MINISTRY OF EDUCATION
TE TĀHUHU O TE MĀTAURANGA

Statistics Learning Matrix

Curriculum Levels 7 & 8

Learning Area Whakataukī:

Kei hopu tōu ringa ki te aka tāepa, engari kia mau ki te aka matua	*Cling to the main vine, not the loose one*

Big Ideas					
Observations can be transformed into data which has whakapapa and is a taonga	**Tāiringa kōrero allows for creativity and exploration, and the discovery of statistical concepts, theories, and models**	**Statistical models are used to explore situations and problems around us**	**Critical thinking, and statistical generalisations, emerge from te hononga of different observations, knowledges, and processes**	**Statistical thinking acknowledges that variation and uncertainty is present and may be quantified and explained**	**In Statistics, wānanga stimulates logical argument, investigation, analysis, and justification, supporting critical evaluation and reasoned conclusions**

Significant Learning

Across all Curriculum Levels, ākonga will…

- reflect on the kaupapa of their own work as well as others', throughout all the work they do.

At Curriculum Level 7, ākonga will…	At Curriculum Level 8, ākonga will… (indicative only)
• recognise that data is a taonga by considering: ○ the cultural and social implications of data acquisition and how this informs its use ○ the whakapapa of data ○ issues of rangatiratanga, ownership, belonging, and sovereignty ○ issues of tikanga, ethics, methodologies, privacy, access, and confidentiality ○ how data can be used to support wellbeing. • make and interpret informal inferences and claims from samples and experiments by: ○ selecting, designing, and using appropriate sampling and data collection methods ○ making informal sample-to-population inferences from random samples for summary and comparison situations, and discussing claims made from these ○ making suggestive inferences based on experiments ○ recognising the limitations of the inference. • develop probabilistic thinking, including the use of modelling and distributions, by: ○ using their lived and learned experience and knowledge to explore uncertainty, variation, and patterns ○ understanding and using risk and relative risk ○ exploring models for data, and using probability distributions such as normal and binomial, and discrete random variables ○ generating data through designing and conducting simulations ○ using representations and key probabilistic concepts. • explore datasets with the potential for creativity by: ○ cleaning and restructuring data, or creating new data structures ○ representing the data in visualisations, such as graphs and infographics ○ looking for potential patterns and relationships ○ creating a narrative from the data ○ making informal conjectures, including informing possible further investigations. At all times at this level of study, learning needs to weave together relevant contextual information with the skills.	• recognise that data is a taonga by considering: ○ the impact of whakapapa on methodology ○ ethical frameworks for data collection and use. • make inferences from samples and experiments by: ○ using appropriate sampling and data collection methods ○ using simulation-based inference approaches such as bootstrapped confidence intervals and randomisation tests ○ building confidence intervals based on the Central Limit Theorem ○ using random allocation in experiments to make causation inferences for paired comparisons and simple proportion-based experiments ○ considering experimental design and the impact on inferences made. • apply probabilistic and distributional thinking by: ○ modelling the probability of an event, including considering the shape of the data distribution and the nature of any model parameters ○ informally testing the suitability of the model ○ perform calculations to verify claims ○ exploring theoretical probabilities, including combined and conditional probabilities. • forecast and make predictions by: ○ finding, using, and assessing appropriate models, including linear regression and time-series ○ measuring the strength of relationships or models. • demonstrate statistical thinking by: ○ evaluating sampling and survey methods (including sampling and non-sampling errors) ○ finding and interpreting margins of error ○ assessing the validity and reliability of results and claims ○ critiquing causal-relationship claims. At all times at this level of study, learning needs to weave together informed contextual knowledge and conceptual development with the skills.

Unpacking the Learning Matrix for Curriculum Level 7 Statistics

This is further detail to help support kaiako in specific areas of the Learning Matrix. Not every section of the LM will be covered in this companion.

At all times at this level of study, learning needs to weave together relevant contextual information with the skills.

Key: *Italicised text* is content that appears in the Learning Matrix, with the standard type giving the further detail.

Recognise that data is a taonga by considering:

- *the cultural and social implications of data acquisition and how this informs its use*
  Consider:
  - the website Te Mana Raraunga has some useful information on this.
- *the whakapapa of data*
  Consider:
  - where has the data come from? For example, a person or group of people, process, or object
  - reasons that the data was gifted, and the permissions granted for future use
  - the timing of the data collection and the relevance for use today.
- *issues of rangatiratanga, ownership, belonging, and sovereignty*
  Consider:
  - who will results be shared with, how will they be shared and how this is planned for?
- *issues of tikanga, ethics, methodologies, privacy, and confidentiality*
  Consider:
  - how all of these are influenced by thinking of data as a taonga
  - anonymity, sovereignty, and data integrity
  - kotahitanga, manaakitanga, and kaitiakitanga
  - how to uphold the mana of anyone who has provided data
  - primary and secondary uses of data and whether these are appropriate, given the whakapapa of the data.
- *how data can be used to support wellbeing.*
  Consider:
  - oranga tonutanga: a future-focused concept from te ao Māori, which refers to continued wellbeing, or creating conditions for descendants to thrive
  - data as a tool that can help or harm communities, depending on how it is used.

Make and interpret informal inferences and claims from samples or experiments by:

- *selecting and using appropriate sampling and data collection methods*
  Consider:
  - what types of data there are
  - sources of variation, including consideration of the variables to be collected, how each variable will be measured, and how each relates to the question of interest
  - data collection and comparison of data collection methods, for example, surveying
  - sample size
  - non-sampling errors

- the design, planning, and use of observational and experimental studies, including questionnaires
- exploring the effect of parameter, sample size and within-sample variation on sampling variation, and why repeatability is important.

- *making informal sample-to-population inferences from random samples for summary and comparison situations, and discussing claims made from these*
  Consider:
  - understanding that the inference is about estimating an unknown parameter, such as means, medians and proportions
  - a graph-based approach to the informal confidence interval. This is the preferred approach in cases where ākonga have access to the data
  - forming and interpreting informal confidence intervals using the following formulae:
    - $ICI\ (parameter)\text{: } estimate\ \pm\ margin\ of\ error$
    - $ICI\ (median)\text{: } median\ estimate\ \pm 1.5 \times \frac{IQR}{\sqrt{n}}$
    - $ICI\ (mean)\text{: } mean\ estimate \pm 2 \times \frac{s}{\sqrt{n}}$
    - $ICI\ (proportion)\text{: } proportion\ estimate\ \pm \frac{1}{\sqrt{n}}$
  - accounting for the probability of a sample occurring by chance
  - informal ("rule of thumb") margins of error and how they are used outside the classroom.

- *making suggestive inferences based on experiments*
  Consider:
  - the likelihood of the results occurring by chance alone, by comparing to binomial (n, p=0.5).
- *recognising the limitations of the inference*
  Consider:
  - the strength and scope of how widely the inference can be used based on the whakapapa of the data and the statistical method.

Develop probabilistic thinking, including the use of modelling and distributions by:

- *using their lived and learned experience and knowledge to explore uncertainty, variation and patterns*
  Consider:
  - how ākonga can bring their experience from outside the classroom to their learning.
- *exploring models for data, using probability distributions such as normal and binomial, and discrete random variables*
  Consider:
  - the shape and the effect of changing the parameters of probability distributions
  - the link between the shape of sample data and properties and characteristics of different probability distributions such as the normal and binomial.
- *generating data through designing and conducting simulations*
  Consider:

- designing and carrying out simple simulations
- using the outcomes of simulations to estimate probabilities and other statistics.

- *using representations and key probabilistic concepts*
  Consider:
  - using representations such as probability trees and two-way tables
  - using key concepts such as informal conditional probability, absolute risk, relative risk, odds, and expected values.
    Note: odds are $\frac{the\ probability\ of\ an\ event\ occurring}{probability\ of\ the\ event\ NOT\ occurring}$ or $\frac{p}{1-p}$
    If the odds of an event occurring are less than 1, the event is less likely to occur than not occur. If the odds of an event occurring are greater than 1, the event is more likely to occur than not occur.

***Explore data sets with the potential for creativity by**:*

- *representing the data in visualisations, such as graphs and infographics*
  Consider:
  - some types of visualisations include but are not restricted to dot plots, box plots, scatter plots, infographics, time series graphs, arrow diagrams.

- *creating a narrative from the data*

  Consider:
  - what the data or display tell us about the wider situation
  - how contextual knowledge supports any trends or relationships seen.