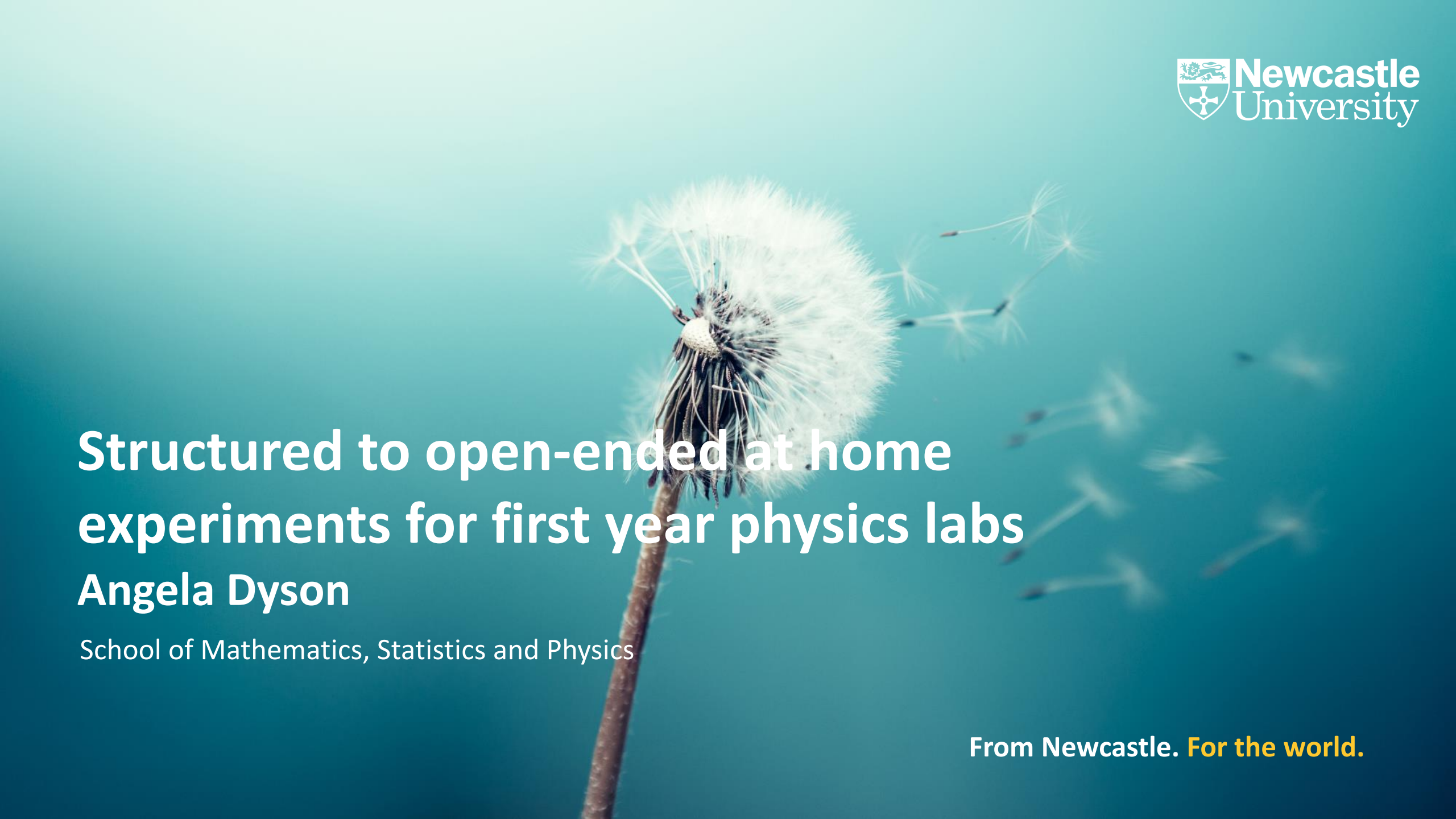

Structured to open-ended at home experiments for first year physics labs

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From Newcastle. For the world.

What we used to do

First year lab was very traditional

Semester 1 Weeks 1-5	Semester 1 Weeks 6-10	Christmas Break	Semester 2 Weeks 1-10
Hands on Matlab 1 hr instruction 2 hr lab Per week	Scripted lab on known physics 3 hr session Per week		Scripted lab on 1st year physics Two 3 hr sessions Per fortnight

+ Drop-in / additional sessions in the run up to assessment deadlines

Class size typically ~80; supported by 3 academic staff and 6 PGR helpers. Students normally work in pairs.
Modern labs with research grade equipment

Assessed by

Matlab – 25% computer based assessment via NUMBAS
Lab - 25% Lab book; 10% Report 1; 20% Report 2; 20% Report 3

Feedback from reports was timed to arrived to allow students to feedforward

Report expectations, format and marking scheme vertically integrated across degree programmes.

Things to consider:

Learning outcomes of the module/programme
Skills required for 2nd year lab
Background of the students
Additional pressures / cognitive load of all remote classes.

We decided that we wanted students to be able to:

Plot and analyze data
Appreciate uncertainties from different sources
Gain some practical hands on experience & skills
Develop their report writing skills

Have fun!

What we designed (& delivered)

Experimental Boxes were sent to each student's preferred address
All information was uploaded to the VLE making it clear if preparatory work was required

Semester 1 Weeks 1-4	Semester 1 Weeks 5-8	Christmas Break	Semester 2 Weeks 1 & 2	Semester 2 Weeks 3-6	Semester 2 7 & 8
Hands on Matlab 1 hr asynchronous 2 hr synchronous remote lab Per week	Data analysis & uncertainties skills 2 X 1.5 hr synchronous remote session Per week + VLE discussion board		Data analysis & Uncertainties consolidation and prep for CBA.	Structured build & test 2 x 1.5 hr synchronous remote sessions Per week + VLE discussion board	Open ended student designed expt. 2 x1.5 hr synchronous remote sessions Per week + Direct contact with PGR

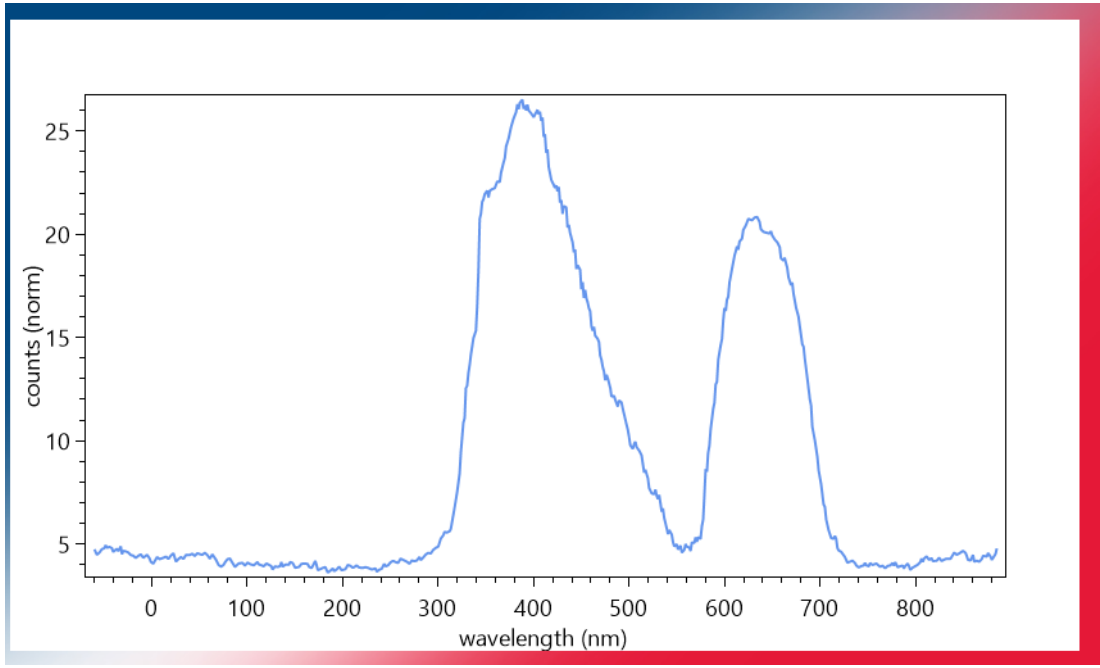
Assessed by

Matlab – 25% computer based assessment via NUMBAS
Lab - 20% Portfolio; 15% Data analysis & Uncertainties computer based assessment via NUMBAS; 20% Report 1; 20% Report 2

Feedback from reports was timed to arrived to allow feedforward

Additional synchronous remote sessions were run prior to assessments.

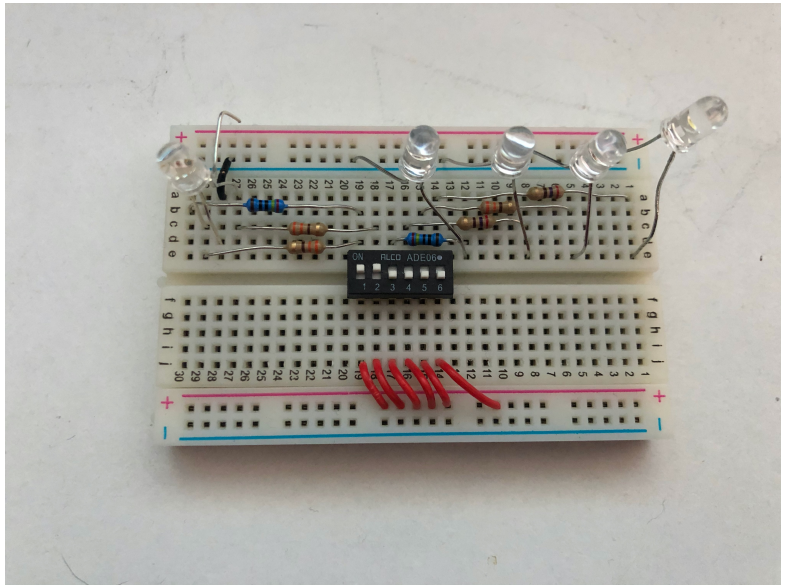
One session was given over to discussing experiment ideas with the group peers and the PGR helper.



Example calibration spectra from the App.

Students were provided with a Samsung Tablet by the School

Each weekly remote session was run on zoom using the breakout rooms feature. Students were divided into eight groups of 10 and they remained in these throughout the year with the same PGR helper.



Week 3: Students built a cardboard spectrometer and had a CD & DVD to make a grating. Students installed an App on their tablets for the spectrometer.
Week 4: Students built a calibration circuit and calibrated their spectrometer
Week 5: A catch up week to ensure all students had a working set-up
Week 6: Students built a multi LED circuit and measured their spectra with their spectrometer.
Week 7-10: Students designed and executed their own experiment using their calibrated spectrometer.

Outcomes

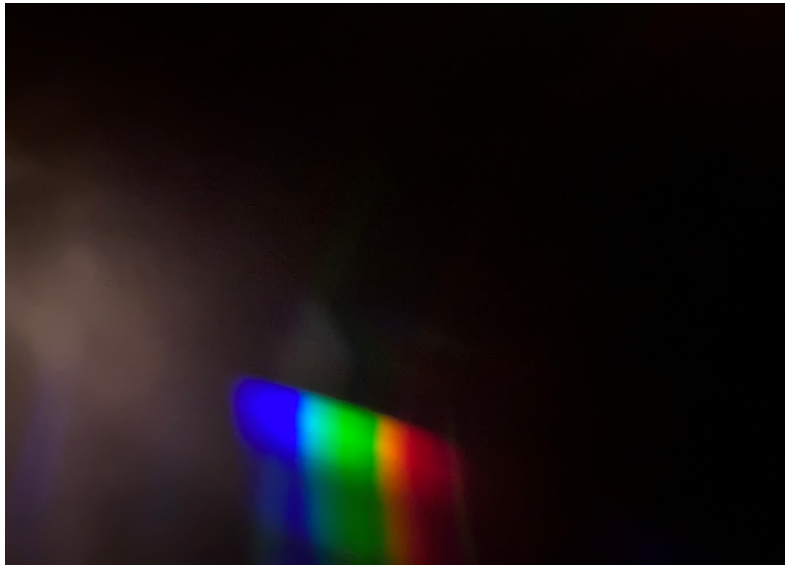
Large range of experiments:
Determination of Planck's constant, spectra of military grade glow sticks**,** investigating blue light reduction from computer screens i.e Apple's night shift mode, efficacy of emergency lighting for colour blind people, comparison of incandescent and LED traffic lights.

Students had not encountered calibration before

Students scores over the module were consistent with the previous year.

Engagement as measured by attendance and submission of work was better than the previous year

Students made the most of the regular smaller working groups. Some had what's app group chats or Slack channels.



Student Feedback

There was little to no instruction on how to write reports and no opportunity to submit a formative assignment for feedback before the summative ones.

In my opinion you can not substitute practical lab work with online and take home experiments.

This module had the best feedback on assessments which really helped me to boost my score in the end of year.

The actual practical I felt was impressive given the circumstances, and for so many students to successfully build and use spectrometers