

Even better than the real thing? Improving remote access undergraduate experiments

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1. Continued uptake in remote access teaching labs

Monash University has recently introduced online monitoring and control to its senior physics laboratory, reflecting ongoing interest in undergrad online labs in Australia and overseas [1]. Stretching back to the beginning of the internet [2]. This interest in remote access is reflected in professional experimental practice in fields as diverse as synchrotron protein crystallography, optical telescopes, and nanofabrication.

Despite reflecting professional practice, remote access is often seen as a (poor) substitute for the ‘real thing’, to be used when circumstances preclude it: dangerous equipment (e.g. radioactivity), lack of resources (e.g. demonstrator hours) or geography (distance education). However, the traditional hands-on approach, where students work in pairs with limited access to the lab is itself far from ideal. For example, students often work in pairs to satisfy both teamwork ILOs and resource constraints.

2. Not as good as ‘the real thing’?

Online access to equipment offers an opportunity overcome the constraints of tradition, and (arguably) provide a better experience than the ‘real thing’. Current undergraduate student experience of La Trobe university’s remote labs [3] over several years has provided anecdotal evidence that some students prefer labs with an online component. Advantages cited include flexibility of access (e.g. through smartphones), greatly increased access time, and the opportunity to work alone

However, to engage meaningfully, students need to be comfortable with the abstraction of the online interface. Online access may be better suited to experienced experimentalists (senior years rather than first year), and a ‘blended approach’ involving a mixture of in-the-room hands-on and online monitoring and control to help overcome the ‘visualisation barrier’.

3. Comparing institutions and cohorts

We present evidence to test the above anecdotal hypotheses. Data was obtained in Semester 2 2018, where senior students in physics majors as well as first-year ‘physics for biology’ students from Monash and La Trobe Universities were surveyed before and after using their respective remote labs in order to measure engagement and satisfaction. Web analytics were used to quantify access patterns, particularly time on task, and these patterns related to the survey results and student grades.

4. References

[1] D. Lowe et al., “Interoperating remote laboratory management systems (RLMSs) for more efficient sharing of laboratory resources,” *Computer Standards & Interfaces*, vol. 43, pp. 21–29, Jan. 2016.

[2] R. Heradio, L. de la Torre, D. Galan, F. J. Cabrerizo, E. Herrera-Viedma, and S. Dormido, “Virtual and remote labs in education: A bibliometric analysis,” *Computers & Education*, vol. 98, pp. 14–38, Jul. 2016.

[3] “FarLabs | Freely Accessible Remote Laboratories.” [Online]. Available: www.farlabs.edu.au/. [Accessed: 15-Jul-2018].