 Shaping statistics

In Stage 4

Implementing new curriculum – building capacity

Welcome to the ‘Shaping statistics in Stage 4’ resource.

This resource is designed to help teachers engage students with the Stage 4 Statistics and Probability substrands:

* Data collection and representation
* Single variable data analysis

Teachers may use this resource individually or as a faculty/group.

Overview

This resource explores the teaching of Stage 4 statistics concepts through the provision of sample lesson plans and practical teaching ideas. It is organised into four main sections.

The continuum of learning

Examine the syllabus content and sequence of learning across the statistics substrands.

Making learning significant

Explore resources to link lesson content to the social, demographic and cultural backgrounds of your students.

Producing flexible and creative users of mathematics

Explore a range of teaching and learning ideas to develop students’ skills in the critical evaluation of statistics.

Wrap up

Browse links to resources to help you integrate spreadsheet software into your classroom.

Rationale

The intent of this learning module is to support secondary teachers’ understanding of key ideas in the Stage 4 statistics substrands of the mathematics K-10 syllabus and to provide examples of teaching and learning resources.

The continuum of learning

Before you begin, familiarise yourself with the continuum of learning table in the mathematics K-10 syllabus. It provides an overview of the substrands and outcomes in each of the content strands.

Consider the pathway of learning across all stages by reviewing the content in each of the statistics substrands. For example, you will observe that:

* students in Stages 2 and 3 are expected to construct, describe and interperet column graphs
* students in Stage 4 can be expected to have prior knowledge of dot plots and line graphs
* histograms, divided bar charts and sector graphs are encountered for the first time in Stage 4
* content relating to the representation and analysis of grouped data does not appear in the new mathematics K-10 syllabus.

Discuss

Make a list of the relevant assumed prior learnings for a student commencing the statistics substrands of Stage 4 Statistics and Probability. Discuss with your colleagues the implications for programming in your school, particularly in the first years of the implementation of the new syllabus. Remember, it will be necessary for teachers to determine the level of achievement of outcomes in the earlier years before planning new teaching and learning experiences.

Key ideas in Stage 4

The study of statistics within the Statistics and Probability strand involves students in the collection, representation, analysis, interpretation and evaluation of data. Key ideas in this stage include –

Data collection and representation

* Identifying variables as categorical or numerical (discrete or continuous)
* Identifying and distinguishing between a ‘population’ and a ‘sample’
* Investigating techniques for collecting data and considering their implications and limitations
* Collecting and interpreting data from primary and secondary sources, including surveys
* Constructing and interpreting frequency tables, histograms and polygons
* Constructing and interpreting dot plots, stem-and-leaf plots, divided bar graphs, sector graphs and line graphs

Single variable data analysis

* Calculating mean, median, mode and range for sets of data
* Investigating the effect of outliers on the mean and median
* Describing and interpreting a variety of data displays using median, mean and range
* Calculating and comparing summary statistics of different samples drawn from the same population

It is important that Stage 4 students have a clear understanding of ‘variable’ in the context of statistics. The syllabus defines a variable as “something measurable or observable that is expected to change over time or between individual observations”. Students learn to recognise variables as categorical

or numerical (either discrete or continuous) and identify examples of categorical variables, discrete numerical variables and continuous numerical variables.

Watch

* Watch the animation ‘[What are variables?](http://www.abs.gov.au/websitedbs/a3121120.nsf/home/statistical+language+-+what+are+variables)’ by the Australian Bureau of Statistics. Note: Stage 4 students are not required to classify categorical data as ‘ordinal’ or ‘nominal’.

Stage 4 students also need to be able to identify the difference between data collected from primary and secondary sources and be able to identify issues that may make it difficult to obtain data from either source.

To demonstrate understanding of key concepts, students could create a video slideshow using internet web 2.0 tools such as Animoto, Smilebox or software such as Microsoft PowerPoint or Adobe Presenter.

Watch

* View this [presentation](http://www.youtube.com/watch?v=IvNt_B4excg&feature=em-share_video_user) on the difference between primary and secondary data sources produced with Xtranormal.
* View this [presentation](http://animoto.com/play/rLNVplQIW12VhKastE8gBQ) on variables produced with Animoto.

Making learning significant

The NSW model of pedagogy as specified in the ‘[Quality teaching in NSW public schools discussion paper](https://www.det.nsw.edu.au/proflearn/docs/pdf/qt_EPSColor.pdf)’ says the “significance of students’ learning lies in the connections between and among the student as an individual and social being.”

The Stage 4 Statistics and Probability substrands present many opportunities for teachers to make learning meaningful and important. By giving students the opportunity to gain experience with a wide range of authentic data, teachers can make clear connections with students’ identities and with contexts outside the classroom.

The CensusAtSchool website, for example, is an excellent source of real data collected from thousands of students across Australia. The website provides a snapshot of the characteristics, attitudes and opinions of those students who have completed the online questionnaires. As such, these data sets provide teachers with the resources to link lesson content to the social, demographic and cultural backgrounds of their students.

Internet links

Spend 10-15 minutes looking through the Australian Bureau of Statistics [Education Services](http://www.abs.gov.au/websitedbs/CaSHome.nsf/Home/Entry+Page.es) and [CensusAtSchool](http://www.abs.gov.au/censusatschool) websites, noting any features/resources you could use in your classroom.

Explore

Download, read and complete the Random sampler activity (.doc 142 kB). This will assist you in gaining a working knowledge of the Random Sampler tool and will also lead you through the steps to organise, display and analyse a sample data set using the functions of Microsoft Excel 2010.

Discuss

Discuss with your colleagues any teaching and learning ideas that you may have that make use of the ‘Random Sampler’ tool. A range of teaching resources can be downloaded from the classroom activities and support materials section of the CensusAtSchool website.

Producing flexible and creative users of mathematics

In our contemporary society, there is extensive use of statistical information in all facets of life. Skills in the critical evaluation of statistics, and the ability to communicate reasoned judgements are therefore essential components of students’ preparation for life in the 21st century.

The following section contains a selection of lesson ideas and resources to use in your classroom to help produce flexible and creative users of mathematics.

Dirty data

Data cleaning is the process of identifying, correcting or removing corrupt or inaccurate records from a data set. In Stage 4, students analyse collected data to identify any obvious errors and justify the inclusion of any individual data values that differ markedly from the rest of the data collected.

In the following sample lesson, students develop critical and creative thinking skills as they utilise the functions of a spreadsheet to detect, resolve and treat errors and inconsistencies in a data set containing 70 records.

Explore

Download and read the lesson scaffold [All washed up – cleaning data](https://schoolsequella.det.nsw.edu.au/file/3d94e822-e690-483c-8141-ddd782173fc5/1/all_washed_up_lp.docx) (.doc 2.4MB). Teaching resources for this sample lesson include:

* [SMART Notebook file](https://schoolsequella.det.nsw.edu.au/file/49d9ce14-b9e3-4668-bfbd-3212089b46ba/1/cleaning_data.notebook) (.notebook 527kB)
* [worksheet](https://schoolsequella.det.nsw.edu.au/file/edb975f2-e6f6-4be7-8b3a-9486e16d1908/1/cleaning_data_ws.doc) (.doc 75kB)
* [student spreadsheet](https://schoolsequella.det.nsw.edu.au/file/28217294-79ef-4e43-8c51-9c922d2d84a1/1/cleaning_data_student.xls) (.xls 18kB)
* [teacher spreadsheet](https://schoolsequella.det.nsw.edu.au/file/86b87412-d38c-459c-bfb1-30fc04e10a6e/1/cleaning_data_teacher.xls) (.xls 33kB).

Getting the count right

In Stage 4, students develop skills in communicating and reasoning as they discuss constraints that may limit the collection of data or result in unreliable data.

In the following sample lesson, students explore the reasons why the estimate for the Indigenous population of Australia has continued to grow rapidly since 1971.

Explore

Download and read the lesson scaffold [Getting the count right](https://schoolsequella.det.nsw.edu.au/file/e9b4b4e3-a66d-4f18-bfb1-9f3859557bad/1/getting_count_right_lp.docx) (.docx 2.8 MB).

Wrap up

Where to next?

The successful teaching of the Stage 4 statistics substrands of the mathematics K-10 syllabus requires some proficiency in integrating spreadsheet software into the classroom.

Web

For further professional learning in this area, you may wish to visit the following sites:

* [Tools4U: Microsoft Excel](http://lrr.cli.det.nsw.edu.au/Lrr2Tale/Tale/Download.aspx?resID=11636&v=1&preview=true)
  + A one page teacher guide for using Microsoft Excel in the classroom.
* [Microsoft help, support and training](http://office.microsoft.com/en-au/training/results.aspx?qu=excel+2010&ex=1&origin=EC079000070)
  + Access to Microsoft help, training, support and how-to-guides for Excel 2010.
* [Excel skills for what graph or display to use when](http://www.abs.gov.au/websitedbs/CaSHome.nsf/home/downloadable+files.es/$FILE/Excel+2010+Skills+What+Graph+or+Display+to+use+When.docx)
  + A quick reference quide from the Australian Bureau of Statistics Education Services.
* [GeoGebra spreadsheet view](http://wiki.geogebra.org/en/Tutorial:Spreadsheet_View_and_Basic_Statistics_Concepts)
  + An online tutorial on GeoGebra spreadsheet view and basic statistics concepts. (GeoGebra will be the feature of the Stage 5 resource, Shaping statistics in Stage 5.)
* [Active data](http://lrr.cli.det.nsw.edu.au/Lrr2Tale/Tale/Download.aspx?resID=6815&v=1&preview=true)
  + A learning resource with an emphasis on collecting, displaying and analysing data through spreadsheets and interactive tasks. Of particular relevenace to teachers of Stage 4 students are the activities related to stem-and-leaf graphs, histograms, divided bar graphs, sector graphs and line graphs.