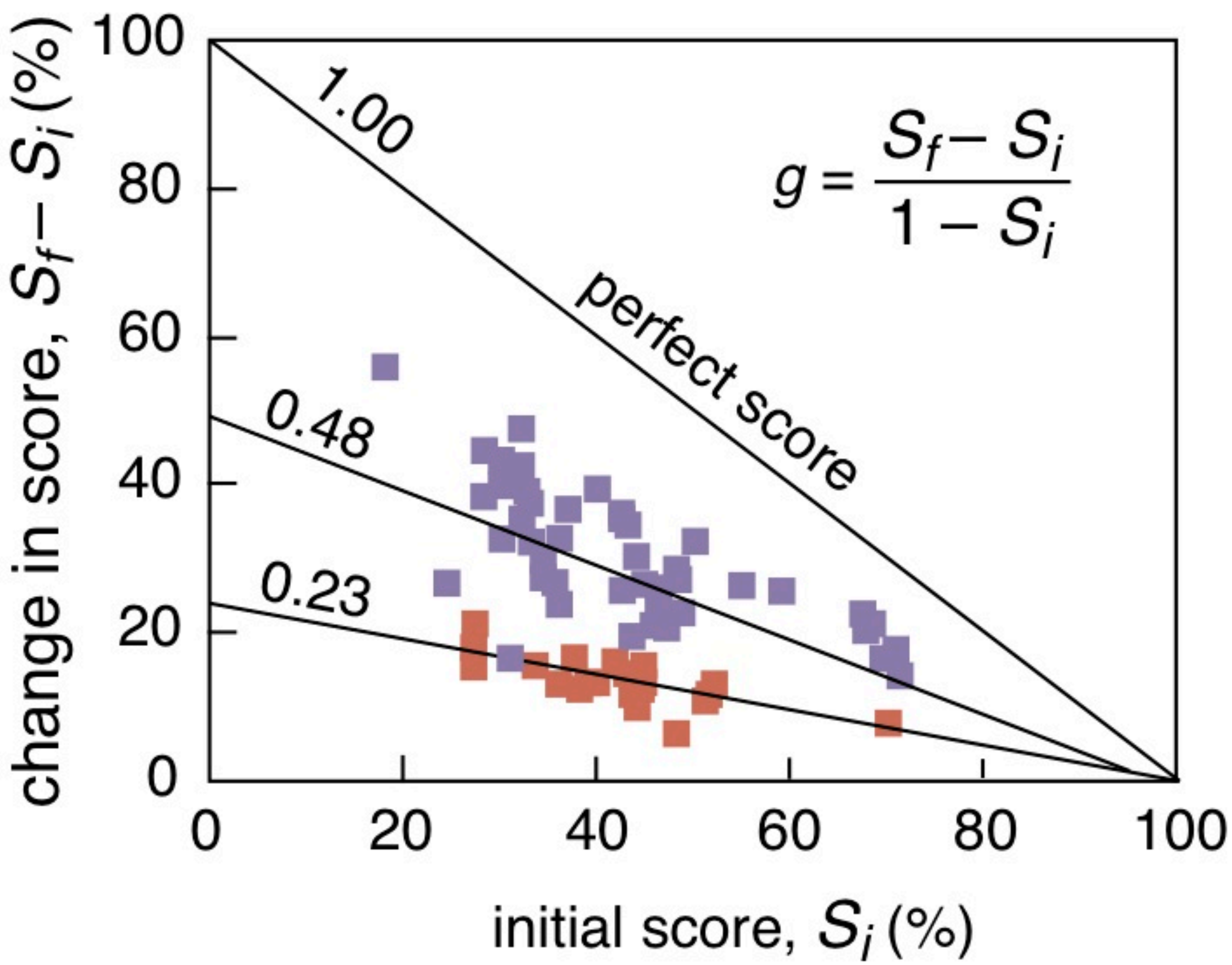
- Classic version of "homework in class"
- Students take advantage of your expertise in class
- Many possible modalities:
  - Think/pair/share
  - Group work
  - Student response systems

Peer instruction



It works



Interactive learning
Traditional lecture

Source: Hake, R. R. (1998). Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *Am. J. Phys.* 66(1).

What do the logistics look like in class?

A show of hands

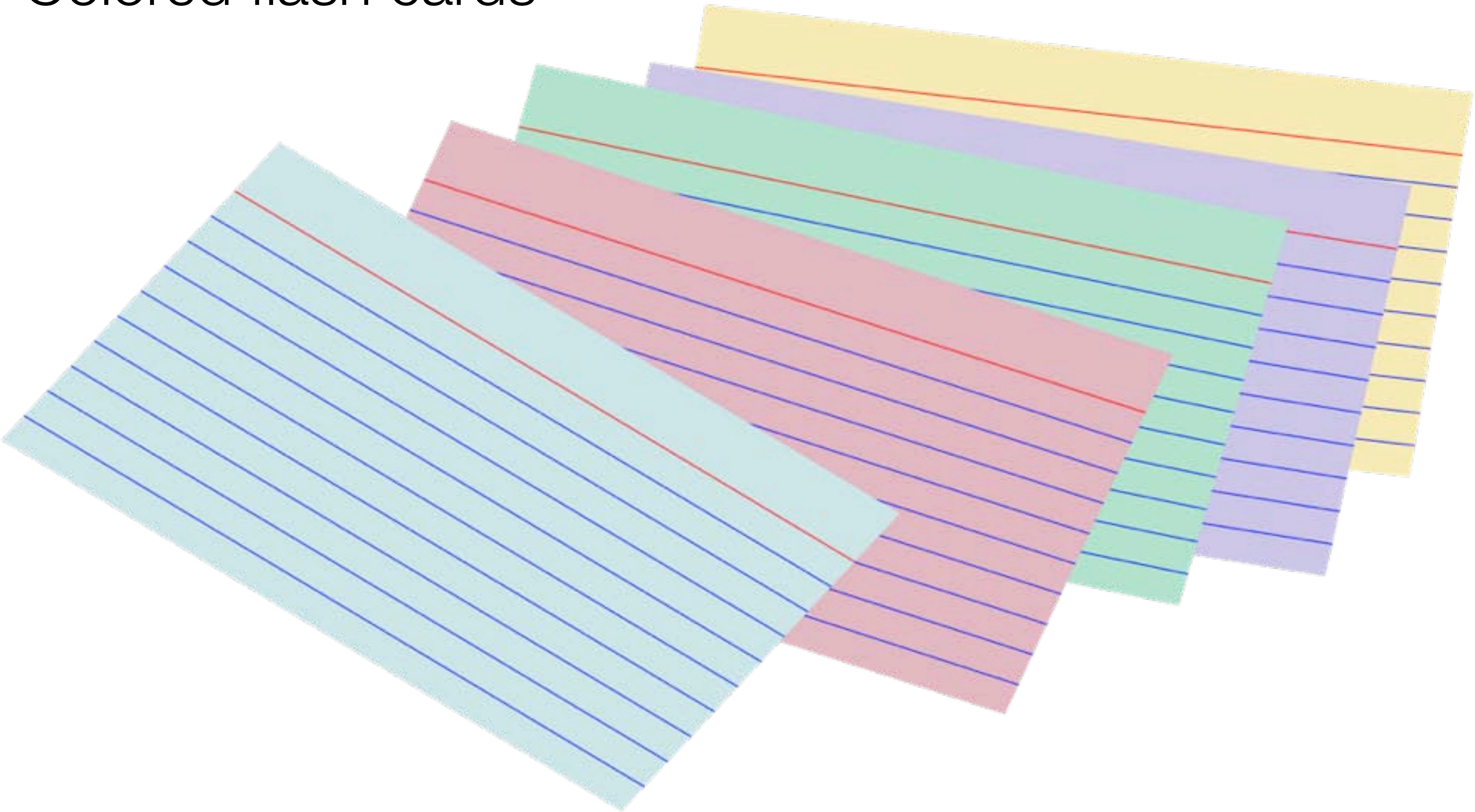
Content delivery

Practice

Clickers

Content delivery | Practice

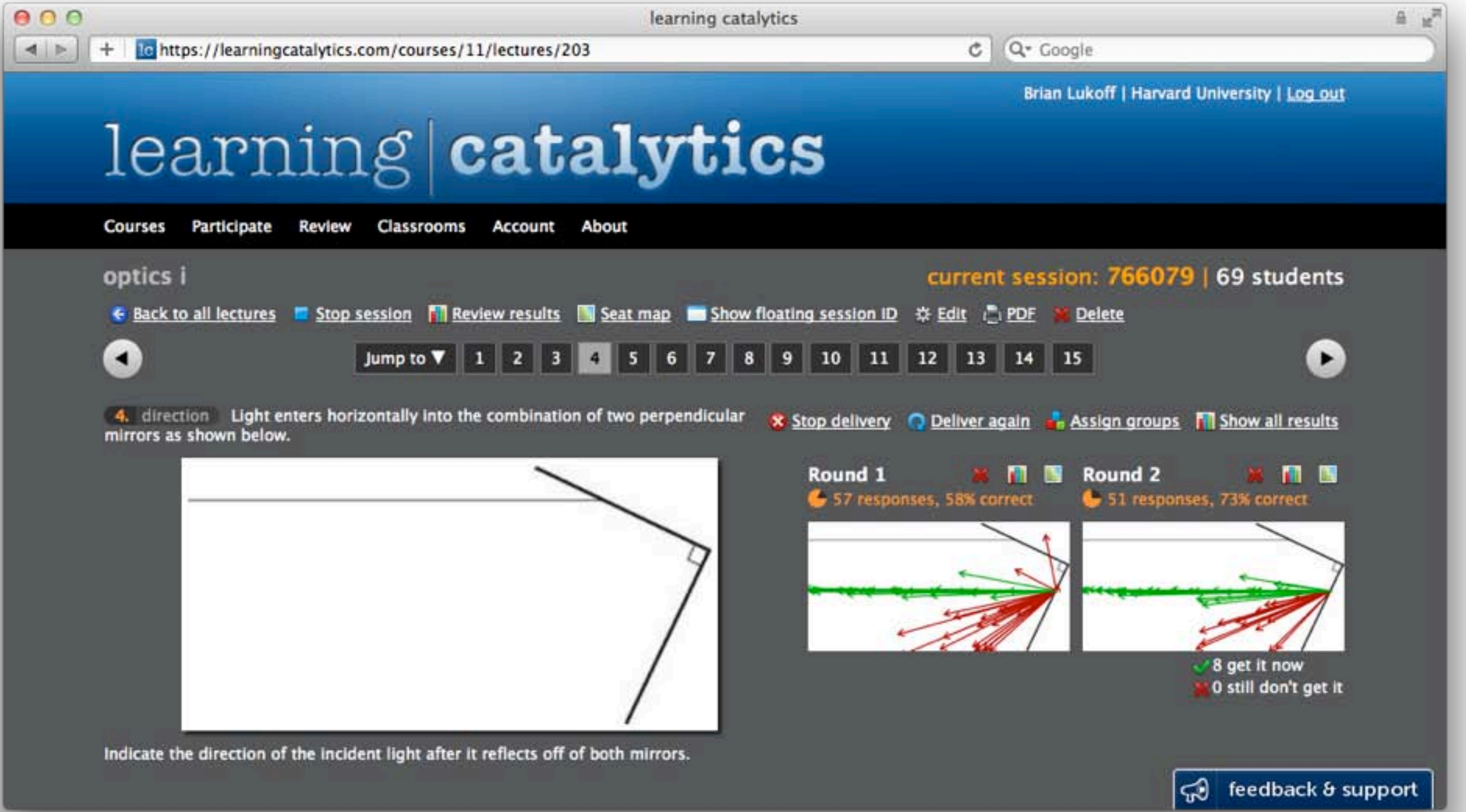
Colored flash cards



Content delivery | Practice

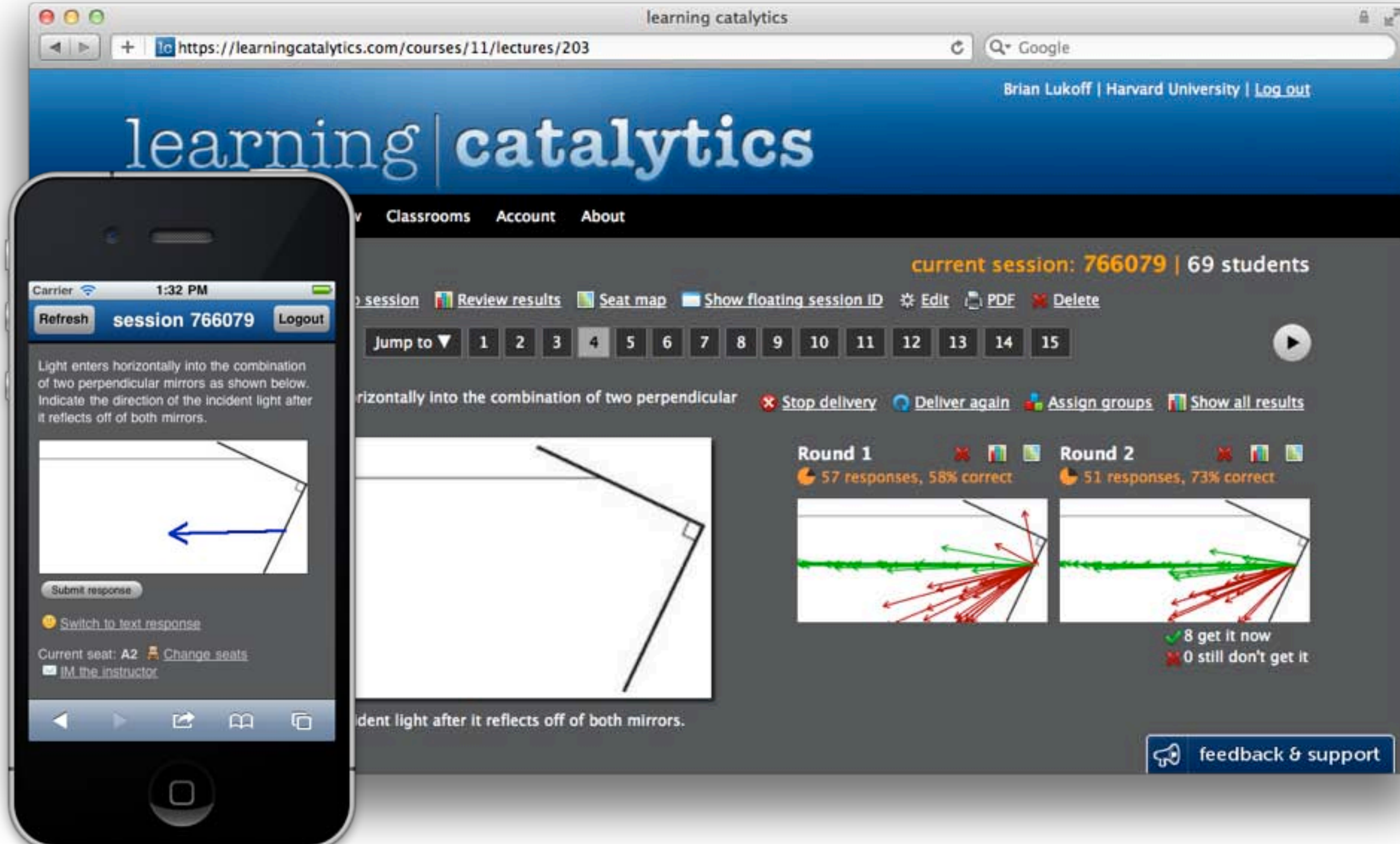
Personal whiteboards

Learning Catalytics

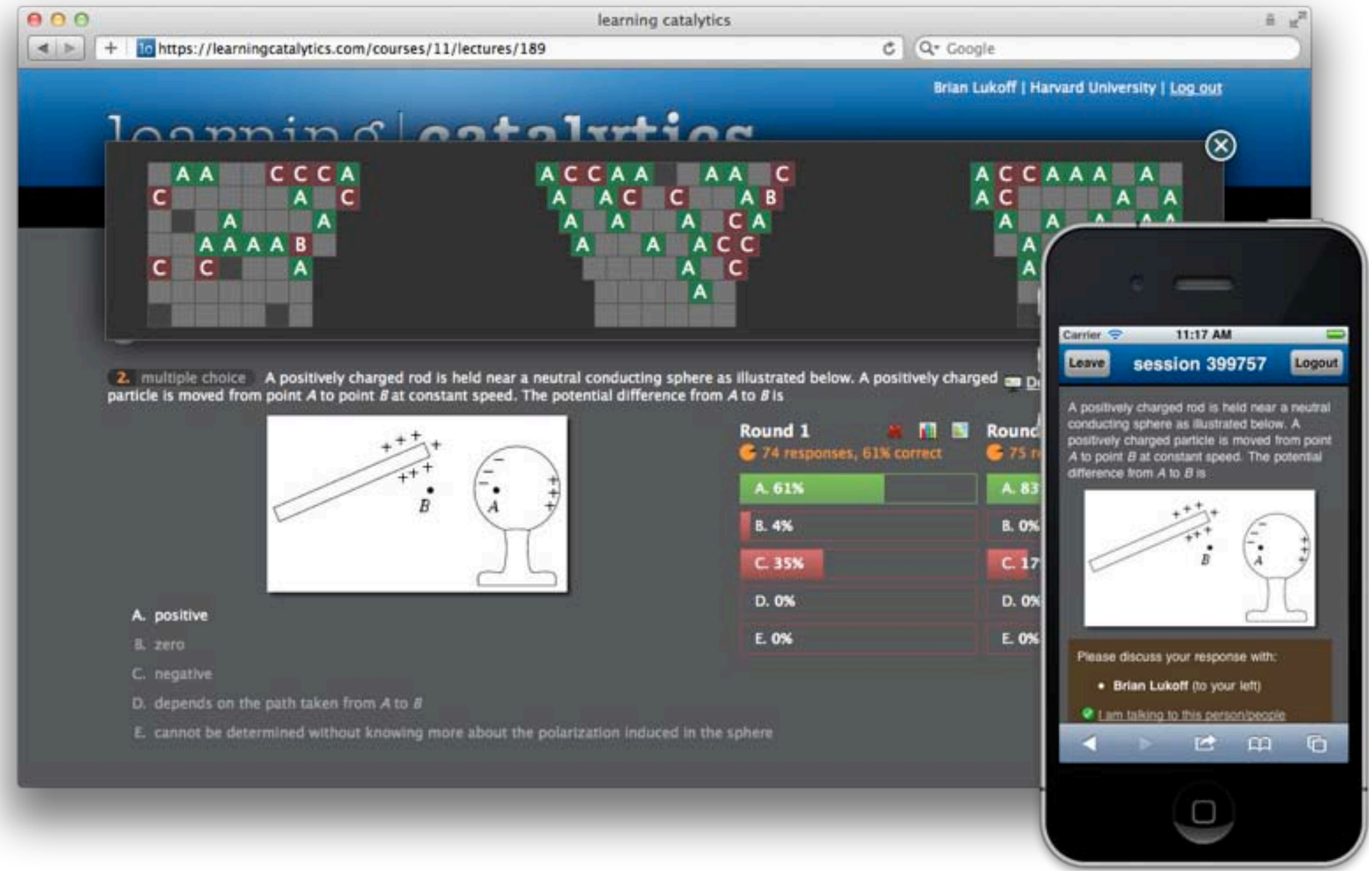


Content delivery | Practice

Learning Catalytics



Learning Catalytics



How do I know what questions to ask?

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- Focus on the learning objective, and work backwards to write the question

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- Focus on the learning objective, and work backwards to write the question
- Ask: what would be good evidence that a student has achieved the objective?
- Use libraries of existing content, like Learning Catalytics (draw directly and use for inspiration)
- Upshot: it's an iterative process

Team-based learning activities

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- Students engage in team application activities, where they are forced to agree on a single answer

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- Students engage in team application activities, where they are forced to agree on a single answer
- Application activities preceded by a team-based readiness assurance procedure to ensure preparedness

Managing expectations

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- Students (and parents!) expect the teacher to be the "sage on the stage"

Managing expectations

- Students (and parents!) expect the teacher to be the "sage on the stage"
- When possible, use data to demonstrate to students the effectiveness of your approach


Everything old is new again


Everything old is new again
Be the “guide on the side” rather than the “sage on the stage”

Final thought: It’s not all or nothing

Thank you!

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Special thanks to:
Gary King
Eric Mazur
Julie Schell
Team-Based Learning Collaborative

FLIPPED CLASSROOMS

Developed and Taught by: Dr. Faisal Kaaleem

Presenter: Shekhar Bhansali
Department of Electrical and Computer Engineering
Florida International University

Introduction

- Educating tomorrow’s Engineers to become effective problem-solvers involves the incorporation of research-based, best practices in teaching and learning that are based on an understanding of how student learns.
- To accomplish the above students should be provided with materials and environments to stimulate critical thinking through a variety of instructional strategies→
- Welcome to Flipped Classrooms

Chosen Course→Circuit Analysis

- Circuit Analysis is one of the first discipline-specific courses for Electrical and Computer Engineering (ECE) majors
- Non-ECE majors take Circuit Analysis along with EE students as part of a multi-disciplinary core
- Practicing Engineers from all disciplines need a solid foundation in circuit concepts to effectively design, test, and manufacture modern systems for electrical, biomedical, civil, and mechanical applications

The Makeup of Our Flipped Classroom

- The concept of Flipped classroom is currently being applied to the *Circuit Analysis* Course this Fall 2012 semester
- Current Classroom size is 25 students from many disciplines
- The classroom is divided into 4 different groups
- The instructor has two teaching assistants available in all class sessions
- Students are provided with previously recorded video tutorials (75 minutes each) and class-notes available to them via BlackBoard

Our Flipped Classroom Session

- Before coming to a class session, students are required to watch previously recorded video tutorials and read the class-notes
- Students are also provided with a list of numerical problems to be solved during each class-session
- During the class-session (75 minutes each) following activities occur:
  - During the first 15 minutes, the instructor goes over important concepts learned outside the classroom

Our Flipped Classroom Session (Cont.…)

- Students work in groups to try to solve the problems via peer discussions and help from instructors and teaching assistants
- Students are then assigned numerical problems (one by one) and the allocated time to finish them
- At the end of the allocated time, the instructor discusses the problem with the entire class and provides feedback
- Student then work on the next problem…

Our Experience So far…

- Our Experience thus far has been mixed and few improvements are required in the existing model
- Mixed reactions are coming from Students as well
  - For some, it is hard to change the typical learning style to a new model
  - For some, extra time beyond the typical classroom learning style required is too much for them
  - For some, model is good but some improvements are required
- Quiz results depicts the above

Encountered Difficulties

- Student Expectations were not clear for some reason
- Some Students were not watching video tutorials and/or reading class-notes before coming to a class-session
  - This affected the other students in the groups while working on the assigned problems
- Some students simply rejected to see the benefits of flipped classroom model
  - They are very much tuned to the traditional pedagogical approach

Our Plan

- Circuits (Profs. Roig, Urban, Kaleem, Subbarao)
- *Nearly 100 years of experience in teaching circuits.*
- *Spring 2013: evaluate instruction strategy with common exam.*
- *Fall 2013: Launch with update curriculum.*

Our Plan

- Offer the Circuits Course using multiple formats to evaluate effectiveness of the different models in Spring 2013 semester with a common final exam.
- During Course Registration, the following brief paragraph will be provided to the students to make sure that the expectations are clear
  - *This special section of EEL 3110 requires students to read lecture notes and watch pre-recorded video lectures before coming to each class. During the regular class meetings, the instructor provides a review of the topic followed by a learning activity where students work in teams to solve numerical problems with the supervision of the instructor and learning assistants to reinforce the material previously studied in the online lecture notes and pre-recorded videos. No additional fees are charged for this section.*

Our Plan (Cont.)

- To Ensure that the students are watching video lectures, quiz/other assessment activity will be introduced that is tied to the students' grades
- To assess the benefit, the model will be compared against the other sections of the circuit class
- Common Syllabi, Book, and material will be used across all sections
- Common Final Exam on the same day/time across all sections will be introduced
- 1 credit hour lab component will still be part of all sections

Our Plan (Cont.)

- Following sections will be introduced in Spring 2013
  - *Traditional Classroom* → For regular students
  - *Online Course* → For self-paced learning
  - *Traditional Classroom with embedded help session* → For students with difficulties in learning circuits concepts
  - *Flipped Classroom*
- We are also planning to introduce hands-on component in the classroom using flexible and modular circuit kits to enhance experential learning

Flipping Circuits I at UF

John Harris
UF ECE

Questions from a chair's point of view

1. Why flip?
2. What to do in class?
3. How effective is it?
4. Who records the lectures?
5. How many students per class?
6. What kind of classroom/furniture is needed?
7. How much credit do faculty get per section?
8. How many faculty do we need?
9. How many meetings per week?
10. What are the challenges?

1. Why flip?

Traditional lectures are often ineffective:

- Faculty give the same lecture year after year
- Faculty hired for research, not teaching
- Circuits 1 has 180 students, this fall: two sections of 90 students each
- At UF, a senior faculty member is retiring

Why are we paying faculty to give *mostly* the same lectures every year? This fall, they are giving the same lecture twice in the same day!

1. Why flip? (part 2)

If students go to traditional lecture, they may be

- sleeping
- reading school newspaper
- doing crossword puzzles
- texting
- on facebook

Flipped:

- Students enjoy watching lectures at home, they choose the time
- Can pause, rewind, fast forward
- Students are more engaged in classroom!

2. What to do in class?

- Answer questions on lectures?
- Homework?
- Quizzes on lectures?
- Assign work in groups
- Group discussions
- Faculty can walk around and help out

3. How effective is it?

- Running assessment with education college (before and after)
- Assessing: satisfaction, time spend out of class, learning, etc.
- Also duplicating an exam

4. How many students per class?

- 20

- We have done experiments with larger sizes

5. Who records the lectures?

- We are recording lectures this fall (extra lecture without semester-dependent material)
- After giving the lecture to class, record reduced video in recording studio
- Or we could use a circuits MOOC
- Lectures are like textbooks, not everybody needs to create them!
- How long should lectures be? (10 mins?) Should we embed questions? (yes!)

6. What kind of classroom/furniture?

-

7. How much credit do faculty get?

- Working this out as we go
- Takes ~2 hours to prepare a lecture→ maybe one traditional course is 3 flipped sections?

8. How many faculty do we need?

- Circuits 1 at Florida has 180 students
- 9 sections of 20 students
- Need 3 faculty getting credit for 1 course each
- Using one senior faculty member (in charge of class) and two enthusiastic postdocs

9. How many meetings per week?

- In spring have 3 50-minute meetings/week
- Do we need this many?
- Can we reduce to 2 meetings/week?
- Third meeting with TA in charge?

10. What are the challenges?

- How to ensure students watch the lectures?
- How to ensure students come to class?
- How to sell this to the students?
- How to sell this to the faculty?
- What do do with dysfunctional groups?
- How to pay for this?

NC STATE UNIVERSITY

REAL: The Remote Educational Antenna Laboratory

Dan Stancil

Acknowledgement: S. Sharma, N. Gist, Yi Jiang, J. Krohn, R. Hodson

Electrical & Computer Engineering
College of Engineering
NC STATE UNIVERSITY

Outline

- Remote Laboratory Background
- Motivation for Remote Antenna Lab
- Description of the Facility
- Operational logistics
- Initial Experiences
- Summary

Remote Laboratories for Education

- Remote Labs: controlling *real things* remotely
- Training for real-world experiences
- Resource leveraging
  - instrument sharing between schools
  - secure after hours use of existing equipment
- Enhanced Classroom demonstrations
  - avoids logistical difficulties of setting up demo in class
  - allows students to play with demo after class at their leisure
- Enables lab component for distance education

Examples

- CMU
  - Demonstrated for ABET team in Fall of ‘94
  - Used in experimental class in ‘95 and ’96
  - Used as lecture demos in ‘99 and ’00
- Other examples:
  - Resource Center for Engineering Laboratories on the Web at the University of Tennessee at Chattanooga (http://chem.engr.utc.edu/) online since 1995
  - Harvard-Smithsonian MicroObservatory of On-line Telescopes,

(http://mo-www.cfa.harvard.edu/MicroObservatory/)

Electromagetics Education

- Students can build things after 1 or 2 semesters of circuits or controls
- Students usually cannot build anything after 2 semesters of electromagnetics!
- Common impression: abstract, mathematical, of little practical use

Antennas as a Solution

- Antennas are everywhere and in everything
- Many antennas are simple to make
  - Printed patterns
  - Wires, copper tape
- But they are hard to test (beyond SWR)
- Consequently most antenna courses with projects use simulation only

Proposed Solution: the Remote Educational Antenna Laboratory

- Anechoic chamber available for scheduling and use by students and educators
- Live control of the chamber and instruments via the web
- Provides opportunity for “hands-on” experience in antenna construction and the next best thing to “hands-on” for testing
- Prototype constructed at CMU (NSF CCLI)
- Moved to NC State & became operational 2011

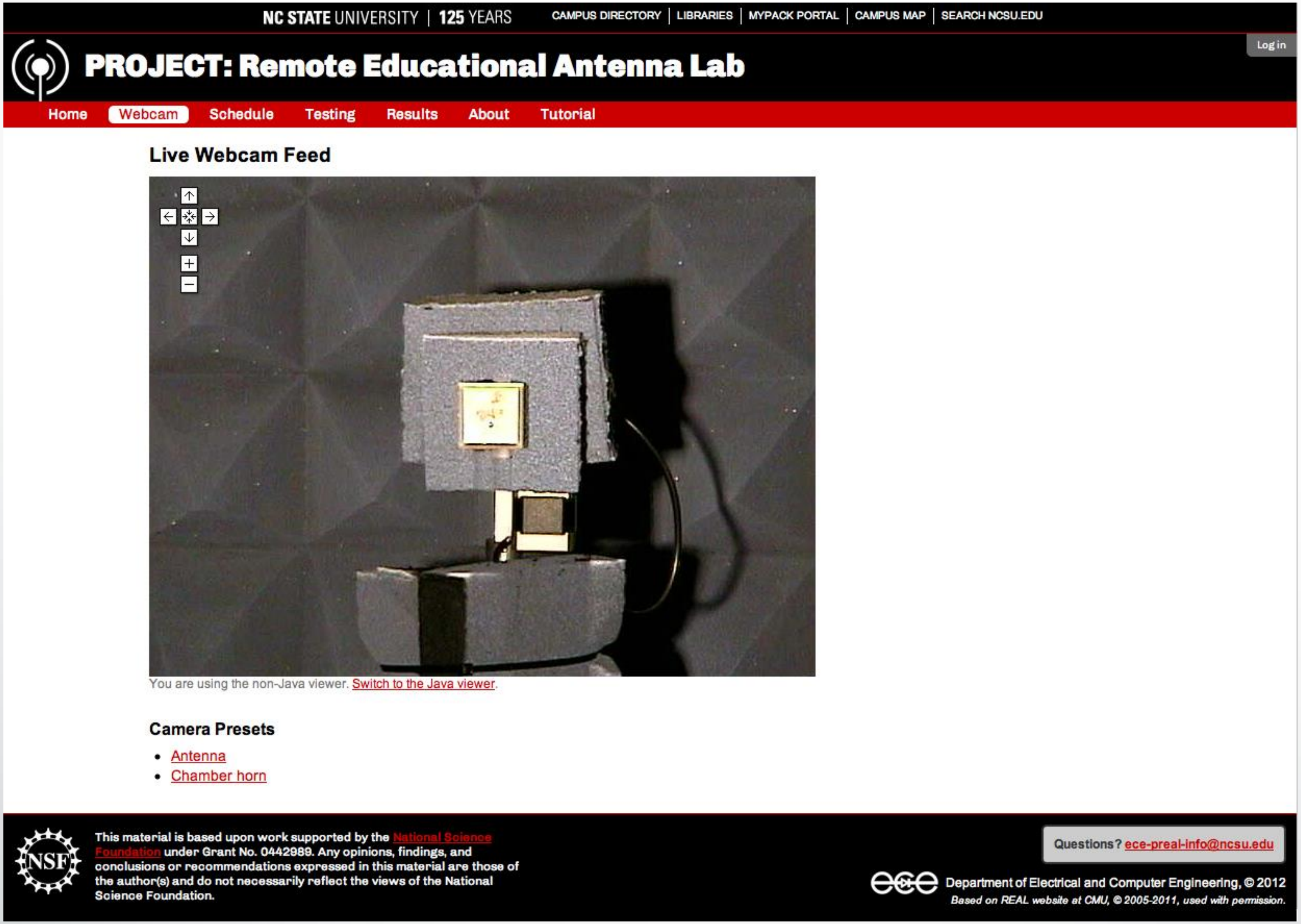
Usage Logistics

- Antennas fabricated at local institutions & time scheduled on facility
- Antennas shipped to NC State prior to scheduled time
- Antennas mounted in chamber by NC State student/technician
- Remote students take control of the chamber measurements & download results
- Antennas returned to students

REAL Facility Description (NC State)

- Rectangular chamber 10’x18’x10’
- Designed for -40 dB VSWR quiet zone above 2 GHz by Cuming Microwave
- Dual axes of rotation
- Instrumentation available to 18 GHz
- Presently configured for 0.7 to 6 GHz measurements
- Available measurements:
  - Impedance & Return Loss with frequency
  - Azimuth and Elevation patterns
  - Co- and Cross-polarization patterns
  - Gain by comparison with standard

Screen Capture from Webcam



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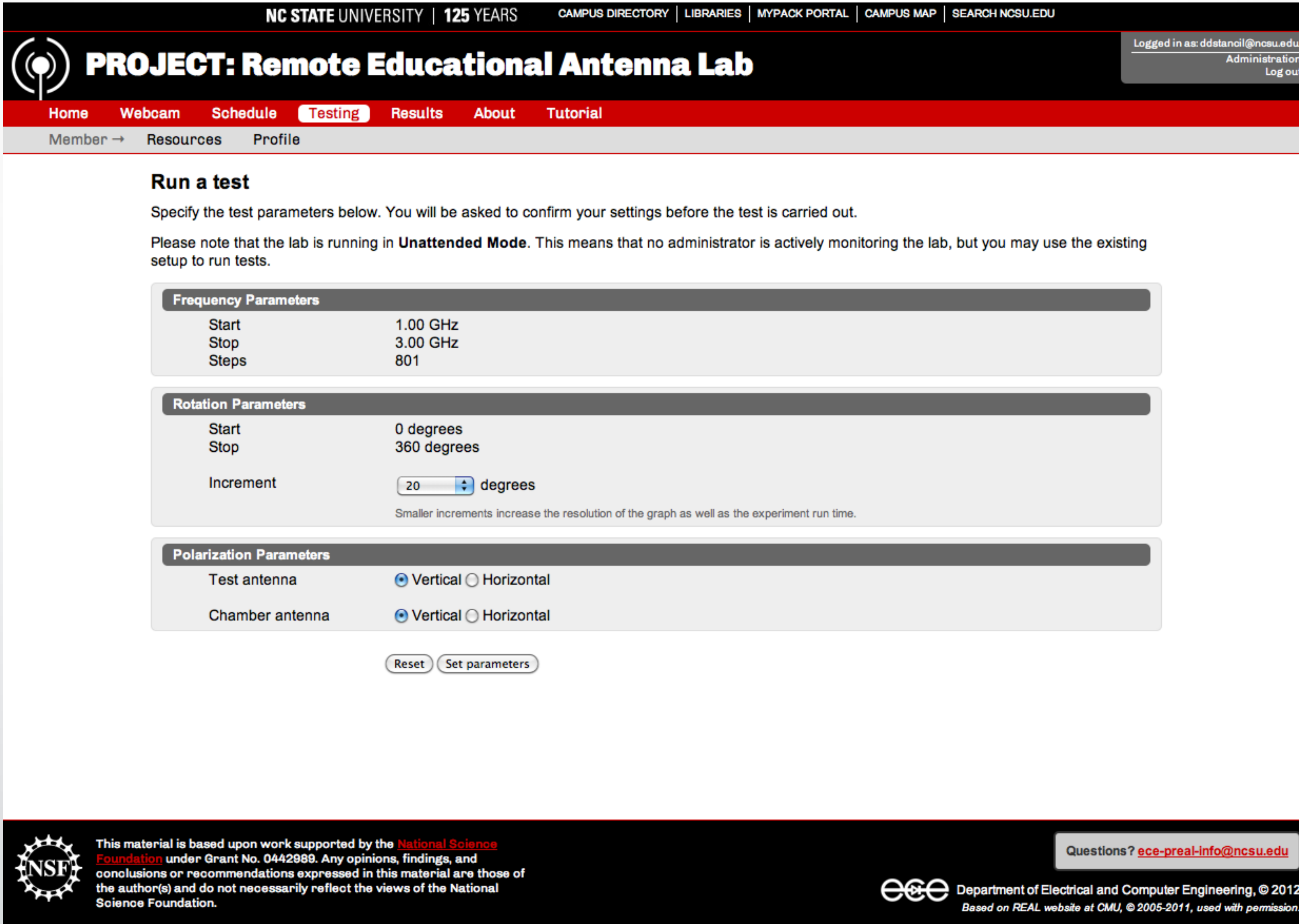
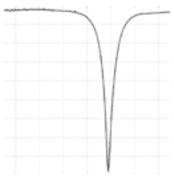
Measurement Interface



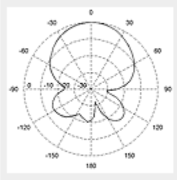
Results "Dashboard"

Plots

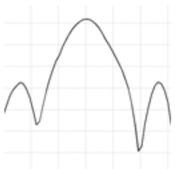
Reflection Coef.



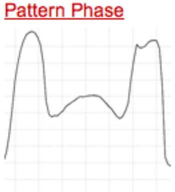
Polar Pattern



Rectangular Gain

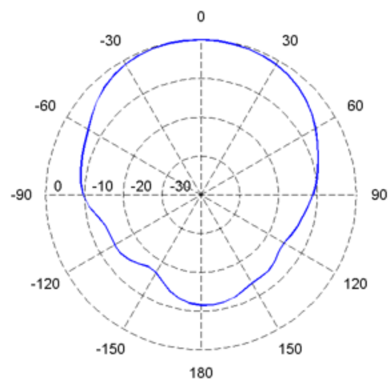


Pattern Phase



Reflection Coef.
Smith Chart

Antenna Pattern @2.3GHz



Adjustable Parameters

Frequency for Pattern Plots = 2.3 GHz Apply

Defined Parameters

Frequency Range
1.00–3.00 GHz

Rotation
0°–360°, 6° increments

Polarization
Test antenna: Vertical
Chamber antenna: Vertical

Metadata · Edit

Date
11/02/2012 at 6:14 PM

Actions

Delete Test
Deleting a test will remove all associated data sets, plots, and metadata.

Download data
Results can be downloaded in Matlab format. Use this file in conjunction with the antenna pattern plotting script to create your own plots using a local copy of MATLAB.

Experience

- CMU
  - Fall ’08, Ga Tech Satellite Comm course (Greg Durgin)
  - Spring ’09, CMU RF systems, WPI Intro to Antennas (Sergey Makarov)
- NCSU
  - Fall ’12, Ga Tech (Greg Durgin), NC State
  - Spring ’13, WPI (Sergey Makarov)

Student & Instructor Feedback ('08,'09)

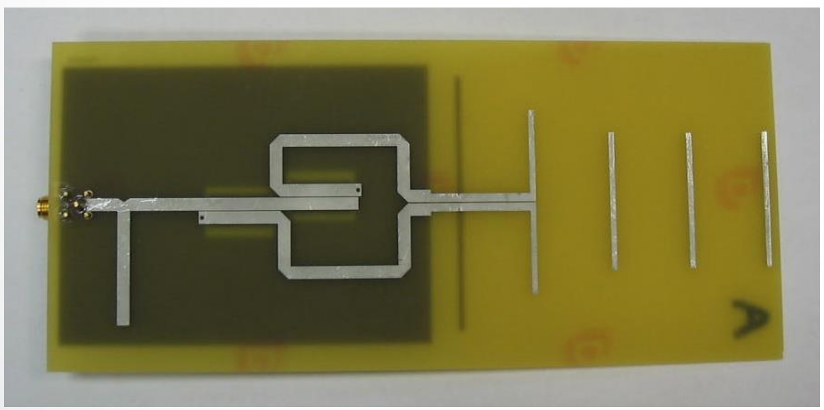
- Experience positive
  - Gained insight into difference between simulation and experiment
  - Provided a real-world experience into engineering design
  - Gained understanding of how antenna performance is measured
  - Gained appreciation for how manufacturing tolerances affected performance

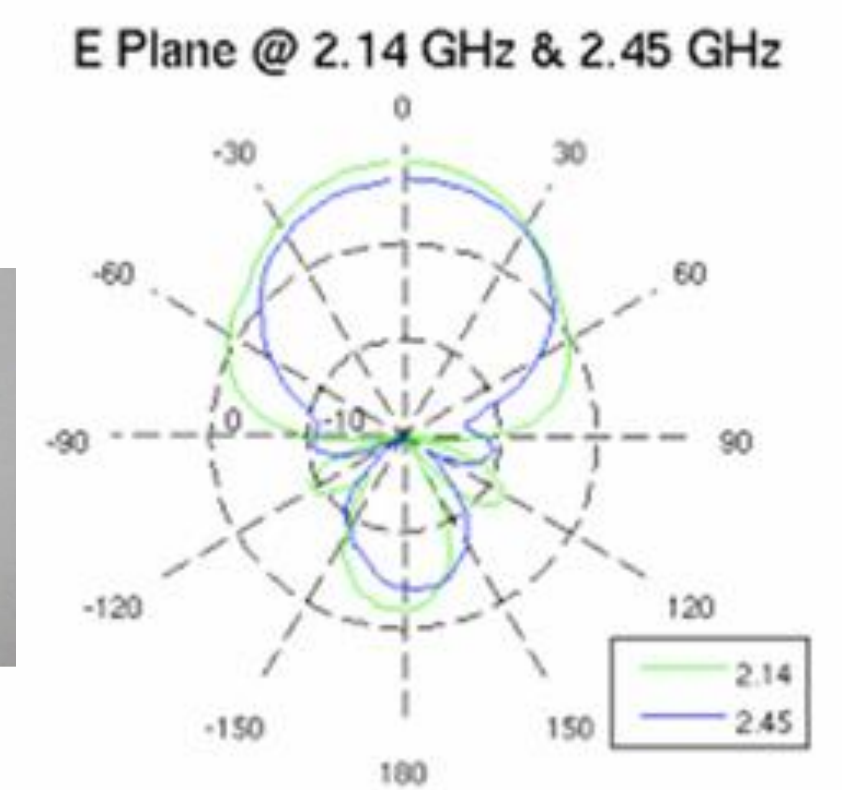
Summary

- Remote laboratories can provide real-world experience, increase use of facilities, and enable laboratory experience for distance ed
- Antennas can give practical spin on electromagnetics
- Remote Educational Antenna Laboratory operational at NC State
- Available for use by any university (as resources permit)
- For more information: http://research.ece.ncsu.edu/preal

Pattern from 5-element Printed Yagi-Uda

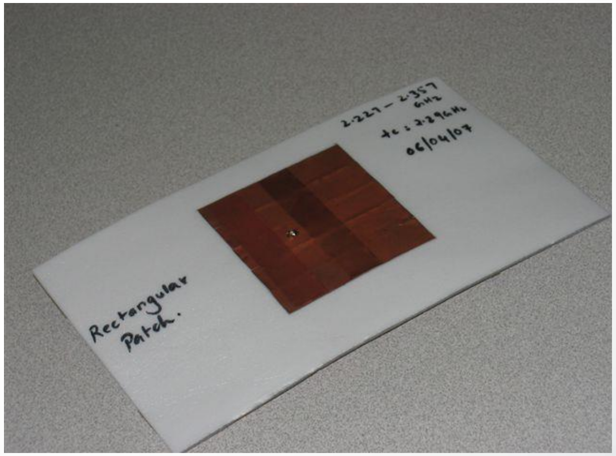
(N. Gist & L. Chikofsky, 18-513 F06)



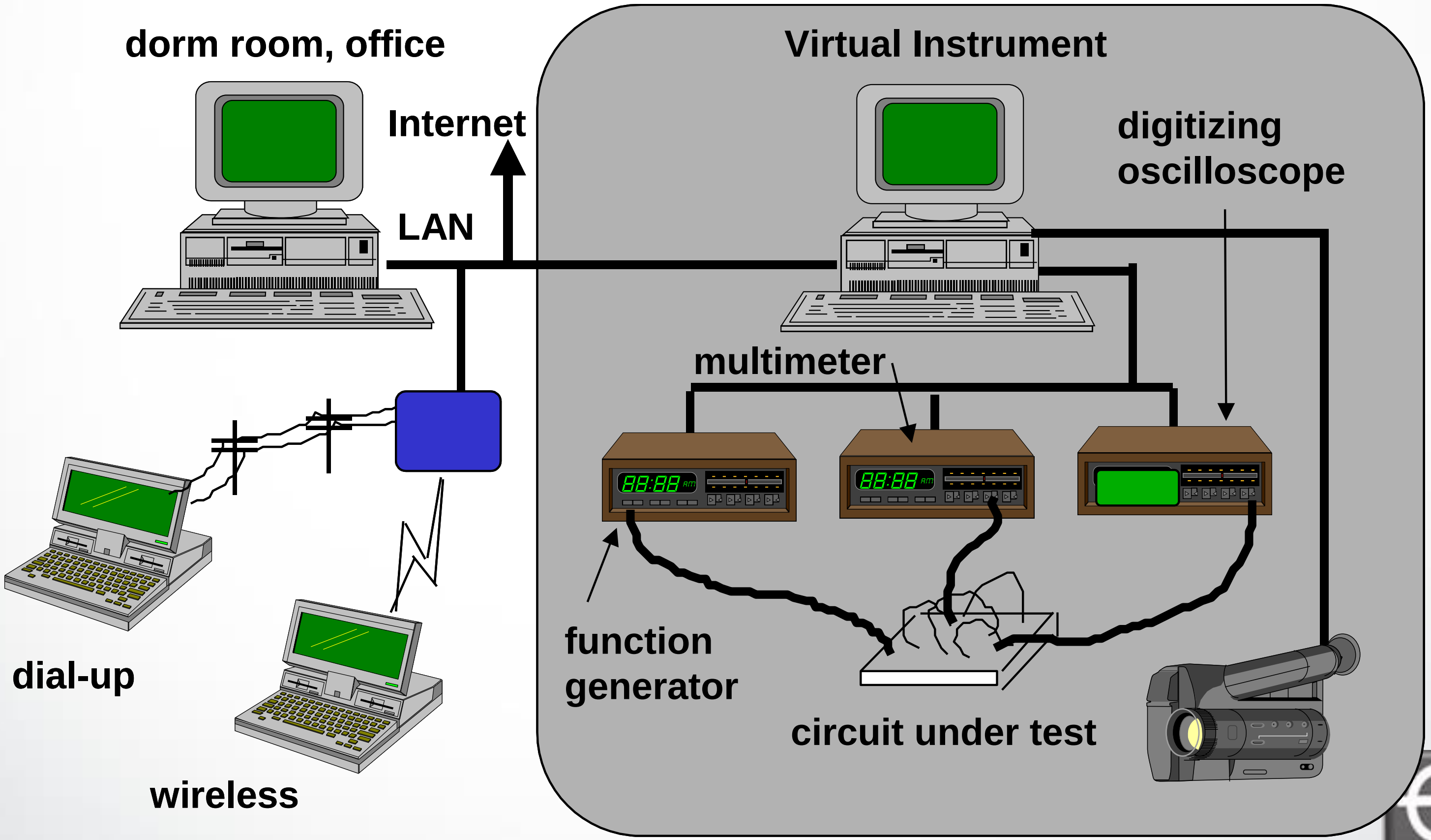


Antenna "Starter Kits"
(M. Gupta and S. Sharma, SDSU)

- Basic kit of parts to make simple antennas
- Includes instructions and example designs
- Available at low cost
- Example: simple patch

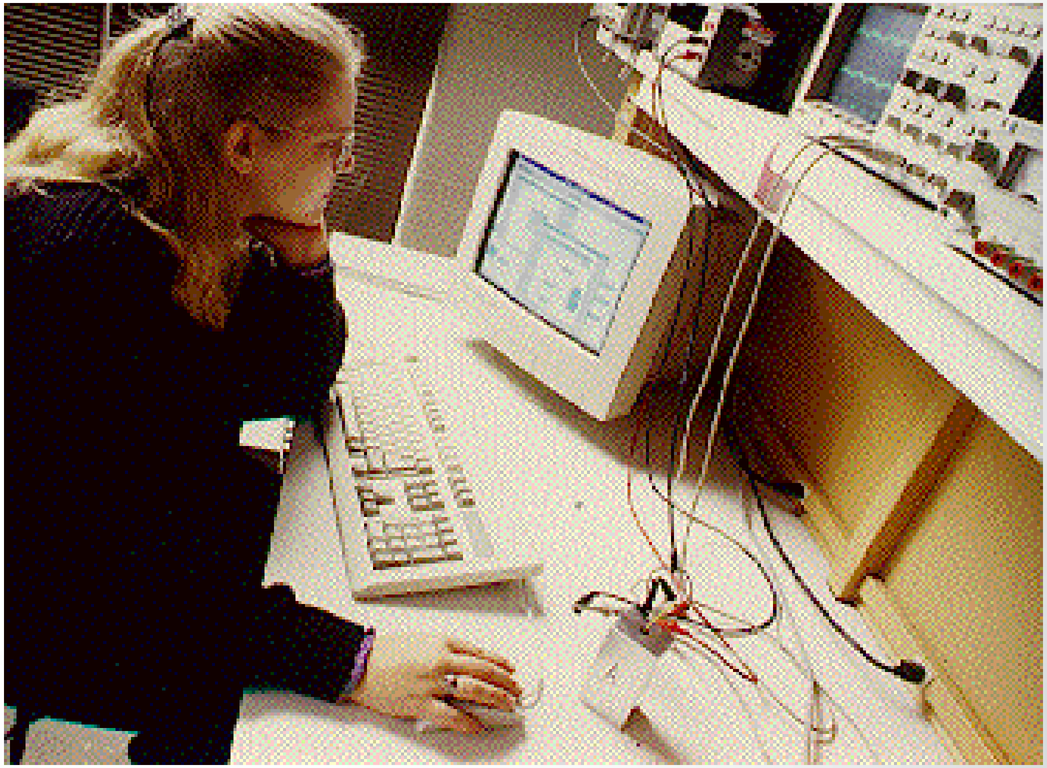


Early CMU Remote Lab (1994)

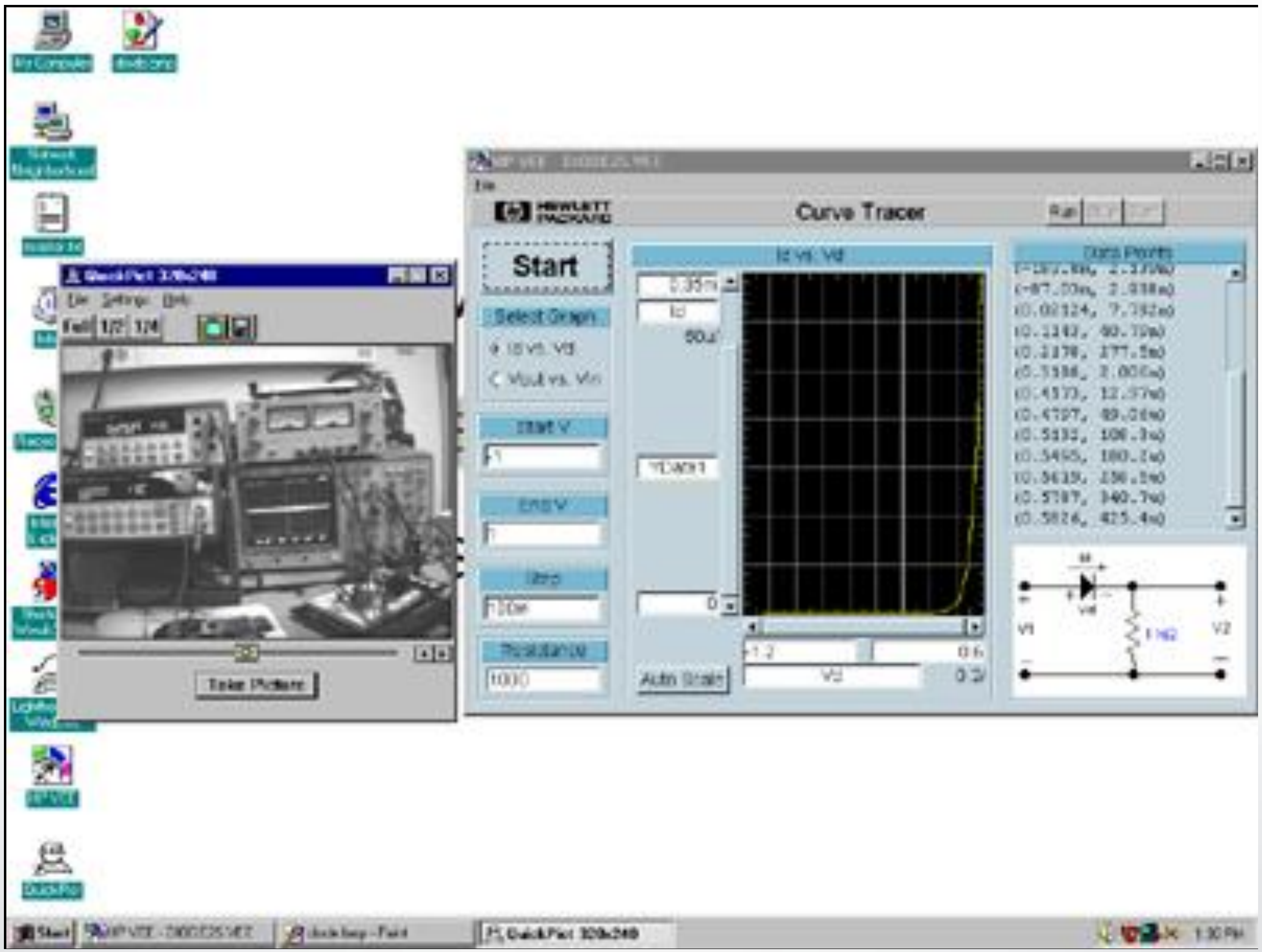


"Black Box" Lab (CMU, 1995-96)

- Failure has occurred in remote telemetry filter
- Students given correct schematic diagram
- Limited to electrical measurements at input and output ports
- Students must remotely diagnose component failure



Lecture Demo Example: Diode I-V Curve (CMU, 1999-2000)



Online
Communication Systems Lab
EEL 4990L

Developed and Taught by Prof. Stavros Georgokopoulos

Presenter: Shekhar Bhansali

Opportunity

- Online labs can be used to:
  - to teach courses by incorporating up-to-date software and hardware in order to improve students' education
  - to develop and use hardware and software experiments to integrate theory and practice
  - to prepare students for the work place by providing them with the required skill-set expected by their job-sites
  - to engage students through lab resources to pursue professional careers in engineering
  - to recruit and retain minority students in the field of engineering by providing a state-of-the art facility with design and measurement tools that parallel the ones in industry

Advantages

- Online labs utilize University resources efficiently as they:
  - Do not require large rooms to accommodate a large number of students
  - Hardware experiments can be simultaneously conducted by a large number of students that access the experiments through the Internet
  - Provide flexibility to students

What it allowed us to do?

- Students are able to access the laboratory and perform their experiments from any remote location using the Internet without time restrictions
- Students have flexibility on conducting experiments at their own pace
- Students can repeat experiments in order to enhance their understanding
- Students can understand better course material by being engaged hardware experiments that integrate theory and practice
- Students become more excited and interested in the field of communications by working with realistic testbeds

What are the challenges you are encountering?

- Currently, students are not familiar with online labs, such as, EEL4990L
- EEL4990L is a new lab and needs to be advertized and explained to students so that more students register for this lab

What is it allowing students to learn?

- The course material on Communication Systems is reinforced through the online experiments
- Students enhance their understanding on principles, such as, spectrum, modulation, demodulation, and detection
- Students learn the types and format of real measurement data

What are the shortcomings?

- Online labs do not offer “touch & feel” experiences to the students as students cannot actually touch the instrument buttons and physically make changes to the experiment
- Online labs do not provide rich teamwork experiences as traditional labs do