 Shaping statistics

In Stage 5

Implementing new curriculum – building capacity

This resource is designed to help teachers engage students with the Stage 5 Statistics and Probability substrands:

* Single variable data analysis (Stages 5.1, 5.2 and 5.3)
* Bivariate data analysis (Stages 5.2 and 5.3)

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

Overview

This resource explores the teaching of Stage 5 statistics concepts through the provision of sample lesson plans and practical teaching ideas. It is organised into four main sections.

Key ideas

Review key ideas and content in the Stage 5 statistics substrands.

Integrating ICT in the classroom

Improve your level of confidence in integrating ‘GeoGebra’ spreadsheet view into your teaching and learning programs.

Developing a healthy degree of scepticism

Explore a selection of resources which highlight how statistics can be misleading.

Wrap up

Develop your own lesson plan using a ‘Lesson study’ process.

Rationale

The intent of this learning module is to support secondary teachers’ understanding of key ideas in the Stage 5 statistics substrands of the mathematics K-10 syllabus and to provide examples of teaching and learning resources.

Key ideas

In Stage 5, students extend their skills in representing, analysing, interpreting and evaluating data.

As you review the statistics substrands you will note that content relating to the representation and analysis of grouped data does not appear in the new mathematics K-10 syllabus. The other significant change for Stage 5 is the inclusion of bivariate data analysis in Stages 5.2 and 5.3.

Key ideas to be developed in this stage include –

| Stage | Single variable data analysis |
| --- | --- |
| 5.1 | * Constructing and interpreting back-to-back stem-and-leaf plots
* Describing data, using terms including ‘skewed’, ‘symmetric’ and ‘bimodal’
* Comparing two sets of numerical data in a display using mean, median and range
* Interpreting and critically evaluating reports in the media and elsewhere that link claims to data displays and statistics.
 |
| 5.2 | * Determining quartiles and interquartile range
* Constructing, interpreting and using box plots to compare sets of data
* Comparing shapes of box plots to corresponding histograms and dot plots
* Critically evaluating sources of data in media reports and elsewhere
 |
| 5.3 | * Calculating the standard deviation of a set of data
* Using mean and standard deviation to compare two sets of data.
 |

| Stage | Bivariate data analysis |
| --- | --- |
| 5.2 | * Constructing and interpreting displays of bivariate numerical data where the independent variable is time
* Constructing and interpreting scatter plots of two numerical variables.
 |
| 5.3 | * Constructing a line of best fit for bivariate numerical data using digital technology
* Critically evaluating the processes of planning, collecting, analysing and reporting studies in the media and elsewhere
* Recognising that statistics are used in the decision-making processes of governments and companies.
 |

Discuss

Familiarise yourself with the outcomes and content of the Stage 5 statistics substrands. 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.

Integrating ICT in the classroom

Information and communication technology (ICT) capability, one of the general capabilities of the mathematics K-10 syllabus, assists students to live and work successfully in the 21st Century. ICT includes digital technologies such as calculators, spreadsheets, dynamic geometry software, and computer algebra and graphing software. With regard to the Statistics and Probability strand, the syllabus says “electronic tools, such as spreadsheets and other software packages, may be used where appropriate to organise, display and analyse data.”

The teaching and learning ideas contained in this resource incorporate the use of digital technologies, including [GeoGebra](http://www.geogebra.org). The capabilities of this software in the area of geometry and algebra are probably well known to you. Version 4.0 of this software comes with many new features and capabilities, including those related to the spreadsheet view.

Download

Download, read and complete the [GeoGebra and Stage 5 statistics](https://schoolsequella.det.nsw.edu.au/file/88a52605-4c5d-4261-bca6-cd1661a59447/1/GeoGebra_Stg5_stats.pdf) activity (.pdf 1.4 MB). This will assist you in gaining a working knowledge of the the spreadsheet view of GeoGebra. Related resources for this activity are [sample\_data\_set.xls](https://schoolsequella.det.nsw.edu.au/file/7e6b1f84-4357-453d-996a-f90bc13e1343/1/sample_data_set.xls) (27kB) and [sample\_geogebra.ggb](https://schoolsequella.det.nsw.edu.au/file/386023cb-ef51-4d5f-b59b-ba9d10bdc16c/1/GeoGebra_sample.zip) (.zip 2.8 kB).

The following sections contain sample lessons and practical teaching ideas to help you integrate ICT in the mathematics classroom.

Comparing measures of spread

In Stage 5.3 Single Variable Analysis, students compare the relative merits of the range, interquartile range and standard deviation as measures of spread.

In the following sample lesson, with the aid of digital technologies, students develop an understanding of the concept of standard deviation being a measure of the spread of a symmetrical distribution.

Explore

Download and read the lesson scaffold [Comparing measures of spread](https://schoolsequella.det.nsw.edu.au/file/76a09731-bf1d-4985-b8ed-9b890a5610a1/1/measures_of_spread_lp.doc) (.doc 797 kB). Related teaching resources for this sample lesson include a [GeoGebra data file](https://schoolsequella.det.nsw.edu.au/file/352d2fb4-2251-4066-812c-47373ab78565/1/GeoGebra_task_C.zip) (.zip 2.58 kB) and [worksheet](https://schoolsequella.det.nsw.edu.au/file/d76f0c56-0dfa-4d36-88dd-a54f21d1afad/1/measures_of_spread_ws.doc) (.doc 154 kB).

The joy of stats

Bivariate Data Analysis involves students in investigating the relationships between two statistical variables, including their relationship over time. In Stage 5.3, students investigate the relationships using lines of best fit.

In the following sample lesson, students investigate the relationship between the wealth and health of nations using a linear regression model.

Explore

Download and read the lesson scaffold [Wealth versus health](https://schoolsequella.det.nsw.edu.au/file/40a444c0-dd83-4a8e-a052-0c4205004fcd/1/wealth_vs_health_lp.doc) (.doc 167 kB). Related teaching resources for this sample lesson include a [worksheet](https://schoolsequella.det.nsw.edu.au/file/df0f97b7-3655-429c-96c9-6d3eb3ffd04f/1/line_best_fit_ws.doc) (.doc 84 kB), [GeoGebra data file 1](https://schoolsequella.det.nsw.edu.au/file/bff787ea-1690-4050-b919-45eb4d1dd9d0/1/GeoGebra_data_set_1.zip) (.zip 4.12 kB) and [GeoGebra data file 2](https://schoolsequella.det.nsw.edu.au/file/fd720508-560c-4c68-8dee-63c93b50f2dd/1/GeoGebra_data_set_2.zip) (.zip 4.35 kB).

Developing a healthy degree of scepticism

The NSW model of pedagogy as specified in the [Quality teaching in NSW public schools](https://schoolsequella.det.nsw.edu.au/file/e44a4408-b7ae-4241-99f7-22241c43273f/1/quality%20teaching%20in%20NSW%20public%20schools%20discussion%20paper.pdf). Discussion paper is fundamentally based on promoting high levels of intellectual quality. Such pedagogy requires students to “organise, reorganise, apply, analyse, synthesise and evaluate knowledge and information”. In recognising that knowledge is constructed and is therefore “open to question”, it requires students to “present or analyse alternative perspectives”.

Across all stages of the mathematics K-10 syllabus, the statistics substrands emphasise the extensive use of statistics in society and challenge students to critically evaluate claims based on statistical evidence. In Stage 5.1, students evaluate the reliability of statistical claims made in the media and in Stage 5.3 they investigate statistical reports and explore how data is used to inform decision-making processes.

The following is a selection of resources that may assist you in developing appropriate units of learning (and a healthy degree of scepticism in your students).

* Review this [lesson idea](http://www.abs.gov.au/websitedbs/CaSHome.nsf/4a256353001af3ed4b2562bb00121564/8809672aaab5ebb8ca25778a00835a16%21OpenDocument) from the Australian Bureau of Statistics
* Explore [Media report 1](http://lrr.dlr.det.nsw.edu.au/Web/activedata/lo/08_misleading_graphs/applets/2393_media_report1/index.html) and [Media report 2](http://lrr.dlr.det.nsw.edu.au/Web/activedata/lo/08_misleading_graphs/applets/2628_media_report2/index.html) learning objects from The Learning Federation
* Browse this [collection of 12 items](http://www.econoclass.com/misleadingstats.html) each with one or more instances of misleading statistics

Where to next?

Discuss

After you have read through the sections of this resource and completed the activities, develop your own lesson plan. This could be done in collaboration with a small team of teachers using a [Lesson study](http://www.aitsl.edu.au/professional-growth/support/classroom-observation-strategies/lesson-study) process. The focus of your lesson could be one of the resources mentioned in the previous sections, or perhaps one of the data sets available on the Australian Bureau of Statistics [Education Services](http://www.abs.gov.au/websitedbs/CaSHome.nsf/Home/Entry%2BPage.es) or [CensusAtSchool](http://www.abs.gov.au/websitedbs/cashome.nsf/Home/Home) websites.