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## Creating accessible spaces for experiential learning in an online environment: How to do the lab without being physically there.

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Hands-on experience in a science lab is crucial for science majors, especially for those pursuing a degree in physics as it forces the engagement of different levels of knowledge in decision-making (Millar, 1994). The switch to online learning due to the pandemic placed an Everest-sized challenge at our feet; how to satisfy the experiential learning outcomes of the program when students do not have access to the physical space and equipment while knowing that the type of laboratory experience affects gains and depth of learning (Bernhard, 2018).

The task brought together a collaboration between research and teaching faculty and technical staff, in order to create meaningful experiential learning opportunities for over a thousand stakeholders. The implemented solutions included the development of hardware and software, the creation of documentation and training procedures for teaching assistants, and designing of the support system for the students.

While at-home labs of various kinds have been successfully implemented at various institutions across North America the remote labs were a creative alternative developed by the physics teaching team at the University of Calgary. Students could log into a website and view a livestream of physical equipment located at the University, connect to the devices, and send commands that allowed them to make measurements in real-time. We used Arduinos and high-resolution cameras to actuate motors, read sensor data, and collect photographs of various digital and analog meters.

During this session we will briefly discuss all solutions we implemented, spending the most time on the remote laboratories, together with some data showing students' self-assessment of their learning. We will also share ideas of how, moving forward, the resources we have developed can be used to increase the accessibility to our courses for life-long learners of various backgrounds and to enhance outreach and recruitment efforts.

### Keyword-1

Remote Learning

### Keyword-2

Educational Labs

### Keyword-3

Arduinos

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