The Statistical Enquiry Cycle

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Statistical investigations should follow the statistical enquiry cycle (SEC) that is mentioned in the New Zealand Curriculum. This affirms that statistics is more than just gathering, analysing and displaying data. It elaborates the features of the cycle when it defines statistics as follows:

Statistics involves identifying problems that can be explored by the use of appropriate data, designing investigations, collecting data, exploring and using patterns and relationships in data, solving problems, and communicating findings. Statistics also involves interpreting statistical information, evaluating data-based arguments, and dealing with uncertainty and variation. (Ministry of Education, 2008, p26).

The heart of statistics is encapsulated in the statement that precedes the section on Statistical investigations at each level of the curriculum. This reads:

"Conduct investigations using the statistical enquiry cycle." (Levels1-3)

"Plan and conduct investigations using the statistical enquiry cycle." (Levels 4-6)

"Carry out investigations of phenomena using the statistical enquiry cycle." (Levels 7-8)

In the National Standards, each section includes the words "investigate … questions by using the statistical enquiry cycle ..." It elaborates the types of questions and the types of data
required from Year 1 to Year 8.

Table 1 displays the SEC, along with an analogous cycle that can be used in probability investigations. This has two extra stages added: "Predict the outcome"; and "Proliferate",
which is to increase the sample size by doing more trials, pooling results of different students, or using technology. These two steps are useful in the SEC as well.

Table 1: Statistical and Probability Enquiry Cycles

SEC (PPDAC)	**PEC**
Pose a question	Pose a question
Plan an investigation	Plan an investigation
	Predict the outcome of the investigation
Data collection	Perform - gather data
Analyse data and make Conclusions	Probe - analyse and conclude
	Proliferate - increase the sample size
Communicate findings	Publicise the findings

This version of the SEC has one small adjustment to the PPDAC cycle (Wild & Pfannkuch, 1999). It has included "Conclusions" as part of "Analysing data". Indeed, a tentative
conclusion may lead to a re-analysis and a refined conclusion. This cycle has added "Communicate findings" as the final step. This is firstly to reinforce the curriculum's emphasis on effectively communicating results. Secondly such communication is not always easy for students. Even when they can analyse data and make reasonable conclusions, they can struggle to convey these to others. And finally, making conclusions is of little worth if these cannot be effectively communicated to

appropriate audiences. Communication aims not just to showcase the findings, but is also the vehicle for enacting change as a result of the investigation.

Statistical investigation as a cycle

The process is referred to as a cycle, because you do not just start with "Pose" and end with "Communicate findings". The conclusion and the findings may in turn pose new questions, and so the cycle continues like spiralling helix, as new investigations build on, test and refine the results and conclusions made from previous investigations.

The cycle may start at other points. One common one is that some data are already available. Then the beginning step is "Analyse data". This would move on to "Conclusions" and
"Communicate findings". This may lead on to "Pose new questions", and thence onwards and upwards around the cycle.

Statistical investigations in real contexts

In all areas of mathematics meaningful contexts and problem solving are important foci. This is particularly so in statistics, where the context is at the heart of the issue. In other areas of mathematics the context may often be subservient to the mathematical ideas teacher wish students to grasp. The context could be thought of as a "pseudo-context" used to illuminate and contextualise the mathematics. However, in statistics, the statistical enquiry cycle is subservient to the context. If the problem posed is not addressed, an effective statistical investigation has not been completed.

Any statistical investigation addresses actual problems in real world situations, for example "How clean is our school?" and "How can we make it cleaner?" All steps of the statistical enquiry cycle need to keep the context at the forefront of thinking. Questions posed need to be relevant to the context; planning must include deciding suitable data to collect and analyse; conclusions must relate to the issue being addressed; and communication must effectively convey these findings to an appropriate target audience.

Links: For more information, including some downloadable posters on the statistical enquiry cycle click on the links:
Each of these needs a heavier emphasis on Communication.

http://www.censusatschool.org.nz/2005/documents/how-kids-learn.pdf

http://www.censusatschool.org.nz/2005/documents/statistical-investigation.pdf

http://www.nzmaths.co.nz/category/glossary/statistical-enquiry-cycle

http://www.censusatschool.org.nz/resources/poster/

References

Ministry of Education. (2007). The New Zealand Curriculum. Wellington: Learning Media Limited.
Wild, C. J. & Pfannkuch, M. (1999). Statistical thinking in empirical enquiry. International Statistics Review, 67(3), 223—265.