

Dorm Room Labs for Large Lecture Courses

Mark B. Moldwin

University of Michigan

mmoldwin@umich.edu



ATMOSPHERIC, OCEANIC AND SPACE SCIENCES

UNIVERSITY of MICHIGAN ■ COLLEGE of ENGINEERING

Abstract

Many large lecture introductory space science courses do not have a lab component. At UCLA and the University of Michigan (UM), I have developed a set of Dorm Room Labs that students conduct as homework (or dormwork) to explore more deeply concepts covered in an Introduction to Space Weather or Intro to Rocket Science course. The concepts are relevant for any general physics or space science course. Using qualitative research methods, I have found that these dorm room experiments have meaningful impact on enabling students to develop conceptual understanding of several important science and space physics topics. These include the structure of dipole magnetic fields, conducting a simple experiment controlling for a single variable at a time, understanding how sunspots help measure the rotation rate of the Sun, and the role of spectroscopy in determining the composition of the Sun. Both UCLA and UM offer faculty teaching mini-grants of about \$500 per course that enables the purchase of Dorm Room Lab kits for classes of well over 100 students.

Background

Many Universities offer 101-type Introduction to Space Science and Engineering Courses (often the Astronomy 101) for non-science majors that satisfy a science breadth requirement

Opportunity for Space and Engineering Faculty to contribute to department teaching needs AND introduce Space Physics to a broader audience

Many students are math and science-phobic and have not had positive science experiences in High School or other introductory science courses.

Motivation

Due to resource constraints, many large lecture 101-type courses do not have lab components

So how do you give students "hands-on" science and engineering experiences to help with conceptual understanding of not only the topic, but what science is all about?

Example Dorm Room Labs

A set of simple experiments that students can do in their dorm rooms.

Dipole Magnetic Field Mapping
Spectroscopy
Paper Rocket Launching
Solar Sunspot Observing
UV Beads



Sample Labs:
Spectroscopy Scavenger Hunt

Goal
Using the spectroscope find a list of elements on campus. Include looking at the reflected solar spectrum.

Soda Straw Rocket Lab:

Goal
To build and launch a soda straw rocket to determine the impact of nose cone length on distance traveled.

Assessing Impact on Learning

Qualitative studies using in class quiz and mid-terms

Ask conceptual question AFTER lecture/LectureTutorials/Peer Instruction, but before DormRoom Lab

Again after DormRoom Lab

Sample Questions:
How do we know that the Sun rotates?

Draw the shape of a magnetic dipole field

How do we know the Sun is made primarily of hydrogen?

Results

"Standard" distributions of correct answers ranging from mid- 60s to low-80s using active learning techniques

Over 90% correct answers after DormRoom Labs (essentially become gimme questions)

Also encourages creativity and photo/video documentation that some students really enjoy

Conclusions

DormRoom Labs bring hands-on "fun" into a traditional large lecture introductory class.

Low cost and supported by University

Positive impact on engagement and learning

References:
Moldwin, M.B., Dorm Room Labs for Introductory Space Science Courses, American Geophysical Union, Fall Meeting 2011, abstract #ED12B-04