

Statistical literacy progressions across the senior curriculum [an interpretation 9/2012]

Statistical literacy: having both the ability to critically evaluate statistical material and to appreciate the relevance of statistically based approaches to all aspects of life in general

AS	part of AS91037 Demonstrate understanding of chance and data	AS91266 Evaluate a statistically based report	AS91584 Evaluate statistically based reports
NZ curriculum	Level 6 AO S6-2 Evaluate statistical reports in the media by relating the displays, statistics, processes, and probabilities used to the claims made.	Level 7 AO S7-3 Evaluate statistically based reports: interpreting risk and relative; identifying sampling and possible non-sampling errors in surveys, including polls.	Level 8 AO S8-3 Evaluate a wide range of statistically based reports, including surveys and polls, experiments and observational studies: critiquing causal-relationship claims; interpreting margins of error.
Key ideas in standard	<ul style="list-style-type: none"> Statistical enquiry cycle Reading and interpreting statistical tables, graphs and associated text Analysing statistical investigations Multivariate, bivariate and time series data 	<ul style="list-style-type: none"> Identifying and commenting on features and findings of a survey relevant to the report's purpose: Population measures and variables Sampling methods Survey methods Sampling and possible non-sampling errors Sample size 	<ul style="list-style-type: none"> Statistical enquiry cycle Principles of experimental design Surveys and polls, including potential sources of bias Interpreting statistical inferences Interpreting a wide variety of statistical tables and graphs Analysing a wide variety of statistical situations Critiquing causal-relationship claims Interpreting margins of error
from TKI senior secondary guides	<ul style="list-style-type: none"> Evaluates statistical reports using critical questions. Relates statistical process to claims made. <p>... relies on the use of current media reports.</p>	<ul style="list-style-type: none"> In a media report on a survey or a poll, identifies sampling error and explains the connection among sample, population, sampling variability, and sampling error. In a media report on a survey or a poll, identifies and evaluates, using critical questions (look under the heading critical questions in the work doc below), sampling methods and possible non-sampling errors such as self-selection, non response bias, behavioural considerations. 	<ul style="list-style-type: none"> Identifies the type of study, that is, survey, poll, experiment, or observational study. Draws on understandings of statistical investigations and how the different types of studies are conducted, uses critical questions to evaluate the study, makes a judgment about the claim and justifies it. making informed approximations or rules of thumb to interpret reported margins of error and is linked to confidence intervals. Explains the connections among sample, population, sampling variability, sample size, confidence level, and poll percentages in relation to the reported margin of error. Estimates the margin of error for subgroups of the poll percentages.
Sentence starters	Proble	The purpose of the article is...	The purpose of the report is... The purpose of the survey was... The population of interest is... _____ would be interested in the report because...
	Plan	The data used in the article comes from...	The variables of interest are... The variables were measured using... The sampling method was... which was/n't appropriate because... The survey questions were/n't appropriate because...
	Data	The data is... [categorical or numerical, variables are, how measured]	The data is [categorical or numerical] Sampling errors were... Non-sampling errors were... Missing data were... Accuracy was...
	Analysis	The comments in the article do/don't accurately reflect the data. For example,... The comments do/don't match the graphs/displays because...	The data were analysed with... The statistics are... The data was communicated using... The data was/n't communicated effectively because... A different analysis/interpretation is...
			In addition to the level 7 concepts, Critiquing causal relationship claims requires understanding of: <ul style="list-style-type: none"> Identifying and explaining whether an experimental or observational study has been used When causal claims can be made, and when they can not (well-designed experiments vs observational studies) Experimental design principles e.g. randomisation, double-blind, placebos, control groups Confounding variables Generalisability of the findings Interpreting margins of error requires an understanding of: <ul style="list-style-type: none"> Poll percentages are used to make inferences about the population and the margin of error is needed to account for sampling variability Who is the population that the inferences are being made for The margin of error reported in the media is based on $p = 0.5$ and 95% confidence level The margin of error is roughly the same as $\frac{1}{\sqrt{n}}$ where n is the size of the sample – why? The reported margin of error is pretty good for poll percentages (sample proportions) from 30% to 70%, but too large for other values – why?

Conclusion	Further questions raised by the article are...	The conclusions are/n't likely to be valid because... The claims are/n't communicated clearly. An example is... Further information is needed, such as... The information in the report would be used for... There is doubt about the conclusions because...	<ul style="list-style-type: none"> The reported margin of error cannot be used for poll percentages for sub-groups of the population sampled – why? The margin of error can be estimated using general knowledge about the population e.g. gender The reported margin of error can not be used to compare two poll percentages from two independent samples, or to compare two poll percentages within the same sample The relationships between the margin of error, poll percentage and sample size The margin of error measures the sampling error (or variability) but there are other associated errors i.e. non-sampling errors such as non-response error, etc. The confidence interval gives a range of plausible values for the true population percentage with 95% confidence A 95% confidence interval means that in the long run for only approximately 19 out of every 20 (95%) surveys taken, the confidence interval will contain the true population percentage The structure of a confidence interval → estimate ± margin of error.
Media reports	<ul style="list-style-type: none"> Interpreting information from graph, table, brief text brief article, current media topic of interest to students 	<ul style="list-style-type: none"> Working towards evaluating articles 3 to 4 pages long. Statistically based reports Detailed article or infographic summarising findings of a survey or poll Article should have enough information to enable evaluation of method 	<ul style="list-style-type: none"> Short article or report (up to one page?) with enough information to enable evaluation of method Investigation could be experiment or observational study or survey or poll
Possible criteria for A	<ul style="list-style-type: none"> using a range of appropriate concepts and terms to demonstrate an understanding of statistical literacy and probability. 	<ul style="list-style-type: none"> Identify a purpose of the report Identify and comment on (in context): measures; variables; sampling methods; survey methods; sampling errors; non-sampling errors. Describe the way the survey results are presented and comment on the effectiveness of the presentation. Identify and comment on the findings of the report. 	<ul style="list-style-type: none"> Identify and comment on key features in reports relevant to any conclusions made in those reports. Features include but are not limited to: PPDAC cycle, measures; variables; sampling methods; survey methods; sampling errors; non-sampling errors, margin of error, design and interpretation of polls, experimental design, displays and measures, data cleaning.
Possible criteria for M	<ul style="list-style-type: none"> providing supporting evidence such as summary statistics, probabilities, data values, trends or features of visual displays reference to the context and the population. 	<ul style="list-style-type: none"> Identify and comment on the key purpose of the report with justification Identify and comment on with respect to the purpose of the survey (in context with justification): measures; variables; sampling methods; survey methods; sampling errors; non-sampling errors Describe the way the survey results are presented and comment on the effectiveness of the presentation with justification make relevant comments on the key findings of the report with reference to statistical evidence. 	<ul style="list-style-type: none"> Identify and comment on key features in reports, supporting the comments made by referring to statistical evidence and processes used in reports, relevant to conclusions made in those reports Features include but are not limited to: PPDAC cycle, measures; variables; sampling methods; survey methods; sampling errors; non-sampling errors, margin of error, design and interpretation of polls, experimental design, displays and measures, data cleaning.
Possible criteria for E	<ul style="list-style-type: none"> integrating the statistical and contextual information and knowledge to show a deeper understanding critical reflection on the validity of the processes and conclusions given in contexts involving probability or statistics. 	<ul style="list-style-type: none"> Identify the key purpose of the report and connect it to a wider context Clearly identify and discuss the impact of these on the findings, with reference to the report and the wider context: measures; variables; sampling methods; survey methods; sampling errors; non-sampling errors Discuss the way the survey results are presented and comment on the effectiveness of the presentation, in context including possible improvements Discuss the effectiveness of the report in achieving its purpose, referring to examples from the report. 	<ul style="list-style-type: none"> Integrate statistical and contextual information to assess the quality of reports with respect to conclusions made in those reports. Features include but are not limited to: PPDAC cycle, measures; variables; sampling methods; survey methods; sampling errors; non-sampling errors, margin of error, design and interpretation of polls, experimental design, displays and measures, data cleaning.