



National Certificate of Educational Achievement  
TAUMATA MĀTAURANGA Ā-MOTU KUA TAEA

## Internal Assessment Resource

### Mathematics and Statistics Level 3

This resource supports assessment against:

Achievement Standard 91583

Conduct an experiment to investigate a situation using  
experimental design principles

**Resource title: Tricky questions**

4 credits

This resource:

- Clarifies the requirements of the Standard
- Supports good assessment practice
- Should be subjected to the school's usual assessment quality assurance process
- Should be modified to make the context relevant to students in their school environment and ensure that submitted evidence is authentic

Date version published by Ministry of Education	December 2012 To support internal assessment from 2013
Quality assurance status	These materials have been quality assured by NZQA. NZQA Approved number A-A-12-2012-91583-01-6189
Authenticity of evidence	Teachers must manage authenticity for any assessment from a public source, because students may have access to the assessment schedule or student exemplar material.  Using this assessment resource without modification may mean that students' work is not authentic. The teacher may need to change figures, measurements or data sources or set a different context or topic to be investigated or a different text to read or perform.

## Internal Assessment Resource

**Achievement Standard Mathematics and Statistics 91583:**  
Conduct an experiment to investigate a situation using experimental design principles

**Resource reference:** Mathematics and Statistics 3.11A

**Resource title:** Tricky questions

**Credits:** 4

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### Teacher guidelines

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The following guidelines are supplied to enable teachers to carry out valid and consistent assessment using this internal assessment resource.

Teachers need to be very familiar with the outcome being assessed by Achievement Standard Mathematics and Statistics 91583. The achievement criteria and the explanatory notes contain information, definitions, and requirements that are crucial when interpreting the standard and assessing students against it.

### Context/setting

This activity requires students to conduct an experiment investigating one type of bias in questionnaire design.

This activity can be adapted to different experimental situations, where the response variable can be identified and there is a range of possible factors that might influence this variable.

Before the assessment, students need to research the context, including details about the variables. Time needs to be set aside for this purpose before the assessment.

Students may be provided with a questionnaire to use for their experiment. However, students need to be able to define their own variables (including modifying the wording of questions) for their experiment.

### Conditions

This activity requires multiple sessions to complete the investigation. Confirm the timeframe with your students including time between the planning and data collection and analysis/conclusion phases for students to review their plan and make minor adjustments to it based on your feedback.

Students are expected to use appropriate technology for example statistical software.

### Resource requirements

Examples of questionnaire bias can be found in Resource A.

### Additional information

None.

## Internal Assessment Resource

### Achievement Standard Mathematics and Statistics

**91583:** Conduct an experiment to investigate a situation using experimental design principles

**Resource reference:** Mathematics and Statistics 3.11A

**Resource title:** Tricky questions

**Credits:** 4

Achievement	Achievement with Merit	Achievement with Excellence
Conduct an experiment to investigate a situation using experimental design principles.	Conduct an experiment to investigate a situation using experimental design principles, with justification.	Conduct an experiment to investigate a situation using experimental design principles, with statistical insight.

## Student instructions

### Introduction

This activity requires you to produce a report describing an experiment investigating questionnaire design bias. You will work individually over a period of <<teacher to insert time and conditions here>> to pose an investigative question, plan, and carry out your experiment, analyse the data from your experiment, make an appropriate formal statistical inference, and write your report.

The quality of thinking demonstrated in your report (including your reflection on the investigative process you have used, and how well you link your discussion to the context) will determine your overall grade.

### Task

Questionnaires are an important tool for collecting survey data and you have probably completed questionnaires yourself. Questionnaires need to be designed very carefully, as the wording and/or order of questions can influence people's responses. This is called questionnaire bias.

Use experimental design principles to investigate one type of questionnaire design bias and write a report describing the investigation.

Use the following steps to investigate the situation and write your report:

1. Research one type of bias in questionnaire design. Resource A provides information about questionnaire bias.
2. Identify the variables you are going to investigate and write an investigative question.
3. Write a plan for an experiment which includes:
  - selecting experimental units
  - determining treatment and response variables

- determining allocation of treatments to experimental units
  - determining data collection and recording methods
  - considering other sources of variation.
4. Submit your investigative question and your written plan to your teacher for feedback and adjust as necessary.
  5. Conduct the experiment. Record the data, making notes about your observations of the data collection and experimental processes. Record any issues that arise.
  6. Write a report containing:
    - your investigative question including the purpose of the experiment and a prediction
    - the plan and the process used to collect the data
    - appropriate displays and summary statistics
    - an appropriate formal statistical inference
    - a conclusion communicating your findings including any reflections about the investigation process
    - an appendix – evidence of how you conducted the experiment, for example, your original plan and any modifications, raw data from your experiment, notes made when conducting your experiment, and the questionnaires used for your experiment.

## Resource A

### *Questionnaire design bias*

The table below provides examples of questionnaire bias, but is not exhaustive. You can research other sources of bias in questionnaire design that could be investigated using an experiment.

<b>Ambiguous questions</b>	Ambiguous questions can lead people to understand the question differently from what was intended. This means their answer could be for a different question from the one intended.
<b>Leading questions</b>	Leading questions use words that guide people towards an answer.
<b>Framing questions</b>	Framing questions may use words that lead people to choose an inaccurate answer.
<b>Formatting of questions</b>	The formatting of questions, in particular how the choices are laid out for people to select from, can influence which ones they choose.
<b>Order of questions</b>	The position an individual question has in the questionnaire can affect the answers that people give.
<b>Suggestive questions</b>	Suggestive questions can influence the answers, particularly when people are not sure about the answer.
<b>Anchoring questions</b>	Anchoring questions (or anchoring bias) can influence the answer to the question that follows the anchor, especially when people are not sure about the answer.