Vicphysics Teachers' Network

Extracts from the Chat Room and the audio of the Discussion held on Weds 5th August, 2020.

Comments on the Support Documents

- Guide to Prac Reporting: Pleased to see trendlines covered.
- The Guide has a section on rubrics at the end.

Practical Investigation: Sources of data and managing the task at home.
The comments have been grouped under several headings.

Data sets from the Log Books of Students from Previous Years
One source of real data is the logbooks of previous years' students. However these examples would need to be checked for sufficient number of trails across a broad range of values for the independent variable.

Students also need more than just the data to make sense of their analysis. Something about the method, apparatus and measuring instruments is also needed. However finding and extracting good examples from log books may be laborious, but it can be done.

Youtube videos
These can be useful, but they often include analysis of the data. Lists to follow.

Useful websites
Those below plus others are also on webpages of the Vicphysics website:
Apps and Applets: https://www.vicphysics.org/appsandapplets/.
Useful websites and Videos: https://www.vicphysics.org/usefulwebsites/

There are many simulations available on websites such as PhET, Fendt and oPhysics, but they have the limitation that they are not real data and often it is not possible give an uncertainty value to the data, which is needed for a proper analysis. Also, a proper investigation needs repeated trials, preferably 5.

- https://ophysics.com : oPhysics s a comprehensive set of simulations written by a recently retired US physics teacher. The simple and elegant illustrations on various physics principles have been written in GeoGebra.
  https://phet.colorado.edu/en/simulations/filter?subjects=physics&sort=alpha&view=grid (34 motion simulations),
- Walter Fendt https://www.walter-fendt.de/html5/phen/ Some of the best physics applets written.
- Clickview
- Mathematica: Lots of simulations
- Algodoo: http://www.algodoo.com/ . Bit of a learning curve but provides a physics sandbox. Can do ball dropping/rolling experiments and collect data. To address lack of error, I've had students use it and move the 'ball' etc with their mouse to approximate the correct location. It looks cartoonish, but it is powerful.

Using Mobile Phone as a Scientific Instrument
The apps below and others are on the Vicphysics website on the following webpages:
'Online learning' https://www.vicphysics.org/online/ ,
'Apps and Applets' https://www.vicphysics.org/appsandapplets/ and
'EPIs and Practical Activities' https://www.vicphysics.org/practicalactivities/

- PhyPhox is a website dedicated to experiments that can be done with a mobile phone, with many being free. The app can be downloaded from Google Play or the App Store.
- Physics Toolbox website provides free and low cost data analysis tools to 'harness the power of mobile sensors and enhance science education'. Their website is well designed with tutorials, apps for Android and iOS, as well as Lessons. Their apps use 16 different sensors.

- SparkVue is a data analysis tool by Pasco with many capabilities. It is a very comprehensive package with substantial teacher resources.

Data Analysis tools

Tracker is a good way to analyse home experiments, but digital methods can be too precise, it is probably better for students to use analogue methods to extract data, if possible. Terry Tan has prepared a simple guide, contact him if you would like a copy.

Kinovea is a free video analysis and modeling tool. It is a more sophisticated and powerful tool than Tracker. There is some support, but not as detailed as Tracker. It is mostly used by sports coaches and athletes to study a performance, but useful in a school context.

Check EPIs and Practical Activities' https://www.vicphysics.org/practicalactivities/ for links to all Data Collection Tools.

Do I have investigations done at home or do I use secondary data?

- I have just inherited a second year 12 physics class and they are all very insecure and probably not in a mental place to run their own pracs at home - so I want to use second hand data to try and help them feel a bit more settled.

Experiments Online

FAR labs (Freely Accessible Remote Labs) https://www.farlabs.edu.au/ has experiments that students can conduct online and record their own data. There are some for Year 11 and two for Year 12 on the Photoelectric Effect and Diffraction of Light using the equipment at the Australian Synchrotron.

However they are set up as structured experiments with little flexibility. For example in the PE Effect, rather than use an adjustable backing voltage which would enable the student to investigate how the photocurrent reduces to zero and so reveal the distribution of energy among the photoelectrons, the photoelectrons are collected by a capacitor. As the capacitor voltage builds up, it repels more and more electrons. The experiment shows a Voltage vs Time graph that plateaus with the students reading off the maximum value of the voltage as the stopping voltage.

Some Home Experiments

- Bouncing balls,
- Elastic bands (cold)
- Rolling different mass balls down a homemade ramp (even a book at an angle) across a surface. Measuring distance rolled from base of ramp.
- Rolling of partially filled bottle,
- paper plane,
- parachute,
- bouncing ball