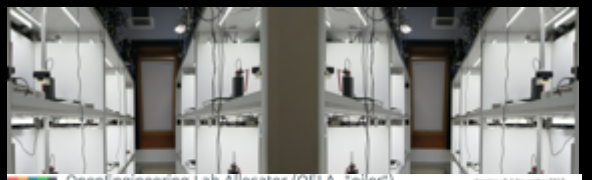
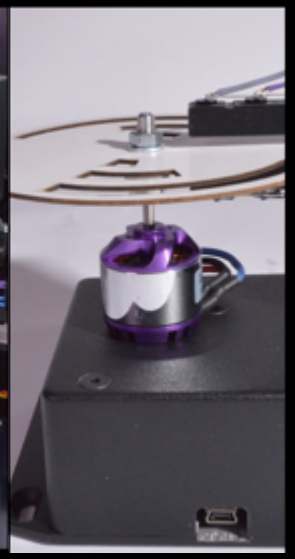
Hybrid Practical Work 2020/21 In School of Engineering

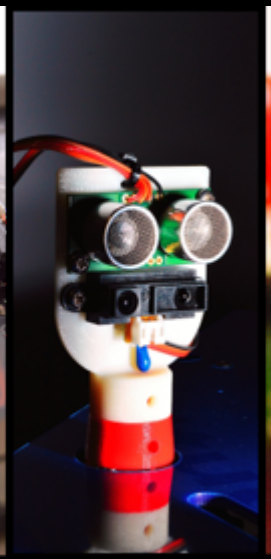
Prof Tim Drysdale
Chair of Technology Enhanced Science Education
School of Engineering

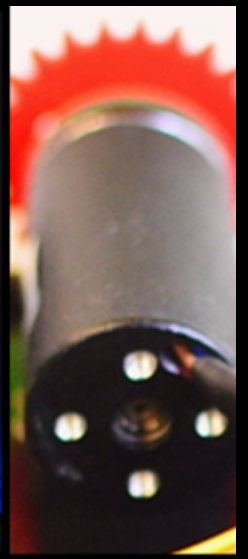
www.youtube.com/watch?v=MSQtI9PPjok

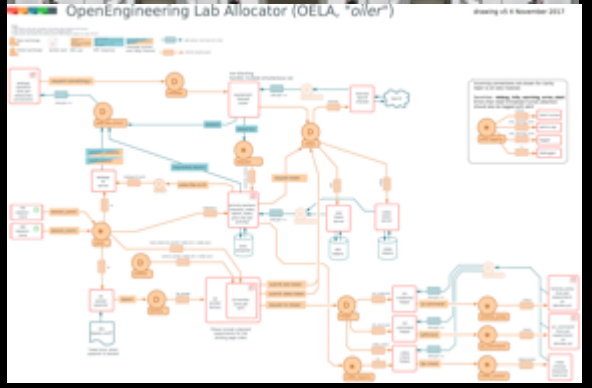
openEngineering Lab, The Open University UK





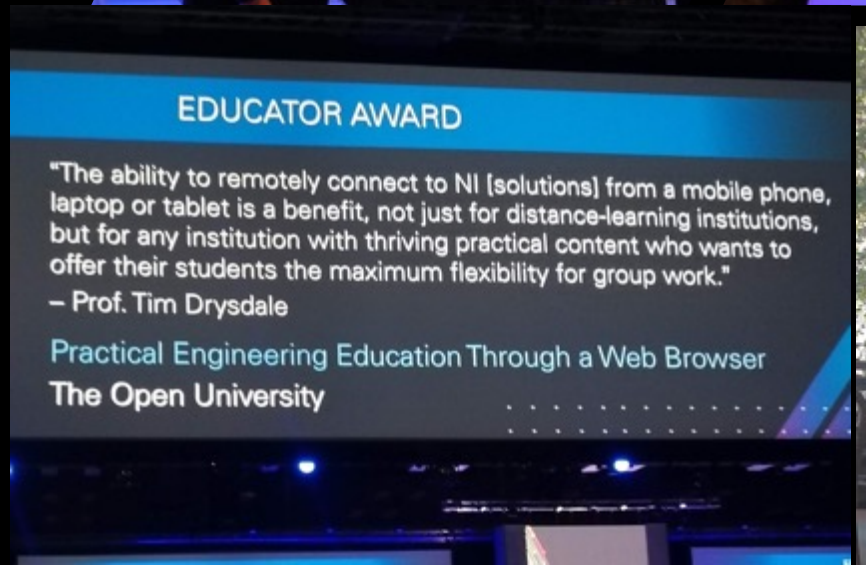






International & UK Awards: openEngineering/openSTEM labs

- National Instruments
  - Global Engineering Impact Award 2019 (Education)
- The Guardian
  - Teaching Excellence Award 2018
- Global Online Labs Consortium
  - Remote Experiment Award 2018
- Times Higher Education
  - Leadership & Management Award 2017 (Outstanding Digital Innovation)



Opinion Piece:

Non-Traditional Practical Work for Traditional Campuses

https://www.tandfonline.com/doi/full/10.1080/23752696.2020.1816845

Timothy D. Drysdale, Simon Kelley, Anne-Marie Scott, Victoria Dishon, Andrew Weightman, Richard Lewis, Stephen Watts

Accepted, May 2020, *HE Pedagogies*

"I really enjoyed this visionary piece and look forward to recommending it once published."

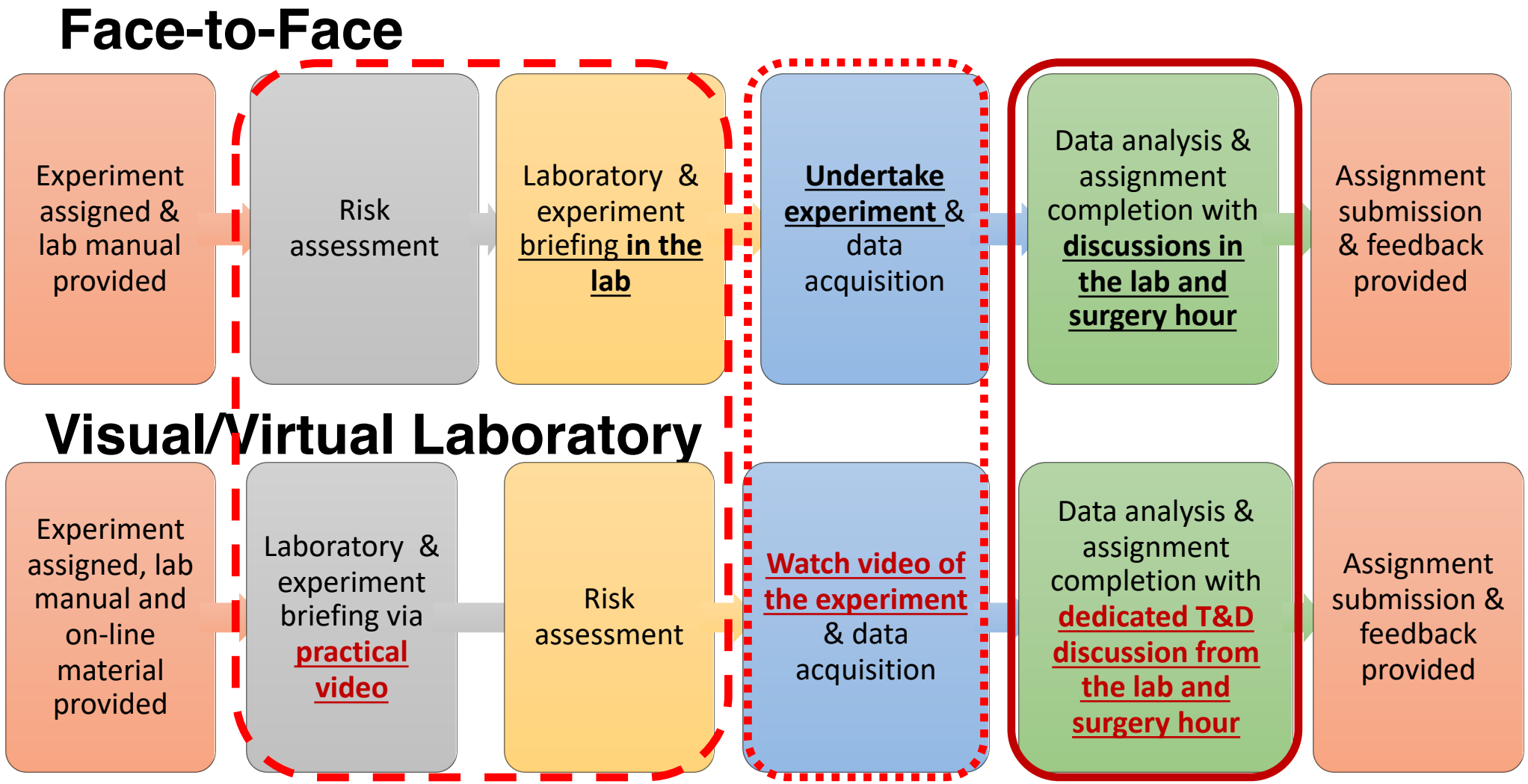
- Reviewer

https://www.wiki.ed.ac.uk/display/EngIntranet/Hybrid+Practical+Work

Name	Staff	Students in room	Students online	Comment	Purpose
In-person lab (IPL)	present to give advice and guidance, no hardware needed	real hardware in the lab	no	Can the staff member(s) move about the lab? If not, then these students will need an online means of communicating to the in-room helper.	Use if capacity not an issu essential without exceptio
Replay demonstration (RD)	demonstrates using pre-recorded video and data	no	yes	Backup in case labs unavailable; prerecord while you still can! Acts as a rehearsal for live sessions.	Use if we are in the worst
Online demonstration (OD)	demonstrates using real hardware in the lab	no	yes	Students can influence what happens via questions and chat; data available for self-led analysis exercises afterwards (either from this session or the pre-recordings)	Use for any case where ca wish to run the session m give more students a cha
Hybrid demonstration (HD)	demonstrates real hardware in the lab	present, no access to hardware	yes	Likely to have limited capacity for in-room students given sightlines will be restricted. May still be useful to laboratories where equipment is a one-off (e.g. fire testing, concrete testing)	Use when you have a sing some of whom are remot
Hybrid practical (HP)	demonstrates using real hardware in the lab (to online students)	real hardware in the lab	yes	This is really two separate events running at the same time - and needs to be administered carefully. There needs to be a staff member demonstrating their equipment to the online cohort in the hybrid/online demonstration style, while another staff member somehow handles the queries that come up from students in the room, who will be doing their own	Use when you have some but sufficient ILO can be a some independent analys to get any students on ca over multiple weeks so ca

Example: Chemical Engineering Lab 3

Daniel Orejon Mantecon (D.Orejon@ed.ac.uk)



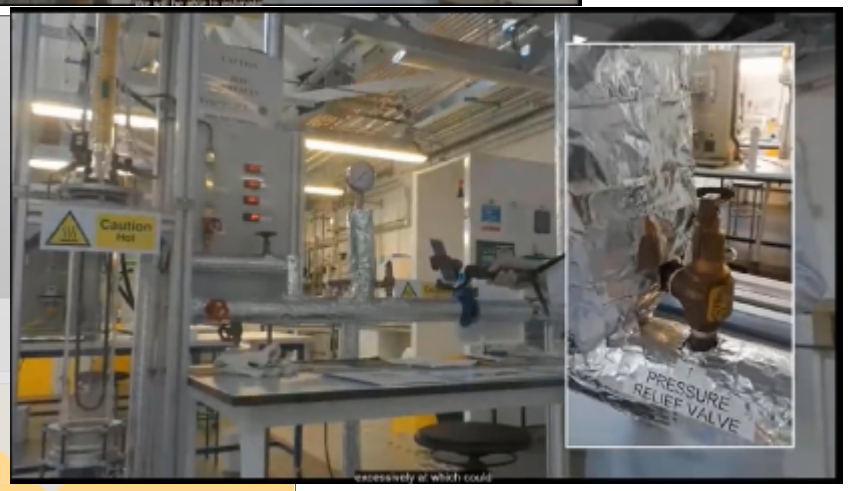
Demonstrated Lab: Chemical Engineering Lab 3

Daniel Orejon Mantecon (D.Orejon@ed.ac.uk)

Assignment Working Flow

Online Laboratory (Friday the week before assignment):

- **Read Manual** Chapter and Sections dedicated to your experiment and assignment
- **Watch Online Laboratory Demonstration**: Introduction, Experimental Apparatus
- Create **Schematics, Risk Assessment** and **Blank Data Sheet**
- **Watch** startup, **experimental runs** and **record the data, and finally shut-down**
- **Create a routine** (Mondays 13:00 to 17:00 and/or Tuesdays from 11:00 –13:00?)



Work towards the assignment (during the week assigned):

- **Data acquisition and Analysis** including Errors
- **One hour/experiment online discussion** with Demonstrator on Wednesdays **from the lab** 11:00 – 13:00
- **One hour hybrid tutorial** specific to the assignment Fridays 10:00 – 11:00 Alrick Building TLC
- **Surgery Hours** Thursdays 9:00 – 10:00

Work towards the assignment & submission (the week after):

- **Independent Learning** Hours
- **Online submission** by Thursday 16:00
- **Note:** Slides for Oral Presentation and Posters will not be submitted online.

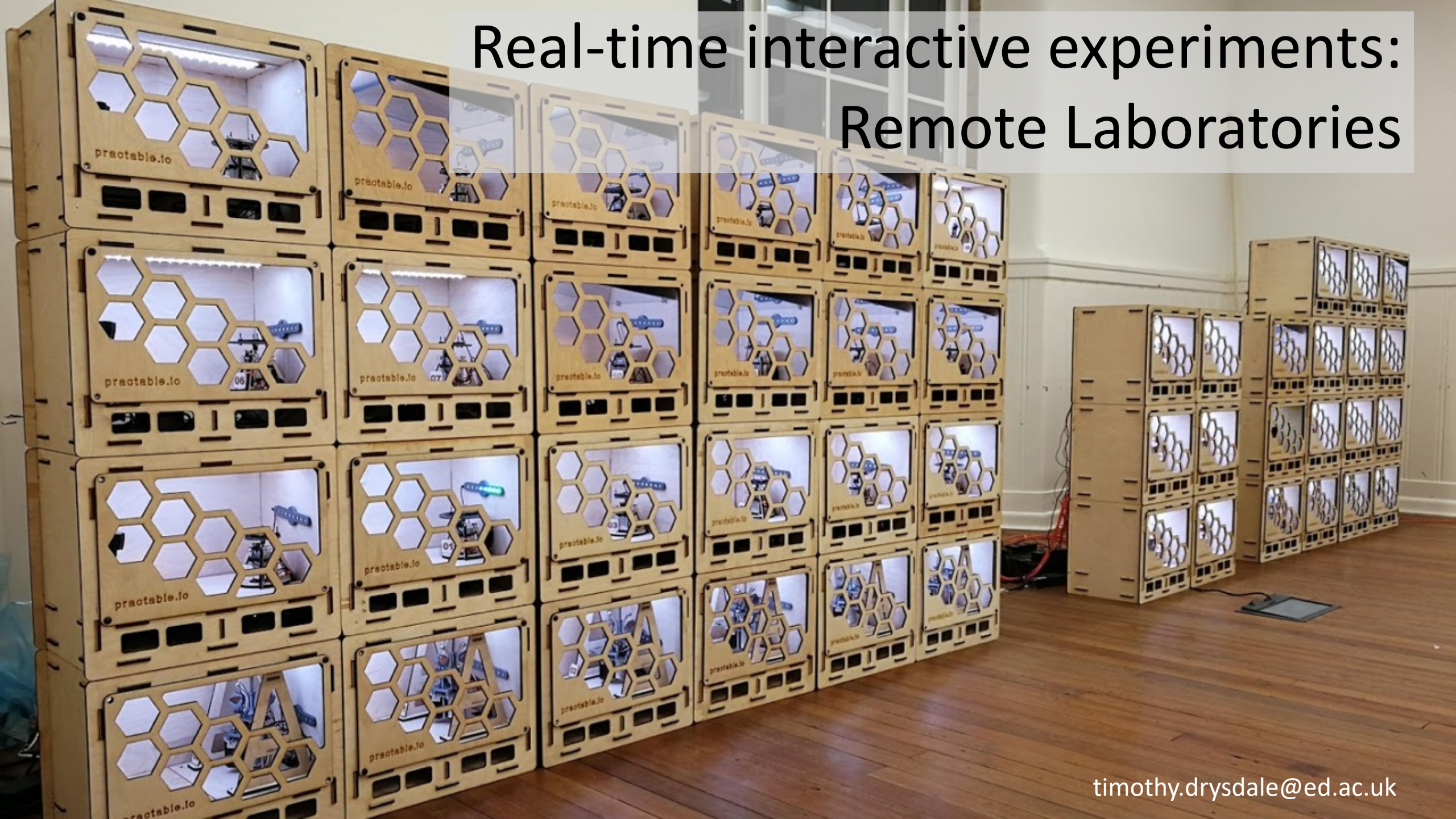
96 students -> 4 Groups -> 5 sessions per group over 4 weeks, Microsoft Teams

Group working at home: Engineering Applications 1

Simone Dimartino (simone.dimartino@ed.ac.uk)

https://media.ed.ac.uk/media/G16+Yellow+-+Present+Beneath+the+Tree/1_gcef4nph/190276703

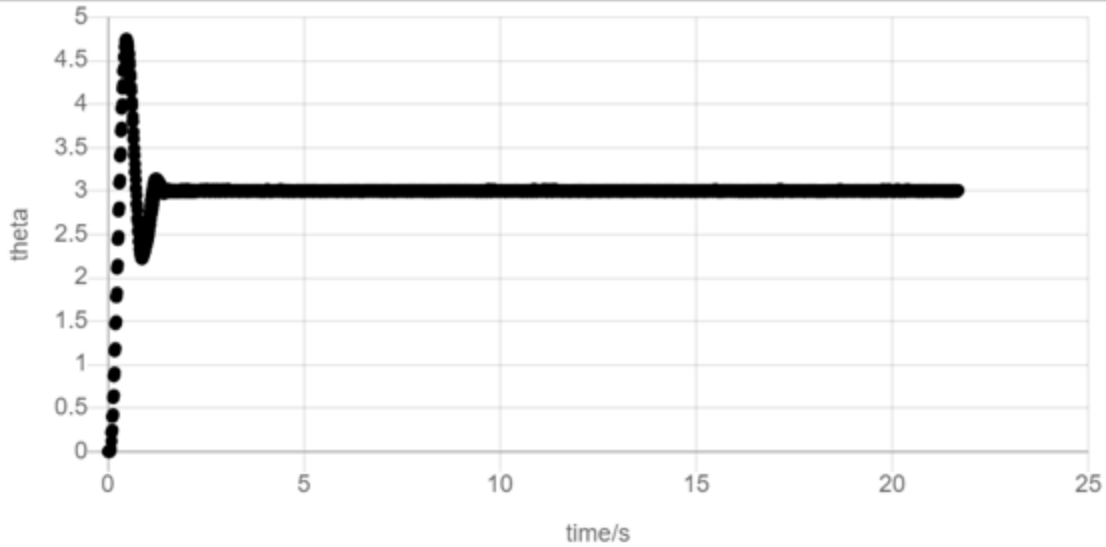
Real-time interactive experiments: Remote Laboratories



timothy.drysdale@ed.ac.uk

Remote Lab: Spinning Disk Menu Tools Clear Workspace *Session ends in: 03 min : 35 secs*

Current mode: position (PID)



Plot function: Linea

$y = ax + b$

Units: rad/s **Gradient:** 0 **a =** 0 **b =** 0

Plot Clear

Live interaction with real equipment
250 students, 80% of final mark
Controls and Instrumentation 3 (course organiser Dr Aristides Kiprakis) UI by David Reid

Hybrid Practical work in Engineering

- Synchronous sessions with online and in-person planned for SEM2, with contingencies in place
  - Plans developed and implemented by Cross-School Working Group led by Tim Drysdale Examples
  - Video demonstrations e.g. chemical engineering course
    - Daniel Orejon Mantecon (D.Orejon@ed.ac.uk)
  - Home group work e.g. cross-school first year course
    - Simone Dimartino (simone.dimartino@ed.ac.uk)
- Remote Laboratories e.g. mechanical & electrical course
  - This activity was happening anyway, with plans pre-dating covid.

timothy.drysdale@ed.ac.uk

Extra slides

practable.io™

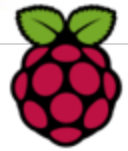
non-traditional practical work

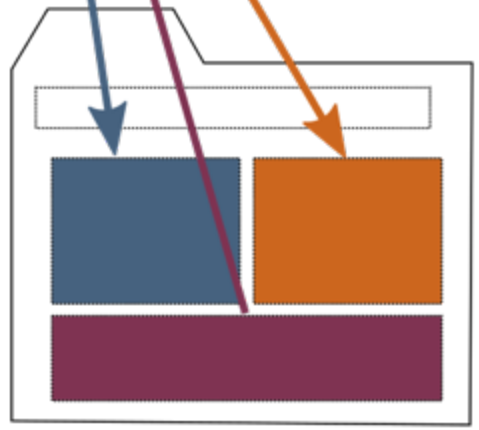
video

data

control

ARDUINO





browser

experiment

Remote laboratories – quick summary

- New pedagogical opportunities in remote and virtual labs
- Solve pressing real-world problems with our teaching constraints
- Previously built award-winning remote laboratory
- New labs for Edinburgh + world
- First usage in assessed coursework (250 students)
- Building another 50 experiments for school of engineering
- Collaborations welcome
- Intended for use across the whole University, as well as our local communities, schools, FE, and HE worldwide (eventually!)
- Open-source infrastructure for international federation and cooperation, enhancing dissemination of good practice.

Use cases

Teaching

- Students collect and analyse data for assessed report
- Students explore difficult concepts in their own time
- Students see that surprising or counterintuitive results are real
- Lecturer demonstrates principle to live audience with live experiment
- Answer a question from student with demonstration
- Students develop experiment as project
- Adapt someone else's experiment to suit your purposes
- etc etc!

Other

- Enhance research impact and dissemination by making prototypes available remotely
- Outreach to schools and communities
- Recruitment, including widening participation (let each student explore something they like)
- Public engagement (large interactive sessions)
- Community contributions – e.g. hybrid museums exhibits
- Make the campus a playful science museum
- Inform visitors of our teaching and research by direct interaction

Create booking

Course

All My Courses

Start

Today 19:30

End

Today 20:30

Filter By

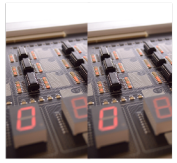
All experiments

Search

Today, 19:30 - 20:30

Sort By

Available Until

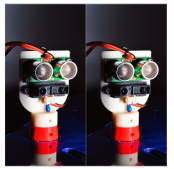


Digital circuits *0/40*

Computing 3

Available until: Tomorrow

Remaining: 35 minutes

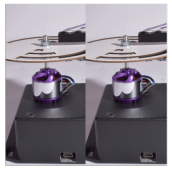


Distance sensors *5/8*

Machines 3

Available until: 22 Dec 2018

Remaining: 117 minutes

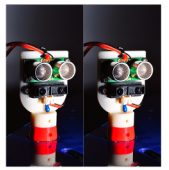


Square wave signals *1/8*

Machines 3

Available until: 20 May 2019

Remaining: 180 minutes

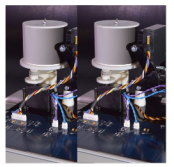


Distance sensors *3/5*

Power Electronics 3

Available until: 20 May 2019

Remaining: 180 minutes



Light sensors *3/12*

Power Electronics 3

Available until: 20 May 2019

Remaining: 12 minutes

Scheduling concept from T. Drysdale and V. Dishon

Workshop technicians +

Learning Technology Developers

+ Student co-creators


10:42
Speed
GO

Opportunities in LT & related spaces

Course Design

- Unpack ILO
- Identify pain points
- Identify “longed for” features
- Create new digital experiences to address these

Deployment

- Identify and arrange access to experiments
- Set up class lists
- (ultimately similar tasks to working with VLE on other course aspects)
- Administer and maintain experimental fleet

Development

- Remix interfaces written in Javascript and HTML5
- Develop experiments (e.g. Arduino + electronics)
- Install and configure software on Raspberry Pi

Why do remote laboratories?

New pedagogical opportunities:

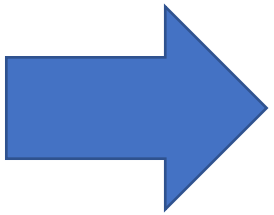
- Student-led / reflective learning
- Authentic Assessment
- Student co-creation
- Community good

Issues we face without them

- Cost & limitations of the current provision
- Increasing class sizes
- Limited laboratory space
- Loss of “exploratory” lab time
- Lack of campus space to build new buildings
  - which would be costly
  - take years to arrive,
  - then be inflexible

Digital alternative for ALL subjects:

-Remote labs
    -Synchronous
    -Asynchronous
-Blended labs
-Virtual labs
-Simulated labs



Pedagogy

Practicality

Sustainability