

# Bring robust labs to online classes

A long time ago, there was a man named Eratosthenes. He knew that the high Summer Solstice Sun cast no shadow in Syene (site of present day Aswan, Egypt). At noon that same day of the year, he measured the length of a shadow cast by a pole standing in Alexandria. Using the widely known, and accurate for the time, 5000 stadia trade route distance between Syene and Alexandria, he calculated that the circumference of the Earth was about 250,000 stadia. This calculation was off by 15%. Not bad for Mr. Eratosthenes, especially considering that he published this work nearly 2260 years ago.

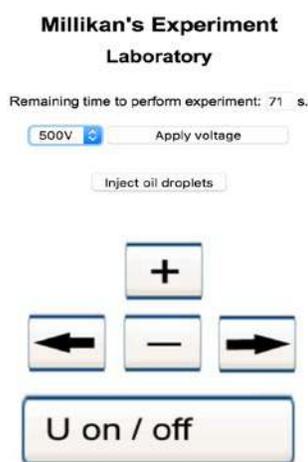
This brings us to teaching science lab based courses online. How does a student “download” a lab? How can we teach lab safety and foster an appreciation for the great works of past scientists? How can we assure that a student receives the same robust lab education that a face to face student studies?

We do this by selecting the appropriate lab activity suitable to online students which also lead to the attainment of your course learning objectives.

There is still the notion that lab science has to be taught in the traditional lab, but that argument begins to unravel when remotely controlled platforms like the Voyager spacecraft (now well out of our solar system), satellites, and even UAVs are taken into consideration. And thinking back to Eratosthenes, how could he possibly have contrived, nevermind conducted, his observations without the use of a traditional lab?

Today there is a rich and varied menu of laboratory offerings that satisfy curriculum demands and the needs of the online student. Let's take a look!

There are several well established lab supply vendors which provide ready made lab kits and instructional videos for biology, physics, chemistry, geology and more. The costs of these kits is on par with textbooks. Just providing students with equipment isn't enough, and won't replicate every traditional lab experience, but it's a start. Portions of your lab curriculum may very well be suited to measurements from home. In fact UAF's introductory course to Atmospheric Science (ATM 101x) makes extensive use of weather instruments to give students an opportunity to make observations in their home towns.



University of Munich Remotely Controlled Lab on Millikan's Experiment web interface.

Several online simulations present students with opportunities to study conditions and phenomena associated with difficult to experience in person situations. With simulations, students can safely observe the protection a sea wall offers against a tsunami or the time dilation in the vicinity of a black hole. The best simulations allow students to ask “What if?” questions and change environmental variables associated with their study.

Another approach to online lab offerings is to separate the lab curriculum from the course completely, and host a separate lab workshop that students attend sometime outside the spring/fall semester timeline.

Alternatives to the traditional lab setting are being used in several universities around the world and are part of many credentialed degree programs. In fact, we have a few exemplary courses taught right here at UAF. If you are interested in exploring these options for a class or program the instructional designers at UAF eLearning are ready to help.

## RESOURCES

[Remotely Controlled Laboratories at Ludwig Maximilian University of Munich](#)

[Behavioral Neuroscience Research Class at University of Alaska Fairbanks](#)

[Organic Chemistry Online at Colorado State University](#)

[Fisheries and Wildlife Sciences B.S. program at Oregon State University](#)

[Science lab kits from Hands-On Labs](#)

[Science kits from Carolina Distance Learning](#)

## REFERENCES

Cagiltay, N. E., Aydin, E., Aydin, C. C., Kara, A., & Alexandru, M. (2011). Seven principles of instructional content design for a remote laboratory: A case study on ERRL. *IEEE Transactions on Education*, 54(2), 320-327. doi:10.1109/TE.2010.205811

Gröber, S., Vetter, M., Eckert, B., & Jodl, H. J. (2007). Experimenting from a distance remotely controlled laboratory (RCL). *European Journal of Physics*, 28(3), S127.