Appendix C: Example Lesson Plan

Introduction:

Using our remotely controllable apparatus, students explore fundamental linear polarization concepts by conducting optics experiments online in real-time. Students can power a laser diode on and off, rotate one of two linear polarizers to create effects on the incipient laser beam, and record data on the resulting fluctuations in intensity read from the light-dependent resistor.

Objectives:

- Acquire experience working with customary optics experiment set-ups
- Acquire knowledge on linear polarization and its effect on light

Students will be able to:

- Discuss the effect of two linear polarizers and the angle between them on a beam of light
- Discuss ways of measuring light including intensity and lux
- Draw three dimensional diagrams of light passing through polarizers

Relevant Previous Knowledge:

- Light can be thought of as an electromagnetic wave
- Light, initially unpolarized, can be linearly polarized along one direction (or one plane of the electromagnetic wave)
- Light can be measured with a unit of intensity which represents the rate at which the energy of light distributes on a surface area
- The intensity of light is affected after passing through a linear polarizer (e.g. intensity is halved after passing through a single linear polarizer)

Example Procedures:

1. Power on the laser diode.
2. Rotate Polarizer #2 to a position where the angle between Polarizer #1 and Polarizer #2 is 0˚.
3. Record the resulting intensity of the laser beam from the LDR reading
4. Repeat steps 2-3 using 30˚, 45˚, 90˚ and 180˚ angles between Polarizer #1 and Polarizer #2
5. Power off the laser diode

Sample Questions:

1. Can you predict and experimentally verify the resulting intensity detected by the LDR in each trial using what you know about the angles between the polarizers?
2. Explain why, even after passing through two polarizers, the intensity of the laser beam seems to only be halved at 0˚ and 180˚.
3. Explain why the LDR intensity reading is 0 when the polarizers are rotated 90˚ from each other.
4. When designing an experiment like this one, what concerns might a scientist have about designing the set-up? (For example, how do we keep all the equipment pieces aligned and at the same level?)