Unit 7 Measuring physical data

About the unit

In this unit pupils learn how to use a computer and remote sensors to measure changes in the physical environment. They compare the use of computerised and manual methods and describe the advantages (and disadvantages) of each.

Through this unit pupils will develop the underpinning knowledge, skills and understanding about datalogging they will need to support their work in other subjects, *eg science, geography*.

This unit is expected to take approximately 4 hours.

Where the unit fits in

This unit builds on unit 6C 'Control and monitoring – What happens when…?' in the key stage 2 scheme of work. It provides the understanding necessary to progress to unit 11 'Data: use and misuse' and unit 13 'Control systems'.

This unit links with unit 7C 'Environment and feeding relationships', unit 8D 'Ecological relationships' and unit 8L 'Sound and hearing' in the science scheme of work.

Expectations

At the end of this unit

most pupils will: understand how to design a computer-based system to record accurately the results of a simple experiment; discuss the advantages and disadvantages of using such a system in comparison with more traditional methods

some pupils will not have made so much progress and will: understand that computers can be used to monitor the physical environment, but may not have realised this as a practical experiment

some pupils will have progressed further and will: reflect sensibly on the system that they have designed and suggest possible alternative applications and/or refinements to the system to make it more effective

Prior learning

It is helpful if pupils have learnt that:

- a computer can be used to control outside events and that this is achieved by connecting an interface to the computer
- input devices such as pressure pads can be used to input data into a computer

Language for learning

Writing – through the activities pupils could:

- make notes to clarify ideas and thinking which can be used later

Resources

Resources include:

- sound sensors
- datalogging interface and software

Learning objectives Pupils should learn:	Possible teaching activities	Learning outcomes Pupils:	Points to note
Activity 1			
• that computers can be used to record changes in a physical environment	• Discuss with the class why it is useful to use a computer to record data, *eg accuracy, length of time, inhospitable environment (extremes of temperature, radioactive materials)*. Ask the pupils to make a list of different events that could benefit from using a computer to log data. • Discuss the types of environmental changes that can be measured, *eg movement, light, sound, temperature, pressure, moisture*. • Ask pupils to add the sensor(s) that would be used to monitor the changes in the events listed.	• talk about devices that can be used to measure changes over time • recognise that different devices do different jobs	
Activity 2			
• to design a system that effectively records a data set from a given scientific experiment • to set up a hypothesis for testing • to make notes to clarify ideas and thinking which can be used at a later stage	• Explain to the pupils that there is a need to design the experiment, and that many factors need to be considered if they are to achieve the desired results. • Demonstrate a simple experiment, explaining the various components of the system. The experiment should demonstrate the setting up of a simple hypothesis. Ask pupils to take notes. • Ask the class to work in small groups to discuss a range of experiments that are familiar to them and write down the nature of the required data in each case. Use the following list as a prompt – *Is there more than one change occurring?* – *Is it a sequence of events?* – *Is it a unique event?* – *How long will the measurement take?* – *How often does the measurement need to be taken?* – *What format do you want the data in?*	• demonstrate the need to plan experiments in order to capture the required data	• Any simple experiment could be used as a demonstration. This could involve the use of light, heat or sound sensors and could be linked to work in science. In each case, there should be a simple hypothesis to test.
• to analyse and apply the collected data	• Explain to the pupils what they can actually do with the data they collect. This should include exporting the data to a spreadsheet to allow post-processing and graphing. Pupils should be able to present the results of an experiment and relate it to the original hypothesis.	• understand how to interpret and present the data in order to make conclusions	

Learning objectives Pupils should learn:	Possible teaching activities	Learning outcomes Pupils:	Points to note
Activity 3			
• to set up a datalogging system to test a hypothesis • to produce a report using the data to demonstrate testing of the original hypothesis	• Explain to the class that they are going to carry out an experiment to test noise levels in the school. Pupils should agree some hypotheses to test. • Explain to pupils the process by which this enquiry is set up. This should include discussing where sensors should be placed and why; how often readings should be taken; what factors might affect accuracy of results; how long the experiment should take (*what noise would you expect overnight and how it would affect readings?*). • Ask pupils to set up the experiment – in groups or as a whole class if equipment does not allow the former. Ask pupils to collect the data so that it is available for the next lesson. • Demonstrate how the software can be manipulated to change measurements, *eg frequency of readings*. Show how the software produces graphs – in this instance with all readings from sensors superimposed onto the same graph. • Show the pupils how to transfer the results from the computer-logged experiment to a spreadsheet to calculate the average noise level over the period of the experiment for each sensor. Ask pupils to produce graphs showing actual readings against the average. • Discuss with pupils the results of comparing averages with actual readings and the impact this might have in terms of, *eg noise pollution legislation*. • Ask the pupils to write a report (using ICT) that presents their results. Ask pupils to examine both the methodology and the accuracy of the outcome.	• design and use a system to capture data effectively to test a hypothesis • present their findings in a report	• This activity allows for sound sensors to be used in as many locations as required. It should enable pupils to see the transient nature of some recordings, *eg sound in the corridor will increase at the end of lessons, an average reading over a day will not show the peaks of sound levels*. • Pupils should be taught how to save data, but this may have to be done by the teacher, *eg if the final results are not available until the next day.* • Extension activity: more able pupils could suggest ways in which they could extend the experiment or apply it in different contexts. • Homework could be an investigation, *eg into noise pollution legislation and the possible consequences for live music*. Pupils should consider the consequences of measuring noise over a period of time or just using the peak measurement.