Experimental Research – Intermediate and Open

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Entry numbers were a little down on last year's, but there were some excellent entries. Many students discovered that modifying a standard experiment produced interesting, often unexpected results.

Frequently, ideas from the web were used, and the entrants who impressed the judges most were those who devised their own, or modified or added a bit extra to an experiment they found on the web. One or two entries this year which initially were awarded high marks were downgraded when a search found an identical experiment and results on the web.

Judges look at how students can adopt a scientific way of operating. This is what gets acknowledgement and bursaries, not the ability to follow a cookbook!

Suggestions in last year's report seem to have been noted; nearly all folders were manila type; distracting fonts, backgrounds and cute pictures were minimal; results were quoted to an appropriate number of significant figures. But there were still some titles which gave no clue as to the nature of the experiment. 'What you need to know!' as a title conveys nothing to the reader.

Some reports had extensive data sets or tables, but graphs showing interesting aspects of the data would have conveyed relevant information faster to the reader. Graphs should have a title, labelled axes, and maybe a legend if there are two or more lines on the graph. Points lying well away from the graph need comment and should not be discarded without good reason.

The 'Method' should report what the student actually did, not what someone else who is trying to duplicate the experiment should do. In science, it is often the mistakes made which lead to a new and better understanding of the world; but only if the experimenter (student) thinks critically about unexpected results. Taking extra measurements, repeating the experiment (maybe many times), and altering a variable (say lighting or temperature) which was thought to have no effect are some ways that systematic and random errors can be identified and allowed for.

Some students think that a hypothesis disproved means the report has no value. All data – whether confirming or disproving our assumptions and beliefs – adds to our collective store of scientific knowledge. It is

important to record ‘failures’, because much can be gained by analysing the unexpected.

To be valid, conclusions must be supported by the experimental data. While inferences can be made regarding the possible cause of unexpected outcomes, this belongs in the discussion, not the conclusion.

Some students assisted judges by putting each of the discussion prompts (eg. ‘Did your results support...’) just before their own comments. Although never seen in ‘real’ science reports, this style made it easier for judges to verify the student's attention to the requirements.

The CSIRO Journal of Soil Research guidelines for scientific reports at http://tinyurl.com/6jot3t are worth studying. Unless these guidelines are followed, the paper will not be published in their journal, and must be corrected before resubmission. Some (abbreviated) guidelines are:

- The *title* should be concise and appropriately informative.
- The *abstract* (preferably less than 200 words) should state concisely the scope of the work and give the principal findings.
- Sufficient *experimental detail* should be given to enable the work to be repeated.
- The *discussion* should explain the significance of the results.