Science Education in the News

Science tools in the Classroom

By Peter Horszowski

Would it change your attitude to practicals and field work if you could measure anything you liked? Force, motion, pH, pressure, carbon dioxide, light, heart rate - just about anything, really. A new system from PASCO Scientific allows you to do that. And not just measure, but store, record and analyse the info on your computer as well.

SPARK Science Learning System is an all-in-one mobile device that seamlessly integrates the power of probeware with inquiry-based content and assessment.

Source: www.pasco.com

It consists of a choice of sensors, software and a USB link. There are about 50 sensors currently available and more under development. A user would simply plug the link into a USB port on computer, and attach a sensor or a combination of sensors. The software automatically recognises both device and sensor, while the computer provides the power.

On screen start/stop controls and a number of different data displays such as meters, digits, tables, scopes and graphs provide easy control and access to information. USB being a very fast communication technology means that the device will not only measure multiple quantities simultaneously, but it does it extremely quickly, over 20 000 times a second, if necessary. The need for such high speed is obvious for experiments on motion where velocity and force change significantly during each millisecond. But sometimes it is the slow sampling which is the most handy. Taking data every half hour or so, for instance, would be more appropriate for a 24 hour examination of pH change in a fish pond.

There are a number of advantages to this computer based system:

- It is cost effective. Because the link and software is the same for all sensors, simply add a new sensor for a range of new experiments. If the initial system was used to monitor motion and force, for example, a very small investment later for a temperature sensor, would open up a range of thermal investigations in physics, chemistry, biology and geography.

- More time with data and less with measurement. Because it is quick and easy to get accurate data, less time is spent on measuring and more time analysing.

- It is flexible, so you can easily change parameters, for scientific investigation. In collision experiments it is simple to alter the mass, change the pulse, track angle, for example. And then again it is easy to get data if you wonder "what happens if"...

- It opens doors. Some experiments can't be done without technology such as this. If for example you drop a magnet through a coil attached to a voltmeter, all that is seen is a flick of a needle. But if the coil were a attached to a voltage sensor the emf spike could be recorded exactly. And it could be analysed: on a time graph, zoomed up to a very fine time scale, and then integrated under the curve for exact quantitative results. In theory it would be possible to do the slow sampling experiments without this technology, but who wants to wake up at 3 am to take a humidity measurement in the terrarium?

In Southern Africa, this technology could have specific advantages.

It stimulates enthusiasm for science. With the sensors, students feel like real scientists - not just going through those old clunky motions, hoping that results match the worksheet. Also a bit of competitiveness and spirit can be introduced. Adele Botha, from Cornwall Hill School in Irene, challenges her students to use their own motion with an ultrasonic mo-

tion sensor to match pre-arranged velocity and displacement graphs. The software scores performance which generates healthy competition between groups and classes. Another spur to enthusiasm is the Xplorer, which works not just as a USB sensor link but a datalogger with display. Students can use it for outdoor work and ad hoc investigation. The American International School of Johannesburg, for example, used an Xplorer for temperature levels in the Northern Province during the 2002 eclipse.

It encourages female enrollment in science. Case studies have demonstrated this effect. John Layman from the University of Marlyland, suggested that it was because of a leveling effect. These days, girls and boys are equally familiar with computers and computer accessories but the traditional practical equipment, like stop watches, calipers and multimeters were thought of as 'boys stuff' .

But for this system to work in the southern African setting, access to computers, computer literacy issues and overburdened teachers need to be addressed.

Fortunately, some of these difficulties can be overcome by creative teaching. Some South African schools for example, use projectors, large monitors and TV adapters to use the probeware as part of a teaching demonstration, instead of a separate practical. Because it is quick to set up and very visual, a lot can be achieved in a lesson that incorporates a computer based demonstration. Homework can be useful too. Students save the results to disk and analyse them later, wherever they have access to a computer.

The shift towards outcomes based education also gives some assistance. The Pasco system's flexibility lets the learner approach a variety of objectives from different angles via a number of interrelated sciences. And the centering of the learner gives scope for individual tangential investigation without overburdening the facilitator.

Documentation is available for several hundred experiments and new experiments are posted on the internet regularly. For examples of these see www.pasco.com/experiments. Worksheets allow participants to become familiar not only with the utilities but also the possibilities, so that they can get creative with new types of experiments. Dawn McMaster of the American school has been using the probeware for a few years now. She says that she enjoys customising her own experiments and that, given the choice, the students prefer the Pasco sensors for experimental work.

There is no single solution to the problems facing science educators in Southern Africa but this kind of technology could help.

For information on the latest USB PASCO Probeware for Science Learning, please contact Peter Horszowski at (011)882-1435 or peter@pert.co.za

Source: Adapted from www.scienceinafrica.co.za

The online resources for educators and students includes manuals and experiments in the core science fields: biology, chemistry, environmental and earth science and physics.