Flexible Physics Mobile – Videos bridging lecture and lab for physics higher education

YouTube Channel: Flexible Physics UW Madison, Website: flexible.physics.wisc.edu

Flexible Physics

- The Flexible Physics (2011-12) and Flexible Physics Mobile (2013-14) projects at UW-Madison created video-based educational objects bridging lecture and lab for high enrollment introductory courses in physics including calculus and algebra general physics, and physics in the arts.

- Switching from Flash-based products on a departmental server to YouTube deployed videos has enabled access for mobile devices while preserving accessibility. Best practices and improvement in learning outcomes will be described.

Video-based learning objects for physics: 2011-2012

THE PROJECT

flexible.physics.wisc.edu

The goal of the "Flexible Physics for the Google World" project is to create video-based learning objects to help prepare students and TAs for physics labs.

This project is sponsored by the Office of the Vice Provost for Teaching & Learning, with contributions from the Libraries, the Division of Information Technology (DoIT), the Division of Student Life, the Office of the CIO, the Vice Chancellor of Administration, and the Provost.

Read more about the project.

Support from UW-Madison Education Innovation program

2011-12 Products

Phys 104: 2nd semester non-calculus physics for biologists, 550 students

Phys 208: 2nd semester calculus physics for biologists, 300 students

VIDEOS FOR PHYSICS 104

E1: Static Electricity
E2: Electric Fields and Potential
E3: Resistor Circuits and Meters
E6: Magnetic Fields and Forces
E5: Magnetic Induction
E4: Magnetic Force on a Charged Particle
L2: Finding Focal Lengths
LC1: Interference and Diffraction
LC4: The Photoelectric Effect

Note to 104 Students: The Balmer Series lab is done online here.

LC5: The Balmer Series
MPC1: Radioactive Decay

VIDEOS FOR PHYSICS 208

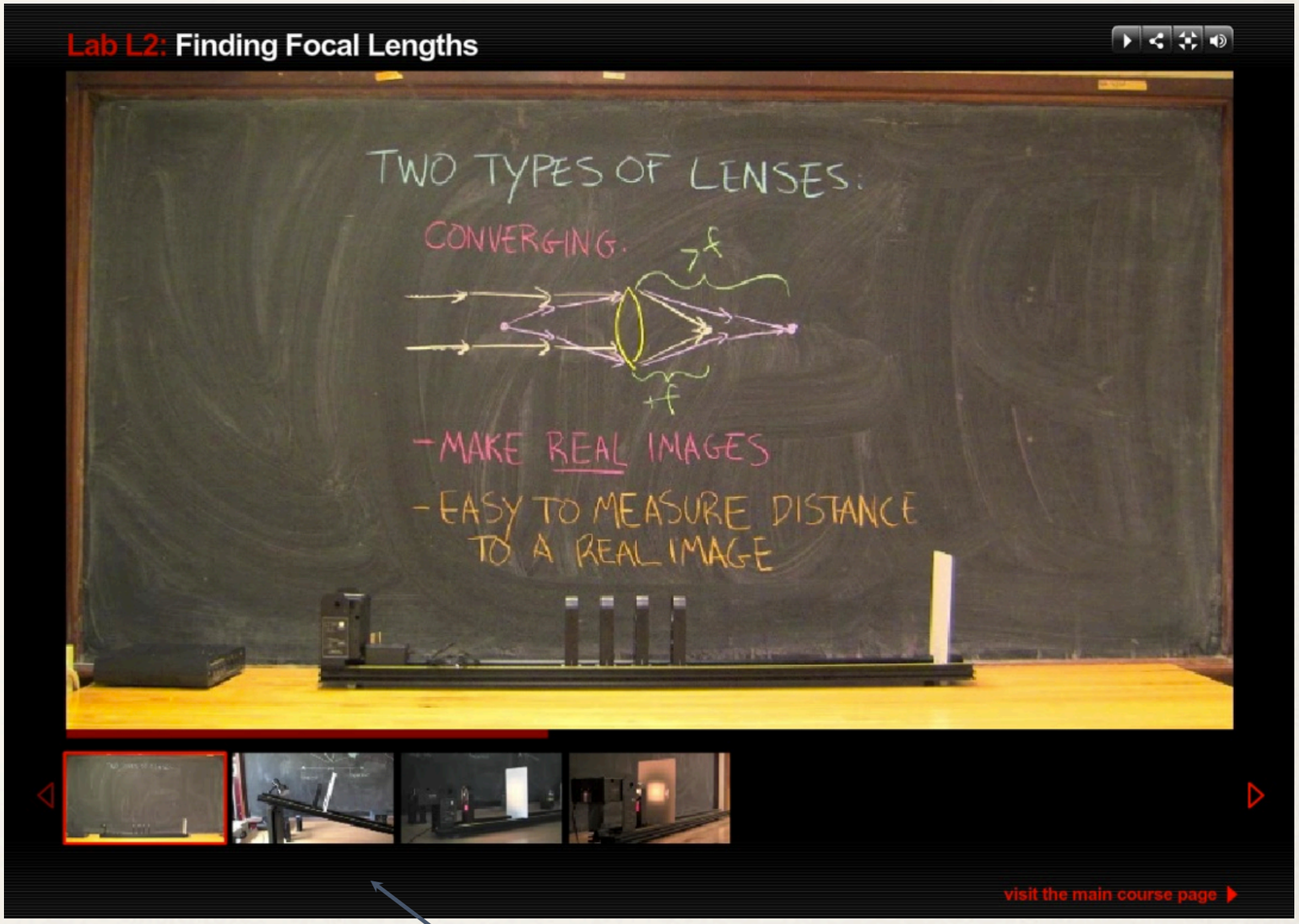
R1: Interference and Diffraction
R2: Lenses and the Eye
R4: Electric Fields and Electric Potentials
R5: Capacitor Circuits and Resistor Circuits
R6: Resistor-Capacitor Circuits
R7: Magnetic Fields and Forces
R8: Time-varying Magnetic Fields and the Faraday Effect
R9: Polarization of Light
R10: Spectroscopy and the Hydrogen Atom

TA TRAINING VIDEOS

S1: String Lab
L2: Lenses
M3: Balance Lab
M9: Angular Acceleration of a Flywheel

Some best practices

- A typical video begins with a short review of concepts.
- We used still photos of a blackboard in the lab, and added a voice over.
- This technique is simple and engaging. It avoids distracting talking heads and associated staging, and the product is easily modified.



A flash navigational menu.

Core best practice: show the actual equipment!

- The remainder of the video introduces the laboratory environment and the actual equipment in a light fashion. Video clips are assembled with a voice over. It is relatively easy to edit and modify and reuse these segments also..
- Show and tell. 5 min max!
- The goal is to help the student to feel comfortable in the lab and to feel prepared to tackle the actual structured laboratory exercises.

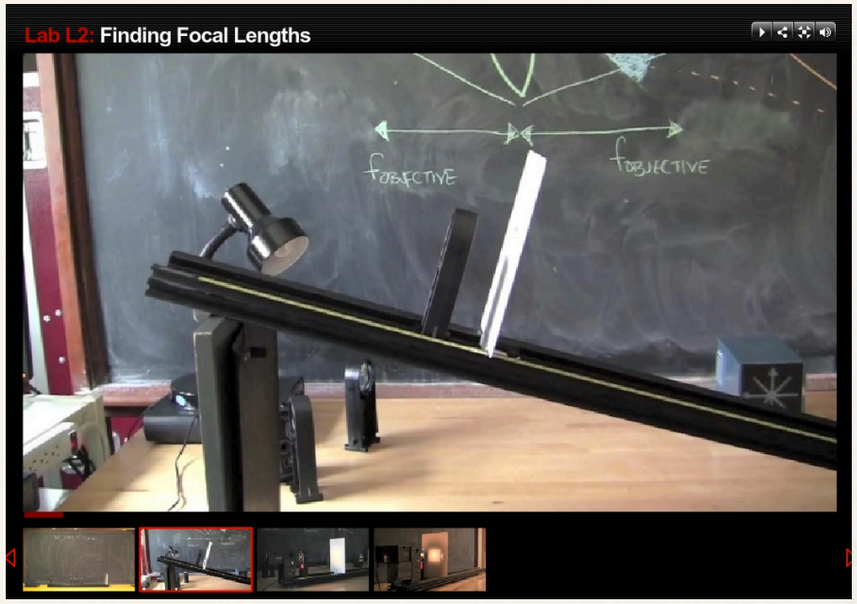


Image of a nearby building

Interactivity

See website to try it.

INTERACTIVITY

We are interested in creating interactive learning objects that engage students as they prepare for lab. To this end, we have created and tested some Flash activities designed to get students manipulating lab equipment even before they get to the lab room.
Check out an example.

This interactive element was programmed with Flash technology.

A small interactive element, e.g. dialing the video to observe the effect of a polarization filter, brings the student even closer to the lab experience.

Accessibility

ACCESSIBILITY AND USABILITY

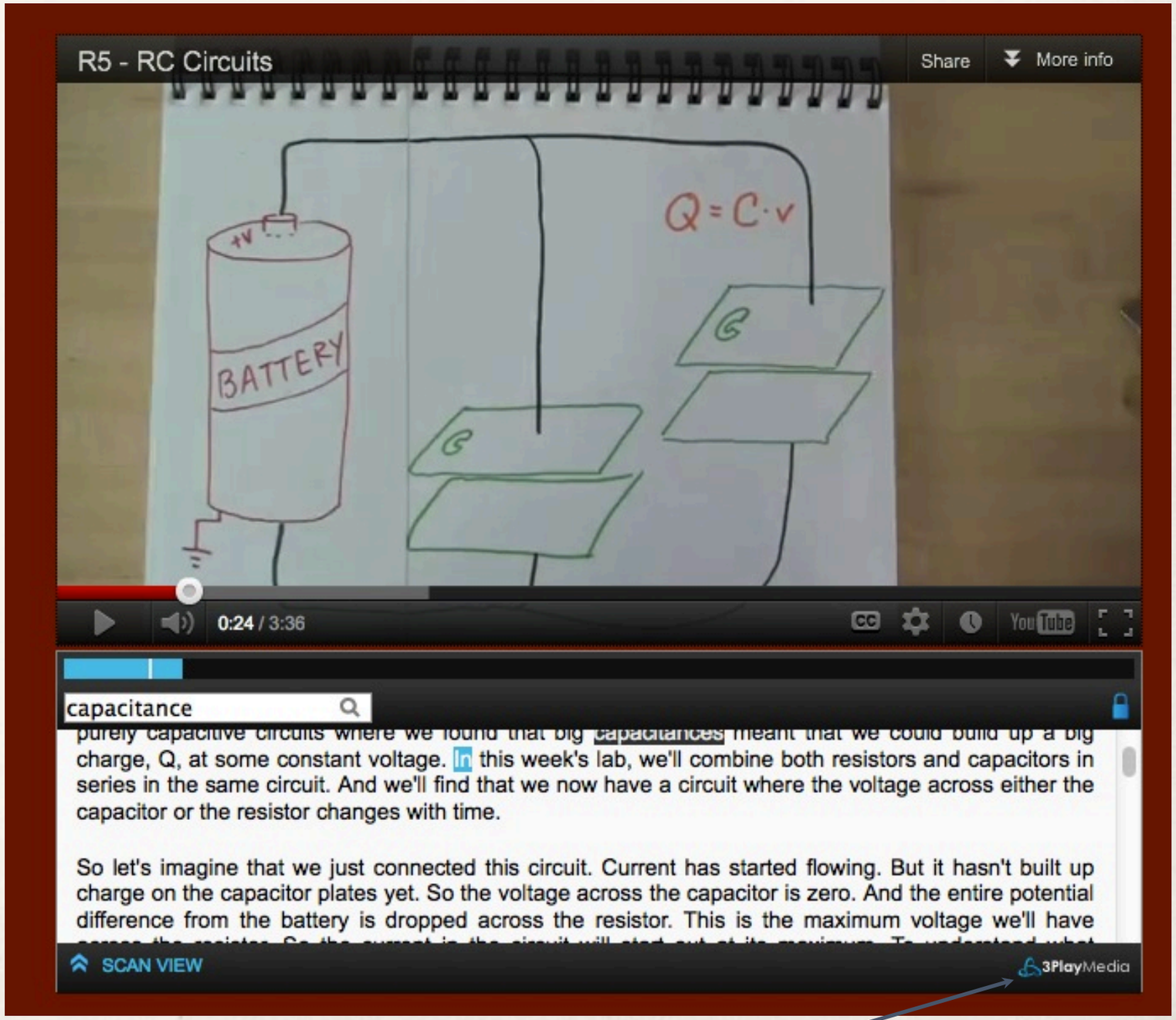
We are currently working on making the lab videos and website accessible to as many students as possible. This will ulitimately involve closed-captioning and audio description tracks, and making the site and embedded Flash objects tabbable. We're exploring the use of interactive transcripts in making the videos most usable to students. Check out an interactive transcript demo!

Accessibility is mandated by federal law. Are your labs and lab materials accessible?

Accessibility: Closed captions, easy consistent interface, easy to find.

Transcripts from 3Play

- The transcript of the audio component of a video can be automatically generated and rendered searchable and clickable!
- Active transcripts are a great navigation tool for both the “advantaged” and “disadvantaged” viewer.
- Accessibility is for everyone.
- Seek advice!!



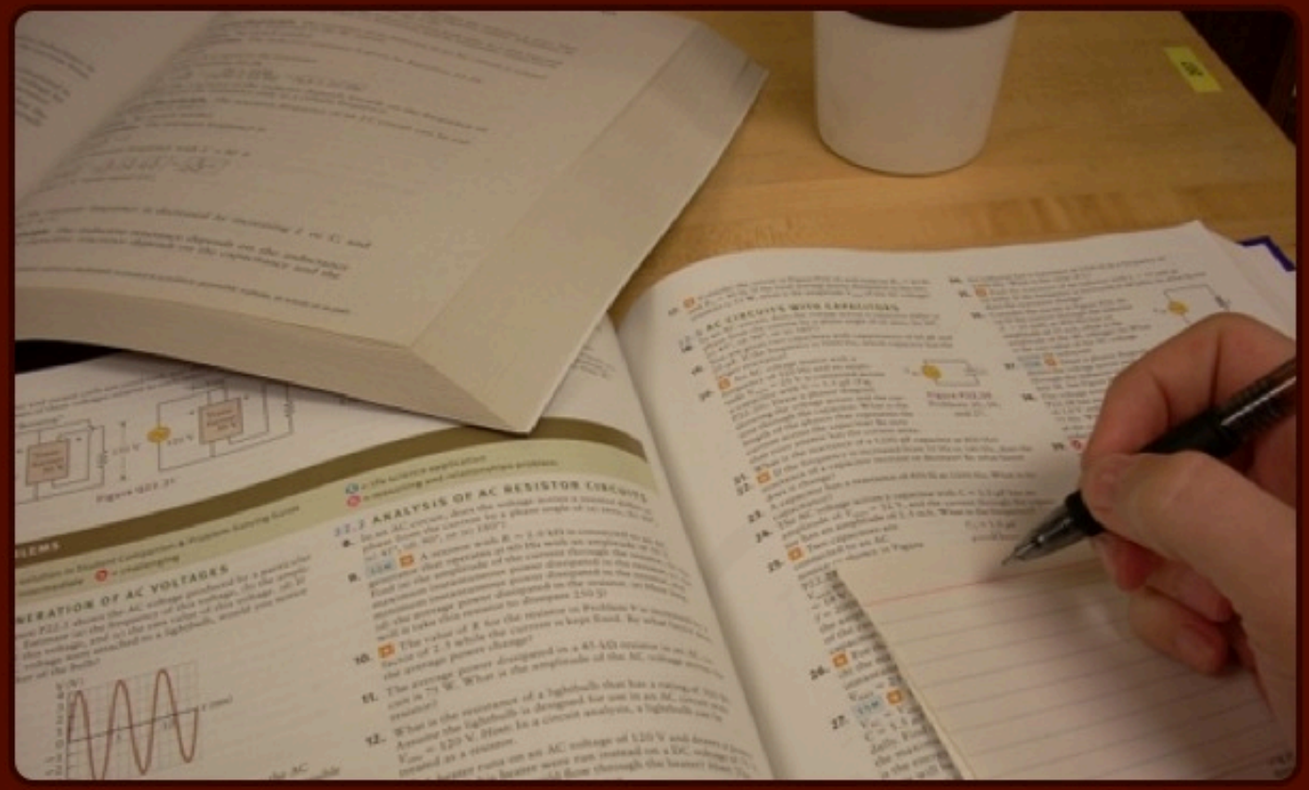
Outcomes

OUTCOMES

Initial assessment of our videos will focus on these questions: did the students feel more prepared, after watching each video, as they began each lab? Did they feel that the videos helped them understand the purpose of each lab? And, at the end of the semester, are they less likely to say "labs are not connected to lecture"?

The bulk of our assessment will be done by questionnaire throughout the Spring 2012 semester. The first semester student response was overwhelmingly positive-- exciting results for us!

Read more on assessment methods and outcomes.



- Survey results and hit counts indicated that students found Flexible Physics materials quite valuable. We touched hundreds of students with each video just while producing them.

Logistics

- Flexible Physics was a team effort.
- Video and still camera equipment and advice was provided by the two members of the Learning Support Services group at UW-Madison.
- A MacBook with iMovie and Youtube suffices though we settled on Flash and our own department server for deployment. (HTML5 may be a better choice now.)
- A Division of Information and Technology services liaison connected the group to advisors in library services, campus experts in accessibility and assessment, and legal services.
- Introductory physics lab staff provided assistance with setup and insights into pedagogy. They concurrently created some TA-focused training videos.
- The principle creative was a masters level student in physics and an experienced teaching assistant. She served simultaneously as an instructor in two laboratory sections (to be closely connected to student concerns) while experimenting with styles and technologies, ultimately settling into a production mode of operation.
- Biweekly meetings served to confront significant issues of style, technology, cost, accessibility, and assessment.

People

- Duncan Carlsmith is Full Professor with the Department of Physics at the University of Wisconsin-Madison and the principal investigator of the Flexible Physics for the Google World project. Carlsmith teaches introductory, intermediate, and advanced courses in physics and he is interested in advancing the use of technology in physics education. Professor Carlsmith's research area is high energy particle physics. He is a member of the CDF collaboration at Fermilab and of the CMS collaboration at CERN.

- Lisa Hardy** is Teaching Assistant for the University of Wisconsin-Madison Department of Physics and a Faculty Assistant supported by the Flexible Physics Project. She holds a Master of Science in Physics from University of Wisconsin-Madison. Ms Hardy is interested in educational technology development, including the use of video and interactive environments.

- Blaire Bundy is Senior Learning Technology Consultant for the Division of Information Technology at the University of Wisconsin-Madison. Mr. Bundy provided oversight of the Flexible Physics project and access to expertise on campus in the areas of learning assessment, accessibility, and copyright. Blaire works with a team of teaching and consulting specialists (TAC), to provide planning and guidance for faculty and staff looking to integrate technology into their instruction.

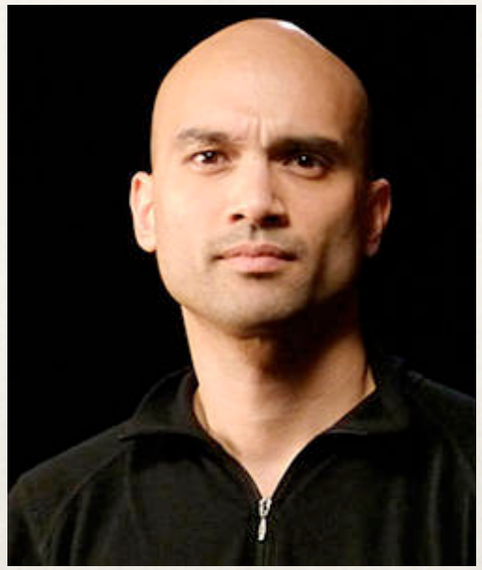
- Jonathan Klein is Instructional Technology Consultant with the University of Wisconsin-Madison L&S Learning Support Services group. Jonathan works on a variety of learning technology projects for Learning Support Services and specializes in digital media and video production.

- David Macasaet is Media Production Consultant with the University of Wisconsin-Madison L&S Learning Support Services group. Mr Macasaet works with all things video and assists faculty and instructional staff in the College of Letters and Science in integrating audio and video into their coursework.

- Jim Reardon is Director of Instructional Laboratories for the University of Wisconsin-Madison Department of Physics. Jim provides teaching assistant training and oversees instruction and scheduling for Physics 103, Physics 104, Physics 201, Physics 202, Physics 207, Physics 208, Physics 247, Physics 248, Physics 207, Physics 308, Physics 321, Physics 407, Physics 408, and Physics 621.

- Brett Unks is Instructional Laboratory Manager for the University of Wisconsin-Madison Department of Physics. Mr Unks manages laboratory equipment for Physics 103, Physics 104, Physics 201, Physics 202, Physics 207, Physics 208, Physics 247, Physics 248, Physics 207, Physics 308, Physics 321, Physics 407, Physics 408, and Physics 621.

**Now pursuing PhD in Ed. Tech. at UC Davis.



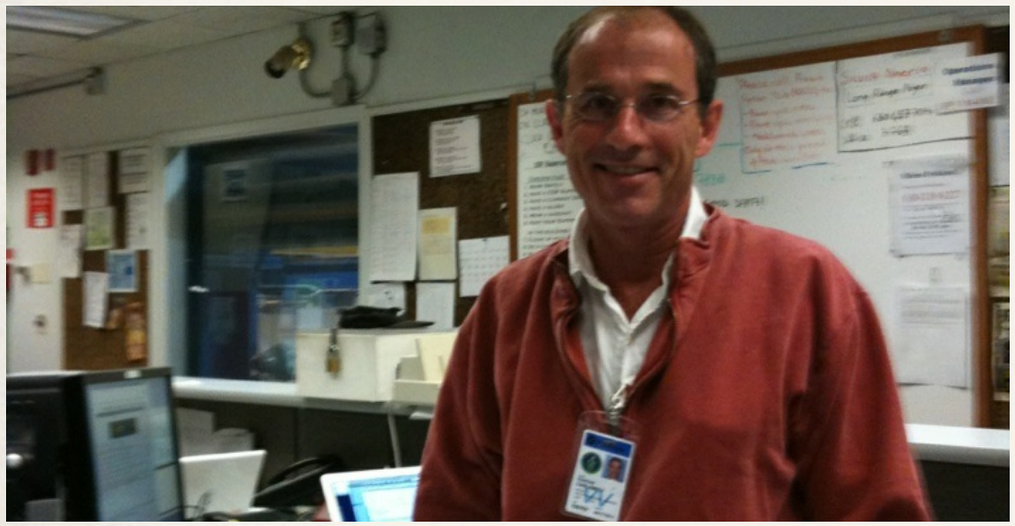
Flexible Physics Mobile:2013-14

- The Flexible Physics project resumed in 2013-14 with support from the UW-Madison Education Innovation program (edinnovation.wisc.edu/).

- Goal: Create educational objects viewable on mobile devices (Flash was deprecated!), remaking archive for Physics 104 (2^{nd} sem. Algebra physics) and Physics 208 (2^{nd} sem. calculus physics for Engineers) and extending the archive to cover the 1^{st} semester Physics 103 and Physics 207 of both course sequences.

- Logistics: Follow previous model using teaching assistants working part-time in the teaching labs and part-time in product development.

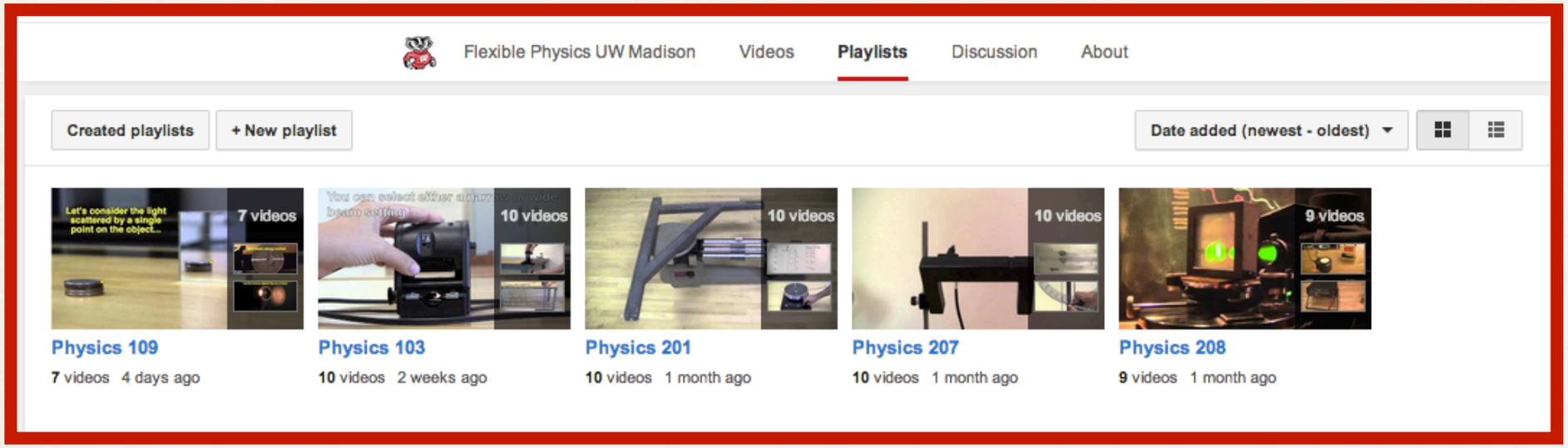
People



Prof. Duncan Carlsmith

Teaching Assistants: Aditya Singh, Lauren Wielgus

YouTube



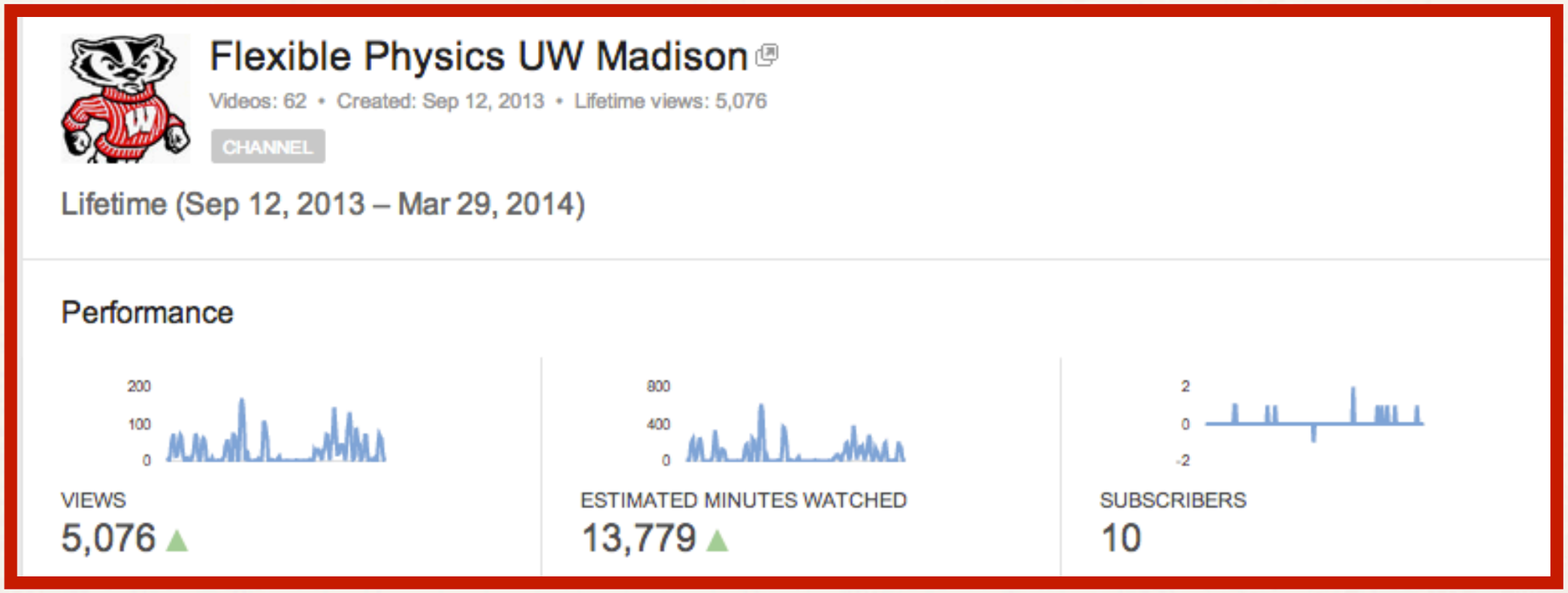
- We chose to redeploy all videos on YouTube: **http://www.youtube.com/user/flxblphy**
- YouTube is well known to students and viewable on mobile devices (tablets, smart phones) via browser or native mobile apps.
- Significantly, YouTube now provides close captioning, and analytics.
- YouTube is free!

Accomplishments 2013-14

We covered ALL of our high enrollment introductory classes and more.

- Physics 104, Physics 208 – all video materials repurposed and redeployed
- Physics 103, Physics 207 – all labs covered
- Physics 201, Physics 202 – all labs covered (much overlap with 201-2)
- Physics 109 – all labs covered by end of Spring 2014
- Experiments with 3d-model creation, physics demonstration video production, and video-based “e-lab.”

YouTube Analytics



- YouTube provides data on device type, total minutes watched, and details of which parts of the video were watched.

Views and devices

- Number of views: The average number of views in Physics 103 Fall 2013 was 658/video and the enrollment was 650. The average number in Physics 207 was about 90% of the 250 students. The late term video Physics 103, Lab HC-3: Latent Heat of Liquid Nitrogen, duration 4:07, received 498 views and 1638 minutes estimated watch time after release, with an 80% average view duration.

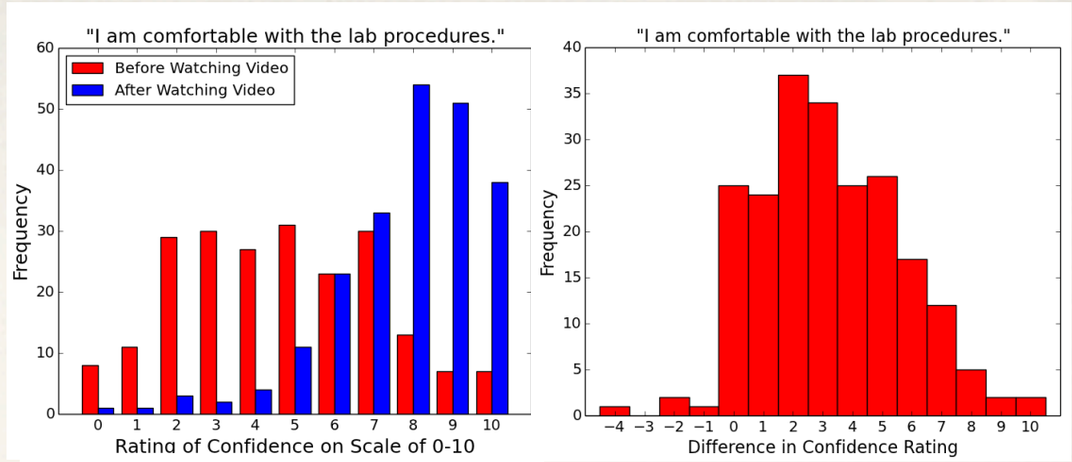
- Device type: 95% of students viewed the Physics 103 and Physics 207 products on laptops as opposed to smart phones or tablets. In Physics 109, 25% of students used mobile devices.

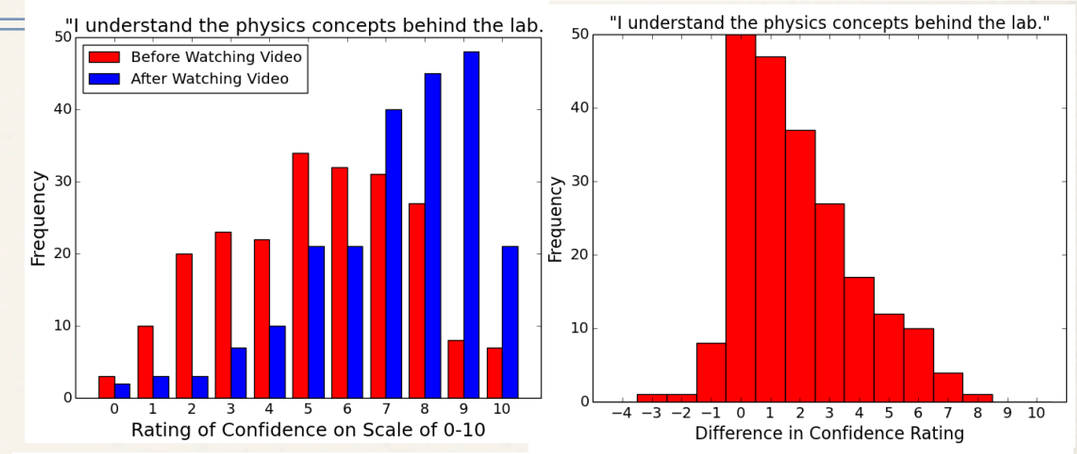
- Hypothesis: Students prefer to use a device with a screen larger than a smart phone (iPhone, Android) to watch videos. Mobile device use is also be increasing generally.

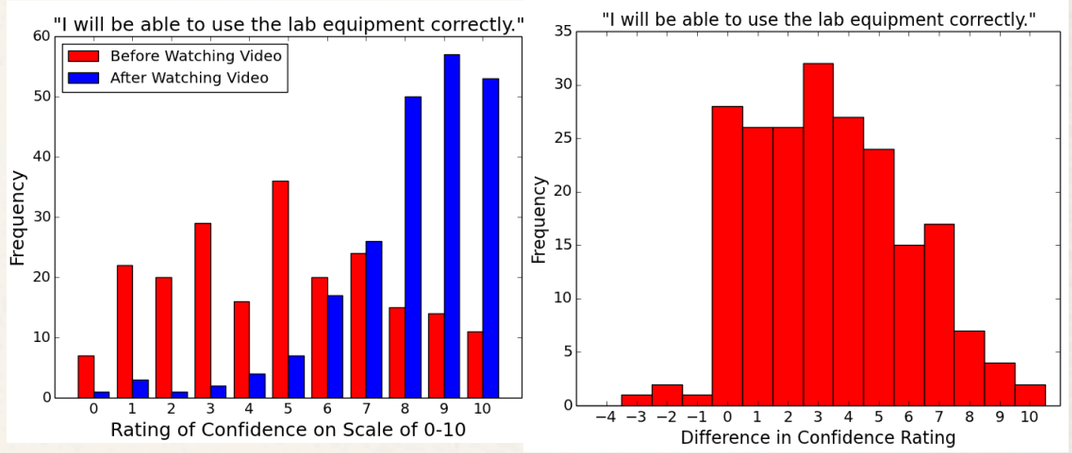
Survey results

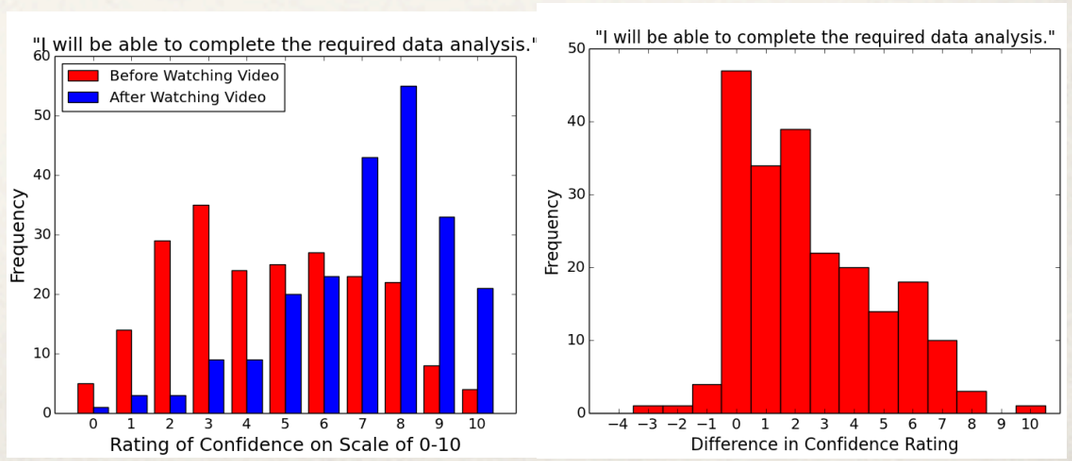
- We surveyed the Physics 103 class at the end of the fall 2013 semester. We received 260 responses. Students were asked to rate their confidence level on 4 statements on a scale of 0-10 before and after watching the videos.

- Students are more comfortable with lab procedures, concepts, equipment, and data analysis and generally better prepared for their laboratory experience.









Conclusion

- Video-based educational objects are a useful bridge between lecture and laboratory for introductory level courses in physics.

- Consumer grade technology makes the production of such products within reach of anyone willing to devote the time and effort to produce and deploy them.

- Feel free to contact any of our team members for assistance. See website for contact information.

- Thank you for your attention.