



# Multiview Distance Delivery of Undergraduate Physics Laboratory Experience

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Our lab curriculum implements the recommendations of the American Association of Physics Teachers<sup>1</sup> for the learning outcomes and emphasizes the proficiencies in


- *collecting, analyzing, and interpreting real data from personal observations,*
- *engineering and troubleshooting experiments, and*
- *using common test equipment in a range of standard laboratory measurements while being cognizant of device limitations.*

and practice of collaboration for assurance of quality and safety (workplace soft skills)


<sup>1</sup>AAPT Recommendations for the Undergraduate Physics Laboratory Curriculum 2014





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I found that the unprepared task to transform the hands-on learning outcomes to online interaction presented the opportunity

- *to demonstrate to the students how to work a real-life problem and*
- *to engage the students in the development and testing of the solution.*



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The online lab follows the steps as the students in the real lab:

1. Explanation of components, instructions for handling of instruments, and setup of experiment.
2. Qualitative testing of functionality of apparatus and measuring devices
3. Troubleshooting as necessary
4. New in online: optimization of the video captures
5. Operation of the experiment and collection of data.
6. Analysis and report by teams of 2-3 in breakout sessions.

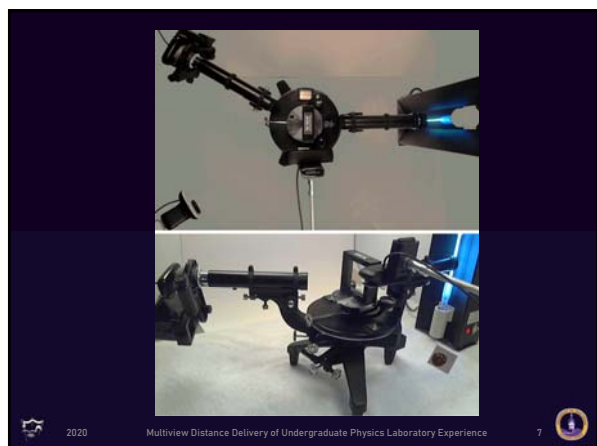
The students are encouraged to ask questions, to call attention to possible errors or oversights in my multitasking and make suggestions for possible enhancements of their experience.



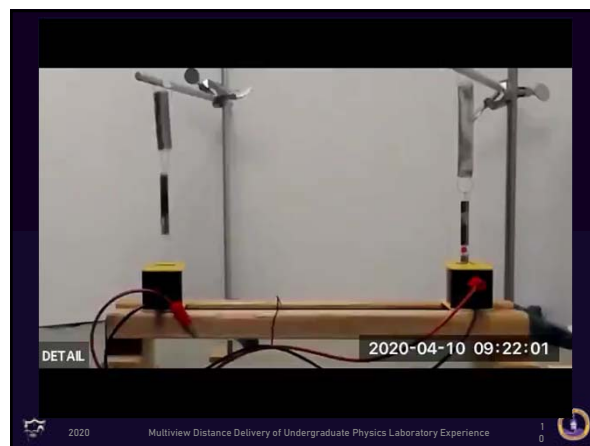
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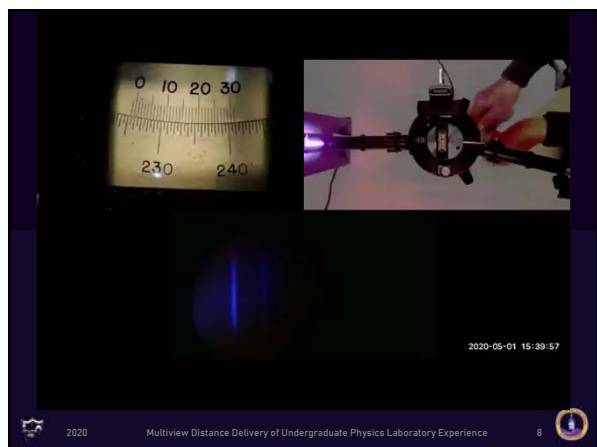
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The streaming of the experiments

- synchronizes the students in their observation and data collection and sets the class up to discuss and compare the results of the different teams; such coordination is usually not achievable in the real setting.
- eliminates the mistakes students make, that so often create valuable teaching moments

Students made good use of the team breakout sessions for analyzing the results and preparing the collaborative report. In fact the screen sharing feature forced them to work together in the same spreadsheet, which usually didnt do on campus', but now came to like it.

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Students acknowledged that we had not only managed the crisis but also learned a lot.

This success would not have been possible without the cooperation of the students in the working relationship that we had established during the labs on campus before.

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As it seems that hygienic distancing is going stay for a while, I am looking for ways to engage students in experiments who have never touched an instrument in a physics lab.

A major obstacle is that the technical multitasking in the streaming compromises the natural interaction with the students.

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Plan:

Streaming of the experiment only within the traditional small groups with one of the group members as the operator in the lab with the instructor on campus.

This way each student acquires hands-on lab experience and practices peer instruction on campus twice or three times during the semester, and in the process develops video capture and streaming skills.

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