**Light intensity attenuation**

**Levels:** 6-8  
**NoS achievement aims:** Investigating in science   
**Contextual strands:** Physical world   
**Topic:** Light intensity

**Rationale**

The decrease in intensity of a light beam is related to the opacity of the medium and the distance it travels.

In determining the decrease in intensity of a beam of light travelling through different materials, students will explore how to manage the ongoing development of a practical investigation. They can be encouraged to discuss how to deal with inadequate or anomalous data, how to modify their methodology, or where to redirect their investigation.

**What you need**

* Sensitive multi-scale light meters (approximately 20–20,000 lux).
* Variable light sources that can have their intensity controlled, for example, by using a variable power supply.
* Multiple sheets (approximately 50 × 50 cm2) of a range of transparent and translucent materials, for example, coloured glass, plastics, and paper.

**Focus**

* What could cause attenuation of a light beam?
* How could attenuation of a light beam be measured?
* What variables might influence the rate of attenuation?
* How could these variables be managed?
* How could you deal with the effects of ambient light?
* How helpful might it be to trial a method before deciding on a final design?

**Exploration**

1. Introduce the scenario that the class is a research consortium with a commercial contract to investigate factors that affect attenuation of light beams through different materials.
2. Discuss with the class the aim of this investigation, introduce the range of transparent and trans-lucent materials they can use, & have them discuss, decide on, & record research focus questions.
3. In groups, get students to discuss a basic technique for measuring light intensity and become familiar with using the light meter.
4. In the same groups, have them share their ideas about an experimental method to answer their research question, then have them record their agreed methodology and draw up an associated data table.
5. Have the students carry out their experiments, record and analyse their data, and make notes on any problems they experience with their methods.
6. With the whole class, have the students discuss their findings, comparing similarities and differences in approach and findings. Guide the students to think about variables and issues that were overlooked in the initial methods adopted. Have them consider any further questions that need investigating.
7. In groups again, have them modify their original methodologies to improve reliability, or refocus their approaches, and then carry out modified experiments.

**Reflection**

* Did the consortium find answers to the research focus question?
* Which factors had the greatest effect on the rate of attenuation of light beams?
* What were the similarities and differences between different group’s approaches? Was any one method any better than any other?
* What did you do with data that was unexpected or which differed from other groups?
* Did the modified methods give improved data? Why/why not?
* Do you think that discussion between your research groups made it easier to modify your method? Why/why not?
* How do you think professional scientists facilitate this type of collaboration and sharing? What happens at science conventions, conferences, and symposia?
* Do you think scientists modify their experimental methods while they investigate things? If they change their minds part way through an experiment, how does this affect their results and how do they report their findings? What is the place of trialling in experimental design?
* What potential applications can you suggest for the type of information being obtained? For example, attenuation of laser beams through fibre optical cables, the range of navigation lights in seaports and landing lights at airports, or the effective range of diving flood lights through turbid water.