 Year 11 Mathematics Standard

Unit title: MS-S1 Data Analysis 

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Duration: 24 hours

Rationale

Statistics relates to the collection, display, analysis and interpretation of information, or ‘data’. The study of data and statistics is important in developing students’ appreciation of the contribution that statistical thinking makes to decision-making in society, and in the professional and personal lives of individuals. Students need to develop their ability to critically evaluate data, data displays and statistical results. They need to learn how quantitative data is generated, summarised, presented, modelled and interpreted so that useful conclusions can be drawn.

Topic focus

The principal focus of this subtopic is planning and management of data collection, classification and representation of data, calculation of summary statistics for single datasets and their use in the interpretation of data.

Students develop awareness of the importance of statistical processes and inquiry in society.

Within this subtopic, schools have the opportunity to identify areas of Stage 5 content which may need to be reviewed to meet the needs of students.

Prior knowledge required

* Uses statistical displays to compare sets of data, and evaluates statistical claims made in the media MA5.1‑12SP

Language considerations

arithmetic mean

blood alcohol content

box-plots

categorical data

categorical variable

continuous

cumulative frequency graphs

cumulative frequency table

deciles

depreciation

discrete

five-number summary

interquartile range

language considerations:

mean

measures of central tendency

measures of spread

median

modality

mode

nominal

numerical data

numerical datasets

numerical variable

ordinal

outliers

pareto charts

percentiles

population

quartiles

random variable

range

sample

sampling

standard deviation

summary statistics

Outcomes

A student:

* represents information in symbolic, graphical and tabular form MS11-2
* develops and carries out simple statistical processes to answer questions posed MS11-7
* uses appropriate technology to investigate, organise and interpret information in a range of contexts MS11-9
* justifies a response to a given problem using appropriate mathematical terminology and/or calculations MS11-10

Assessment (including formative and summative)

Some strategies for formative assessment could include:

* Reflecting on students’ responses to a class discussion
* Beginning the lesson with a few questions on content from previous lessons before progressing
* Having students write their own questions on a topic or having them write a specific number of questions with the same answer
* [3-2-1 Exit slips](http://www.theteachertoolkit.com/index.php/tool/3-2-1) - http://www.theteachertoolkit.com/index.php/tool/3-2-1
* [Chalk Talk Routine](http://www.santeesd.net/cms/lib/CA01000468/Centricity/Domain/12/VT_ChalkTalk.pdf) - http://www.santeesd.net/cms/lib/CA01000468/Centricity/Domain/12/VT\_ChalkTalk.pdf
* [Red, Yellow, Green Cups](http://www.sstr2.org/Downloads/Cups%20as%20student%20feedback.pdf). Alternatively, students could indicate beside the questions their level of understanding using the letters, R, Y or G. http://www.sstr2.org/Downloads/Cups%20as%20student%20feedback.pdf
* [Mindmaps](https://emedia.rmit.edu.au/learninglab/content/how-create-mind-map) - https://emedia.rmit.edu.au/learninglab/content/how-create-mind-map

Summative Assessment: MS-S1 Data Analysis – Assessment Task

S1.1 Classifying and representing data (grouped and ungrouped)

| Content | Teaching and learning strategies and evidence of learning | Resources |
| --- | --- | --- |
| * describe and use appropriate data collection methods for a population or samples ◊
	+ investigate whether a sample obtained from a population may or may not be representative of the population by considering different kinds of sampling methods: systematic sampling, self-selected sampling, simple random sampling and stratified sampling
	+ investigate the advantages and disadvantages of each type of sampling
	+ describe the potential faults in the design and practicalities of data collection processes, eg surveys, experiments and observational studies, misunderstandings and misrepresentations, including examples from the media
 | Theory:* Use the various graphs on the ‘Statistics how to’ website to identify how graphs can become misleading.
* Discuss and identify key aspects of each type of sampling techniques as well as relevant examples of each (for example; census - The National Census, stratified - national opinion of Malcolm Turnbull of 20-30 year olds, systematic - the number of faulty products per day that come out of a production line)
* The teacher could lead a discussion on the positives and negatives of each technique and its desired purpose (for example; create questions such as ‘How many girls in the class like the colour blue?’ Then talk about who you would ask as well as which techniques you could use and why/why not).

Application:* Students could investigate the most recent Australian census, discussing the faults in the design and practicalities of data collection.
* Students could take samples using each of the sampling techniques
* Students could look at two or more different polls on the same question and compare results
* Students could visit the Galaxy Research and look at the types of polls conducted. Students should consider the size of samples and the use of small samples to make generalisations about how people will and how sometimes these samples are disposed towards a particular viewpoint
* Perform basic class surveys (pets owned, hair colour, transportation to school) based on the various types of sampling.
* Students could create various surveys online via survey monkey or other online survey creators. Questioning could be based around common issues in society or within the school. This could be done after discussing the correct ways to ask survey style questions.
* Students could research pop culture references of sampling techniques for example; the book/movie The Hunger Games represents stratified sample (must be a girl and a boy).

Metalanguage:Using the Living Oxford Dictionary to view word definitions and origins to help create more understanding (key words to be searched could include stratified, census, survey, and so on. or all other words used in the glossary). | * [Misleading Graphs - Real Life Examples:](http://www.statisticshowto.com/misleading-graphs/) http://www.statisticshowto.com/misleading-graphs/
* [2016 Census Overview](http://www.abs.gov.au/websitedbs/d3310114.nsf/Home/Assuring%20Census%20Data%20Quality) (Australian Bureau of Statistics): http://www.abs.gov.au/websitedbs/d3310114.nsf/Home/Assuring%20Census%20Data%20Quality
* [Galaxy Research:](http://www.galaxyresearch.com.au/polling/) http://www.galaxyresearch.com.au/polling/
* [Survey Monkey](https://www.surveymonkey.com/): https://www.surveymonkey.com/
* [Oxford Living Dictionary](https://en.oxforddictionaries.com): https://en.oxforddictionaries.com
 |
| * classify data relating to a single random variable ◊ **Paperclip icon**
	+ classify a categorical variable as either ordinal, eg income level (low, medium, high) or nominal, eg place of birth (Australia, overseas)
	+ classify a numerical variable as either discrete, eg the number of rooms in a house, or continuous, eg the temperature in degrees Celsius
 | Theory:* Use ‘Know, Want, Learned’ (KWL) Graphic Organiser to review student’s background knowledge of categorical and numerical variables.
* If required, students read and summarise information on the types of variables via the ABS (Australian Bureau of Statistics website).

Application:* Given a stimulus, students think of as many random variables as they can, for example; “the colour of cars”. Generate a class discussion to determine whether the variables are categorical (nominal or ordinal) or numerical (discrete or continuous). A discussion regarding the variable ‘shoe size’ is useful as an example of a variable which appears to be numerical but is actually categorical.
* Using the 2016 Australian census, students find examples (about 5 each) of questions that involve nominal, ordinal, continuous and discrete variables.
* In groups, students select a variable, and consider the ways its classification can change, depending on context and how the variable is measured. A Jigsaw group activity may be used to improve student understanding. In the activity student groups may be given a different classification of age (ordinal, discrete, categorical) and they could discuss, by reading the article, how age can be classified in that way. The jigsaw activity then allows students to share their understanding with other students.
* As an extension, students could be given another variable, such as height, and find times when it could be categorised as something other than continuous.

Metalanguage:* Students research the definitions and/or root of terminology, for example; random variable, categorical, numerical, ordinal, nominal, discrete, continuous, quantitative and qualitative.
 | * [Examples of KWL Organiser](https://goalbookapp.com/toolkit/strategy/kwl-chart): https://goalbookapp.com/toolkit/strategy/kwl-chart
* [What are variables?:](http://www.abs.gov.au/websitedbs/a3121120.nsf/home/statistical%2Blanguage%2B-%2Bwhat%2Bare%2Bvariables) http://www.abs.gov.au/websitedbs/a3121120.nsf/home/statistical+language+-+what+are+variables
* [Stimuli can be found at](http://www.101qs.com) http://www.101qs.com/
* [2016 Australian Census can be found at:](http://www.abs.gov.au/ausstats/abs%40.nsf/Lookup/2901.0Main%20Features802011/%24FILE/2011%20Census%20Household%20Form.pdf) http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/2901.0Main%20Features802011/$FILE/2011%20Census%20Household%20Form.pdf
* [An example, with ‘age’ as the random variable can be found at](http://www.theanalysisfactor.com/level-of-measurement-not-obvious/): http://www.theanalysisfactor.com/level-of-measurement-not-obvious/
* An [explanation and examples of Jigsaw activities](https://www.jigsaw.org/) can be found at: https://www.jigsaw.org/
* [Oxford Living Dictionary:](https://en.oxforddictionaries.com) https://en.oxforddictionaries.com
 |
| * review how to organise and display data into appropriate tabular and/or graphical representations **AAM** ◊ **Paperclip icon**  Information and communication technology capability icon Literacy icon
	+ display categorical data in tables and, as appropriate, in both bar charts or Pareto charts
	+ display numerical data as frequency distribution tables and histograms, cumulative frequency distribution tables and graphs, dot plots and stem and leaf plots (including back-to-back where comparing two datasets)
	+ construct and interpret tables and graphs related to real-world contexts, including but not limited to: motor vehicle safety including driver behaviour, accident statistics, blood alcohol content over time, running costs of a motor vehicle, costs of purchase and insurance, vehicle depreciation, rainfall, hourly temperature, household and personal water usage Sustainability icon Civics and citizenship icon
 | Theory:* Show students clear examples of graphs with reasoning and effectiveness of that graph type depending on the types of variables to be displayed as well as common features.
* Watch a short video on selecting the appropriate graph.
* Look through and identify the commonalities and differences between histograms/polygons and cumulative histograms/ogives.

Application:* Use an excel spreadsheet or CreateAGraph to create a variety of charts from data sourced from online (Australian Bureau of Statistics) or collected from and/or by the students.
* Look at CreateAGraph and ask students to identify why only certain values or words may be entered for certain types of graphs.
* Students use the graphical tool on Gapminder to find data to graph and see a visual representation of how to graph different types of data. Students should discuss, for example, how data changes over time and how this change is reflected in the graph. For example, a line graph would be used to display a person’s blood alcohol content over time. A bar chart may be used to display the costs of puchasing a car, registration and insurance. Rainfall may be recorded in a column graph. Students should be given the opportunity to interpret other types of graphical displays for example; sector graphs.
* Use current statistics on road safety/crash analysis to give students the opportunity to construct tables and graphs (for example; overtime analysis of deaths on NSW roads, Pareto charts of causes of accidents, and so on). Use excel or graphing software to plot and create graphs of car maintenance/costs (amount owing on a loan versus value of the car over time). Loan calculators may be effective tools for this activity.

Metalanguage:* Students research the definitions and/or root of terminology, for example; random variable, categorical, numerical, ordinal, nominal, discrete, continuous, quantitative and qualitative, and so on
 | * [Choosing the right graph:](https://www.youtube.com/watch?v=Ka5pGmHJENI) https://www.youtube.com/watch?v=Ka5pGmHJENI
* [CreateAGraph website](https://nces.ed.gov/nceskids/createagraph/): https://nces.ed.gov/nceskids/createagraph/
* [Australian Bureau of Statistics:](http://www.abs.gov.au/) http://www.abs.gov.au/
* [More data sets through “Kaggle”:](https://www.kaggle.com/) https://www.kaggle.com/
	+ Note: The Kaggle website has an extensive number of datasets, but the site should be explored before opening it in class. The amount of data is overwhelming, however, it can be difficult to locate useful data. It may be worth downloading specific datasets and tailoring it to suit the needs of the class.
* [Gapminder tool:](http://www.gapminder.org/tools/#_chart-type=bubbles) http://www.gapminder.org/tools/#\_chart-type=bubbles
	+ The Gapminder site, whilst included here, is more often used to display bivariate data. However, the site does include some examples of single variable data. The website should be explored before opening in class.
* [NSW Road Statistics](http://roadsafety.transport.nsw.gov.au/statistics/index.html): http://roadsafety.transport.nsw.gov.au/statistics/index.html
* [Notes on constructing a Pareto Chart:](http://asq.org/learn-about-quality/cause-analysis-tools/overview/pareto.html) http://asq.org/learn-about-quality/cause-analysis-tools/overview/pareto.html
* [Car loan Calculator](https://www.stgeorge.com.au/personal/personal-loans/calculators/car-loan-calculator) (St George Bank): https://www.stgeorge.com.au/personal/personal-loans/calculators/car-loan-calculator
* [Oxford Living Dictionary:](https://en.oxforddictionaries.com) https://en.oxforddictionaries.com
 |
| * interpret and compare data by considering it in tabular and/or graphical representations **AAM** ◊ **Paperclip icon**  Information and communication technology capability icon Literacy icon
	+ choose appropriate tabular and/or graphical representations to enable comparisons
	+ compare the suitability of different methods of data presentation in real-world contexts, including their visual appeal, eg a heat map to illustrate climate change data or the median house prices across suburbs Sustainability icon Ethical understanding icon Difference and diversity icon
 | Theory:* Students investigate the StatTrek website to identify and create a summary of key aspects of data comparison via different forms of data.
* Students compare different data displays for the same data to determine the suitability of data displays and to identify the key features of different data displays.

Application:* Use the internet and hardcopy resources to collect a variety of graph types with relevant real world contexts (for example; newspaper clippings, yearly analysis/reviews from bank websites, surveys/analysis from the Australian Bureau of Statistics, and so on.). This could be done at the start of the topic, made into a collage and put on the back wall of the room for reference throughout the topic.
* The ABS site has an educational section which encourages students to compare data displays for the same data. Students could collect data, graph it into two different displays, compare the effectiveness of the different displays and discuss the effect of the displays in communicating different ideas.
* Give students access to charts on the change in house prices in different places (for example; Sydney vs Newcastle) and ask students to compare these data sets using correct metalanguage.
* Students could watch videos of scientists and politicians arguing over misrepresentation of data about climate change.
 | * [Link for StatTrek](http://stattrek.com/statistics/charts/compare-data-sets.aspx?Tutorial=AP): http://stattrek.com/statistics/charts/compare-data-sets.aspx?Tutorial=AP
* [Sydney Morning Herald](http://www.smh.com.au): http://www.smh.com.au
* [NAB](https://www.nab.com.au): https://www.nab.com.au
* [ABS](http://www.abs.gov.au/): http://www.abs.gov.au
* [Australian Stock Exchange](http://www.asx.com.au/): http://www.asx.com.au/
* [World Statistics:](http://world-statistics.org/index.php) http://world-statistics.org/index.php
* [Comparing data displays of foot length:](http://www.abs.gov.au/websitedbs/CaSHome.nsf/Home/CaSQ%2B37%2B-%2Bcomparing%2Bdata%2Bdisplays%2Bof%2Bfoot%2Blength) http://www.abs.gov.au/websitedbs/CaSHome.nsf/Home/CaSQ+37+-+comparing+data+displays+of+foot+length
* [House price data in Newcastle](https://www.realestate.com.au/invest/house-in-newcastle%2C%2Bnsw%2B2300) (for other suburbs simply change the suburb/area name or postcode): http://www.realestate.com.au/invest/house-in-newcastle,+nsw+2300
* [Link for MathsLink:](https://mathslinks.net/browse/misleading-graphs) https://mathslinks.net/browse/misleading-graphs
* Brian Cox vs. Malcolm Roberts on Climate change:
	+ [1.5 min snippet](https://www.youtube.com/watch?v=sG8gLt4GChg) https://www.youtube.com/watch?v=sG8gLt4GChg
	+ [29 min full video](https://www.youtube.com/watch?v=qVB-rpC2x3w) https://www.youtube.com/watch?v=qVB-rpC2x3w
 |

S1.2 Summary Statistics

| Content | Teaching and learning strategies and evidence of learning | Resources |
| --- | --- | --- |
| * describe the distinguishing features of a population and sample ◊
	+ define notations associated with population values (parameters) and sample-based estimates (statistics), including population mean , population standard deviation , sample mean  and sample standard deviation
 | Theory* Discussion: sample vs population for example; class vs school, school vs state

Application* Class could together develop SWOT Analysis (Strengths, Weaknesses, Opportunities, Threats - See Resources) or create PMI chart on the different sample types.
* Using existing data sets from the Australian Bureau of Statistics (ABS), United Nations (UN), Google Public Data Explorer or Illustrative Mathematics, students could analyse the differences between samples and populations, using notations to explain findings to other students.
* Informal task – Using 2016 Census QuickStats (See Resources) students can compare population mean and standard deviation (calculated from census data) with the sample mean and standard deviation (calculated from class data of the same topic/issue). For example: Family Composition - Single Parent, Average Children Per Family, Gender, and so on.

Metalanguage* Students can investigate and create a definition table with headings: symbol / name / definition / formula / example (students could also research why these specific symbols are used)
 | * [PMI Chart:](https://lo.unisa.edu.au/mod/book/view.php?id=611321&chapterid=100451) https://lo.unisa.edu.au/mod/book/view.php?id=611321&chapterid=100451
* [SWOT Analysis:](https://research-methodology.net/theory/strategy/swot-analysis/) https://research-methodology.net/theory/strategy/swot-analysis/
* [Random Sampler](http://www.cas.abs.gov.au/cgi-local/cassampler.pl) http://www.cas.abs.gov.au/cgi-local/cassampler.pl
* [Australian Bureau of Statistics:](http://www.abs.gov.au) http://www.abs.gov.au/
* [UNdata:](http://data.un.org/) http://data.un.org/
* [Google Public Data Explorer:](https://www.google.com/publicdata/directory) https://www.google.com/publicdata/directory
* [Illustrative Mathematics:](https://www.illustrativemathematics.org/) https://www.illustrativemathematics.org/
* [Census Quick Stats:](http://www.abs.gov.au/websitedbs/D3310114.nsf/Home/2016%20QuickStats) http://www.abs.gov.au/websitedbs/D3310114.nsf/Home/2016%20QuickStats
* [Census@School:](http://www.abs.gov.au/censusatschool) http://www.abs.gov.au/censusatschool
 |
| * summarise and interpret grouped and ungrouped data through appropriate graphs and summary statistics **AAM** ◊ **Paperclip icon**
	+ discuss the mode and determine where possible
	+ calculate measures of central tendency, including the arithmetic mean and the median (ACMEM050)
	+ investigate the suitability of measures of central tendency in real-world contexts and use them to compare datasets Critical and creative thinking icon Civics and citizenship icon
	+ calculate measures of spread including the range, quantiles (including but not limited to quartiles, deciles and percentiles), interquartile range (IQR) and standard deviation (calculations for standard deviation are only required by using technology)  Information and communication technology capability icon
 | Theory* Students are able to use statistical measures to summarise and interpret grouped and ungrouped data.
* Students should engage in discussion regarding how data is grouped, in regards to continuous data, and the appropriateness of graphs to represent the data.
* Students should discuss the pros and cons of the measures of central tendency and the appropriateness of each, depending on the data.

Application* Class Discussion: Identify known types of graphs used in Maths and Statistics and how they are appropriately or inappropriately used.
* Students conduct survey to collect grouped and ungrouped data in teams. Should carefully choose topic of interest such as “Number of hours spent on social media by teenagers (grouped in hours)” or “Number of hours spent on social media (grouped in age groups)”.
* Discussion should take place regarding the uniformity of the size of groups, and whether the first group should include 0. Discussion should take place in regards to group boundaries for continuous data, for example, if groups are 30 - 34, then 35 - 39, where would the value of 34.5 belong?
* If groups of students create different data sets they can communicate results to each other and discuss effects. Can represent data in various formats – graphs can be created using Microsoft Excel or Create a Graph, or automatically generated using SurveyMonkey or Google Forms (summary graphs). Other areas of interest to investigate: advertising (particularly for mode), sporting events (crowds, hospitality, transport, and so on), suitability of central tendency measure (mean vs median for house prices or national incomes)
* Students can calculate the measures of central tendency: mode, median and mean of the data collected and discuss which is the best measure?
* Measures of spread calculated using the formulas, using handheld calculators, creating calculators in Microsoft Excel (“How To” Guide online) or using online calculators.
* Discussion regarding the benefits of measures of spread. Students need to understand what a small or large standard deviation might indicate. For example, factory production would require small standard deviations to ensure uniformity in the production line. In contrast, a dog shelter may collect data on the weight of all dogs in the shelter. A high standard deviation may indicate a large range in the size of the dogs, justifying the need to stock a variety of care products.

Metalanguage* Students compile a list of key terms, their definitions and an example of how to use them for measures of central tendency: mean, mode, median; and measures of spread: range, standard deviation, IQR, deciles.
 | * [Create a Graph:](https://nces.ed.gov/nceskids/createagraph/) https://nces.ed.gov/nceskids/createagraph/
* [Survey Monkey:](http://www.surveymonkey.com) www.surveymonkey.com
* [Random Sampler](http://www.cas.abs.gov.au/cgi-local/cassampler.pl) http://www.cas.abs.gov.au/cgi-local/cassampler.pl
* [Wolfram | Alpha Widgets – Descriptive Statistics Calculator](http://www.wolframalpha.com/widgets/view.jsp?id=8fa250c1bd10e4a8af4edd3f81b30a5f) http://www.wolframalpha.com/widgets/view.jsp?id=8fa250c1bd10e4a8af4edd3f81b30a5f
 |
| * investigate and describe the effect of outliers on summary statistics ◊ **Paperclip icon**
	+ use different approaches for identifying outliers, including consideration of the distance from the mean or median, or the use of $Q\_{1}-1.5×IQR$ and $Q\_{3}+1.5×IQR$ as criteria, recognising and justifying when each approach is appropriate
	+ investigate and recognise the effect of outliers on the mean and median
 | Theory* Students should develop an understanding of the impact of outliers on data and how the measures of mean and median are impacted. Students, as mathematicians, should not only determine if data is an outlier, through calculation, but should analyse the relevance and cause of outliers.

Application* Students research own data set to use for example; local prices of recently sold houses or could use pre-existing data sets – this can lead to discussions of property implications and how various factors can impact results. Websites such as Gumtree and CarSales.com.au students can specify range therefore influence results.
* Groups of students create data sets, identify outliers and calculate statistics with and without outliers. Student could complete the investigation around the salt content of a range of products available in Australian supermarkets.
* Students could perform in class investigation to collect data and have relevant discussion about the concept of outliers (how they exist, their credibility, and so on) Investigation Examples: students can visit the topdrawer website and study the dataset for cricket. The data, included in a table and in a scatterplot, clearly includes an outlier.
* Students could visit a website for a local cricket association and use data from the last season to determine if an outlier exists. For example, students could visit the Newcastle District Cricket Association website and visit the Hall of Fame section. Students can download various types of data. They can try to predict if dataset has an outlier before then using the formula to determine if the data has an outlier.
* Students could visit the ABS Random Sampler data sampler page and generate datasets with selected characteristics. Students might, for example, generate datasets for the number of hours students averaged per week. They could draw box and whisker plots and use the inter-quartile range formula to identify outliers. Students could calculate the mean and median for the datasets with and without the outliers to assess the impact of the outliers on the measures.

Metalanguage* Use the Living Oxford Dictionary to view word definitions and origins to help create more understanding (key words to be searched could include outliers, variance, correlation).
 | * [Misunderstandings (Outliers)](https://topdrawer.aamt.edu.au/Statistics/Misunderstandings/Misunderstandings-of-averages/Outliers) https://topdrawer.aamt.edu.au/Statistics/Misunderstandings/Misunderstandings-of-averages/Outliers
* [Describing Data Sets with Outliers:](https://www.illustrativemathematics.org/content-standards/tasks/1875) https://www.illustrativemathematics.org/content-standards/tasks/1875
* [Data Reduction: Central tendency](https://topdrawer.aamt.edu.au/Statistics/Good-teaching/Data-reduction/Central-tendency) https://topdrawer.aamt.edu.au/Statistics/Good-teaching/Data-reduction/Central-tendency
* [Activities: Beware of outliers (student worksheet)](https://topdrawer.aamt.edu.au/Statistics/Downloads/Beware-of-outliers-Student-worksheet) https://topdrawer.aamt.edu.au/Statistics/Downloads/Beware-of-outliers-Student-worksheet
* [Activities: Plots and Outliers](http://topdrawer.aamt.edu.au/Statistics/Misunderstandings/Misunderstandings-of-averages/Plots-and-outliers) http://topdrawer.aamt.edu.au/Statistics/Misunderstandings/Misunderstandings-of-averages/Plots-and-outliers
* [Newcastle District Cricket Association link](http://mycricket.cricket.com.au/common/pages/asphost.aspx?id=HBA&entityid=2975): http://mycricket.cricket.com.au/common/pages/asphost.aspx?id=HBA&entityid=2975
* [ABS Random Sampler data generator](http://www.cas.abs.gov.au/cgi-local/cassampler.pl) http://www.cas.abs.gov.au/cgi-local/cassampler.pl
 |
| * investigate real-world examples from the media illustrating appropriate and inappropriate uses or misuses of measures of central tendency and spread (ACMEM056) **AAM** **Paperclip icon**
 | Theory* Students, individually or in groups, research statistics in the media and their influences and present findings to other groups.

Application* As a class, choose a current and relevant topic. Groups are assigned different perspectives of an issue to research and present arguments of opposing opinions using statistics to support their arguments. Once cases presented, a debate/inquiry can occur questioning the statistics used.
* Mock debate: students choose a political party and current issue and communicate ideas using statistics from the party perspective
* Topics of interest could include: incomes (disparity of average wage, using mean vs median, how statistics are influenced by including people such as Australia's wealthiest people), how social issues are represented statistically in various newspapers (with clear political influence) for example; environmental issues
* Research misleading graphs, how misinformation is used to incorrectly inform society (Resources: Misleading Graphs). Errors in misuse of summary statistics can misinform the public. Students could visit the BBC website to identify how the word ‘average’ can be misleading when the data includes outliers.
* The Quora website outlines an activity involving chocolates. Students could participate in the same type of activity, or similar, which requires them to measure a sample and use it to calculate the measures of central tendency and measures of spread. Students should be encouraged to think how a similar concept exists in other types of data collection, such as those involving sampling of public opinion.

Metalanguage* Students investigate the use of language to analyse data.
 | * [Fox News - Misleading Graphs](https://www.businessinsider.com.au/fox-news-charts-tricks-data-2012-11?r=US&IR=T) https://www.businessinsider.com.au/fox-news-charts-tricks-data-2012-11?r=US&IR=T
* [Misleading Graphs](http://www.statisticshowto.com/misleading-graphs/) http://www.statisticshowto.com/misleading-graphs/
* [Misleading Data Resources](http://www.suffolkmaths.co.uk/pages/Maths%20Projects/MisleadingData.htm) http://www.suffolkmaths.co.uk/pages/Maths%20Projects/MisleadingData.htm
* [Link to BBC website:](http://www.bbc.co.uk/skillswise/factsheet/ma38aver-l1-f-distorted-averages) http://www.bbc.co.uk/skillswise/factsheet/ma38aver-l1-f-distorted-averages
* [Link to Quora website:](https://www.quora.com/What-are-good-examples-of-misleading-statistics) https://www.quora.com/What-are-good-examples-of-misleading-statistics
 |
| * describe, compare and interpret the distributions of graphical displays and/or numerical datasets and report findings in a systematic and concise manner **AAM** ◊ **Paperclip icon** Critical and creative thinking icon  Information and communication technology capability icon Literacy icon
	+ identify modality (unimodal, bimodal or multimodal)
	+ identify shape (symmetric or positively or negatively skewed)
	+ identify central tendency, spread and outliers, using and justifying appropriate criteria
	+ calculate measures of central tendency or measures of spread where appropriate
 | Theory* Students can research for graphs individually, create class discussion to analyse the elements of graphs. Students are addressing the concept “What makes a good graph?”

Application* Teachers could facilitate a Jigsaw Strategy Activity (with Home Groups / Experts (See Resources for more strategy information). Students split into groups of 3-5 “Home Groups”, Home Groups move to Expert Groups to become experts on modality / shape, and so on then return to Home Groups to teach information to their Home Groups
* Students can choose a social issue that has improved over time, can discuss trends, influences, how future changes can further improve results. Improvements should have positive perspective when dealing with sensitive issues
* Students can choose a relevant issue, investigate data, present the issue and discuss how changes can be made to improve data/improve social issue for example; mortality rates in indigenous communities, obesity rates of teenagers, immigration data coinciding with political policies
* Chance to discuss relationship between skewness and influence with mean – particularly in relation to the HSC
* Topics of interest: currency rates, financial mathematics, Olympic data/sports, health

Metalanguage * Students develop table or infographic: Shape / Name / Meaning / Uses in the media or in “everyday life”
 | * [Jigsaw Strategy](https://www.jigsaw.org/) https://www.jigsaw.org/
 |
| * construct and compare parallel box-plots **AAM** **Paperclip icon**  Information and communication technology capability icon
	+ complete a five-number summary for different datasets (ACMEM058)
	+ compare groups in terms of central tendency (median), spread (IQR and range) and outliers (using appropriate criteria)
	+ interpret and communicate the differences observed between parallel box-plots in the context of the data
 | Theory* Students learn to create a 5 number summary to produce a box plot.

Application* Students can perform an investigation to compare data for example; differences between gender, year groups, schools
* Data can be derived from secondary sources such as ABS Random Sampler for example; monthly immigration NZ vs AUS
* Parallel Box Plots may compare data between Genders, Year 11 Students over consecutive years, data comparing local schools to national schools. They may compare data between different cricket seasons for a player or for a team.

Metalanguage* Table of definitions/examples of elements of 5 number summaries.
 | * [5 Number Summary Calculator:](https://www.easycalculation.com/statistics/five-number-summary.php) https://www.easycalculation.com/statistics/five-number-summary.php
* [Statistics Calculator: Box Plot:](http://www.alcula.com/calculators/statistics/box-plot/) http://www.alcula.com/calculators/statistics/box-plot/
* [Create Box and Whisker Chart:](https://www.meta-chart.com/box-and-whisker) https://www.meta-chart.com/box-and-whisker
* [ABS Census@School](http://www.abs.gov.au/censusatschool) http://www.abs.gov.au/censusatschool
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Reflection and evaluation: