

Using Data Loggers

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Introduction:

The aim of this workshop is to expose participants to ideas incorporating the use of Data loggers in both the Junior and Senior science classroom and to provide for hands on experience with some relevant Mandatory experiments for the NSW Stage 6 syllabus. Participants will explore some of the possibilities that Data loggers provide to enhance the educative experience of their students and discuss some of the issues associated with the selection of appropriate experiments. It is hoped that all will gain some ideas and skills that they might then adapt for use with their own students.

Programme:

1. An Introduction to Data loggers and demonstration of some simple experiments (10 mins)
2. Some ideas on WHY science classes should use Data loggers, WHEN to use Data loggers, and HOW to use Data loggers. (10 mins)
3. Hands On session, with Instruction as needed, with a range of Common data loggers available to use and compare. (25 mins)
4. Opportunity to complete experiments and discuss any issues arising (15 mins)

Brief Description of each part:

Part 1.

The range of data loggers available, and the growing availability of competitively priced probes and sensors, has seen data logging systems becoming much more common. The incorporation of a requirement for exposure to data loggers in the Stage 6 Science courses has seen schools purchasing systems and teachers, sometimes reluctantly, looking for suitable ways to use data logging with their students. In the introductory section of this workshop I will quickly demonstrate some very simple experiments and the basic operating principles in using sensors, interfaces and computer software. This will provide examples of some of the potential the data logger has for enhancing and improving the quality of student experiences in performing experiments.

Part 2.

In this section my aim is to highlight some issues to be considered, arising when data-loggers are considered as part of a science teacher's pedagogy.

Why use data-loggers?

The majority of modern students are exposed to a huge array of stimuli from their environment. The television, home computer, computer games, game consols, hand held games, mobile phones etc, etc leaves the modern classroom teacher with a lot of competition for the sort of attention that will lead to a real interest and enthusiasm for classroom learning. Computers and gadgets are highly attractive to students and they readily adapt to become effective users of various devices that many older individuals find particularly confronting. This interest of students in modern interactive devices, and their ability to absorb themselves in solving problems they find relevant, allows the effective use of data-loggers in a science classroom to be a beneficial experience which can actively engage students in a process they find enjoyable and, with the power of most software now available, present the experimental results in various forms to allow, with teacher guidance, for an improved understanding of how the experimental variables have interacted.

With the desire of all science teachers to encourage their students' interest in science and learning with the possibility that some of their students may go on to a career with a science base, the use of the data logger in science classrooms becomes of even greater importance. Modern scientists rarely do any of their work

without data loggers and computers being involved. The necessary skills, and an understanding of the reasons for their use, are very important for all students of science. Modelling of the techniques that are genuinely used by research scientists also has an inspirational component for the budding scientist or a student that has a natural empathy for the experimental process. I will suggest that, rather than just to satisfy the minimum requirements of the Stage 6 science syllabi, science teachers should actively seek to effectively involve data-logging activities as part of their students' science experience at all levels.

When to used data-loggers?

The classroom experience for science students needs to be diverse, particularly when it comes to;

- Designing and carrying out experiments,
- Analysis, Problem solving, and communication of an understanding based on experimental results.

The data logger can be an invaluable tool to collect and analyse experimental data, having the ability to clearly present real time results, with sensors and probes able to respond to parameters that are beyond the normal range available from most traditional classroom equipment. It is clear that in the future data loggers and the use of computers will become natural components of a secondary science classroom as technology becomes even more widespread and in common use with even more applications involved in the everyday life of a future human. The development of the fundamental skills involved with setting up of experimental apparatus, presenting data, producing an interpreting graphs, means that, at this stage, the traditional approach to performance of experiments is still an integral component in a teacher's pedagogy. The use of the computer and data logger can be seen as an added bonus to enhance the opportunities for;

- new ways to explore traditional themes or//
- to perform experiments that were previously very difficult, time consuming, or dangerous.

During the workshop, certain experiments (listed below) will be used as examples to illustrate where the data logger can be of enormous benefit to allow for

- improvements in time efficiency
- clear presentation of data to allow easier analysis and interpretation
- difficult data rapidly displayed to allow clear visual interpretation of relationship between variables

The experiments to be discussed involve;

- Measurement of Transpiration rate of plant during photosynthesis and in dark.
- A "Real" experiment to demonstrate the influence of the Greenhouse effect on air temperature
- How a whole Junior class can accurately take measurements of variation in their Pulse before and after exercise and, at the same time, examine their heart beat using a data-logger to model ECG.
- "Various" Physics based Experiments to explore aspects of, motion, waves, magnetism and electromagnetic induction
- Measuring the melting points of Tin and Lead and then recording the temperature at which the combined melts solidify to form an alloy.

Other examples from personal experience will be included if time permits.

How to use data-loggers?

When the requirement for data-loggers was introduced as a mandatory experience in the HSC science courses, some practicing teachers viewed the change with scepticism and, for some of the older practitioners, as an imposition requiring them to invest valuable time to undergo training to familiarise themselves with the new technology and operation of the systems. Some teachers commented that they failed to see the need to invest huge amounts of time and resources to do something that they saw as offering little real advantage over traditional experimental techniques. The cost of equipment was seen as a real problem for many schools as the required equipment was relatively expensive and a significant commitment for many science departments. Fortunately, to some extent, the provision of funding to assist in purchasing the required computers, interfaces and probes has slowly been forthcoming and most schools now have the ability to conduct data-logging with their students. The idea that teachers would have to go through some massive learning curve in order to use the loggers and software could have, 10 years ago, have had some validity but now, the various manufacturers have invested huge amounts of time to make the various data logging systems almost foolproof and requiring no more computer skills than would normally be involved in word processing or using spreadsheets. During the workshop I will attempt to show just how easy it is to use the various data loggers available and offer some simple tips to provide the participants with insights gained from many years of using data loggers.

Part 3.

This part will be devoted to a hands-on session where a selection of data loggers from different manufacturers will be available for participants to use. Instruction will be provided as needed with participants encouraged to explore and compare the various systems and conduct simple experiments using different probes and sensors.

The Data loggers available will be;

PASCO® interfaces and sensors with Data Studio software

PASCO® USB Explorer with Easyscreen software and USB probes and sensors

Ezilog interface with software from "The Logical Interface"

Multilog Pro with Multilab Pro software and Fourier® sensors

DataHarvest® EASY SENSE Advanced

A range of sensors for each system will be available for use.

Part 4.

The following experiments will available for participants to conduct.

Biology – Transpiration rate of plants under varying light intensity

Chemistry – Titration curves, pH of salt solution, Exothermic and Endothermic reactions

Senior Science – Heart rate and modelling ECG

Stage 6 Physics - Determining 'g', Exploring collisions and momentum conservation, 'g' by free fall,
The inverse square law and radiant energy, Principles of electromagnetic induction
I have other possibilities if time permits.

Stage 5 Physics – Newton's Second law