# Are you average? Part 1

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| Year levelStrand(s)Lesson lengthCD Code | Year 8Statistics60 mins[AC9M8ST02](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-7_year-8_year-9_year-10/content-description?subject-identifier=MATMATY8&content-description-code=AC9M8ST02&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick)**,** [AC9M8ST04](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-7_year-8_year-9_year-10/content-description?subject-identifier=MATMATY8&content-description-code=AC9M8ST04&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick) |
| Lesson summary | Students will plan and conduct a statistical investigation to find the average height of students at their school. Students analyse and report on the distribution of their data for the ‘whole’ school drawing conclusions with respect to different sampling techniques and whether methods chosen were fair and considered. |
| Learning intention | * We can understand and evaluate the implications of obtaining data through different sampling methods.
* We apply this knowledge in a real-world context statistical investigation.
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| Success criteria | By the end of this lesson, students can:* explain the significance of different sampling methods
* justify the chosen sampling method for their group's target population
* collect and present data in a coherent manner
* analyse and discuss the data's implications in relation to the average height of students at the school.
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| Why are we learning about this? | Understanding data sampling and its implications is crucial in making informed decisions. Investigating the height of students at their school offers a practical application, making the learning relevant and engaging.  |
| Prerequisite student knowledge and language | It is expected that students have:* a basic understanding of statistics and data sampling
* familiarity with terms: sampling, representative, random choice, population, survey.
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| **Resources** | Teacher’s slides (PowerPoint)Teacher’s notes and examples (Word)Who is Mr Average quiz ([Forms](https://forms.office.com/Pages/DesignPageV2.aspx?subpage=design&token=7e7723b7d5cd4770a0c659b1429239f3&id=muagBYpBwUecJZOHJhv5kTyy9Zy2r5dPgbyJnDy1vyxUNVFPTVIyNkVVUDYxNjVZVzgyQlRYVzFZTC4u))Digital devices (tablets or computers)Deck of playing cards |

Curriculum information

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| Achievement standard | Students conduct statistical investigations and explain the implications of obtaining data through sampling. Students analyse and describe the distribution of data. They compare the variation in distributions of random samples of the same and different size from a given population with respect to shape, measures of central tendency and range.  |
| Content description(s) | Students analyse and report on the distribution of data from primary and secondary sources using random and non-random sampling techniques to select and study samples. ([AC9M8ST02](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-7_year-8_year-9_year-10/content-description?subject-identifier=MATMATY8&content-description-code=AC9M8ST02&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick))Students plan and conduct statistical investigations involving samples of a population; use ethical and fair methods to make inferences about the population and report findings, acknowledging uncertainty. ([AC9M8ST04](https://v9.australiancurriculum.edu.au/f-10-curriculum.html/learning-areas/mathematics/year-8/content-description?subject-identifier=MATMATY8&content-description-code=AC9M8ST04&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick)) |
| General capabilitiesCross-curriculum priority | Numeracy: * Interpreting and representing data ([Level 7](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-8/general-capability-snapshot?subject-identifier=MATMATY8&content-description-code=AC9M8ST04&general-capability-code=N&element-code=NS&sub-element-index=0&sub-element-code=NSIRD&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=2&subjects-start-index=0&view=advanced))

Digital Literacy: * Interpreting data ([Level 5](https://v9.australiancurriculum.edu.au/f-10-curriculum/general-capabilities/digital-literacy/slideout?code=DLIC5&element=1&sub-element=2))

Ethical understanding: * Exploring ethical issues ([Level 5](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-7_year-8_year-9_year-10/general-capability-snapshot?subject-identifier=MATMATY8&content-description-code=AC9M8ST04&general-capability-code=EU&element-code=EURES&sub-element-index=0&sub-element-code=EURESB&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick))

Critical and Creative Thinking: * Draw conclusions and provide reasons ([Level 5](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-7_year-8_year-9_year-10/general-capability-snapshot?subject-identifier=MATMATY8&content-description-code=AC9M8ST04&general-capability-code=CCT&element-code=CCTANA&sub-element-index=0&sub-element-code=CCTANAB&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick))
* Develop questions ([Level 5](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-7_year-8_year-9_year-10/general-capability-snapshot?subject-identifier=MATMATY8&content-description-code=AC9M8ST04&general-capability-code=CCT&element-code=CCTINQ&sub-element-index=0&sub-element-code=CCTINQA&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick))
* Identifying, processing and evaluating information ([Level 5](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-7_year-8_year-9_year-10/general-capability-snapshot?subject-identifier=MATMATY8&content-description-code=AC9M8ST04&general-capability-code=CCT&element-code=CCTINQ&sub-element-index=1&sub-element-code=CCTINQB&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick))
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| Areas of challenge | Some students may:* use sampling methods that affect accuracy and demonstrate underestimating and bias
* think that statistical investigation requires data from the entire population
* believe that statistical investigations always have a clear answer
* have difficulty creating graphs and calculating summary statistics using technology.

To address the areas of challenge, the following suggestions are below. Teachers can: * emphasise the importance of choosing appropriate sampling methods, use examples to demonstrate the impact on accuracy, highlight pros and cons of different methods, and engage students in comparing outcomes with different sampling methods
* explain the difference between population and sample, highlight the impracticality of collecting data from the entire population and provide examples of investigations using samples, for example, market research versus census
* highlight the uncertainty and variability in statistical investigations, explain that conclusions are based on probabilities and can vary with samples, engage students in analysing results with consideration for uncertainty
* use group structures to leverage a wider range of skills and knowledge, source easy guidance videos, use an excel template with pre-coded stats and graphs.
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| Strategies | [Collaborative learning](https://www.mathematicshub.edu.au/plan-teach-and-assess/teaching/teaching-strategies/collaborative-learning/)[Mathematics investigation](https://www.mathematicshub.edu.au/plan-teach-and-assess/teaching/teaching-strategies/mathematics-investigation/) [Explicit teaching](https://www.mathematicshub.edu.au/plan-teach-and-assess/teaching/teaching-strategies/explicit-teaching/) |

Lesson structure

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| Learning hook15 mins | This lesson is one lesson broken into three parts. This is part 1 and focusses on the first and second stages (Understand and Plan) of the [ACARA statistical investigation process](https://v9.australiancurriculum.edu.au/teacher-resources/understand-this-learning-area/mathematics#accordion-b499bacc02-item-d5b69ff97c). Download and use the Teacher’s slides to accompany your teaching of this lesson. Download the Teacher’s notes and examples to familiarise yourself with the materials before planning and teaching this lesson. Note that the lesson is designed to be edited to fit your class and your timetable. You may wish to condense its contents and combine with the next lesson: Are you average? Part 2.**Introduction*** As students enter the room, allocate them into groups for the statistical investigation project. You could use a strategy of visibly random grouping (for example, using playing cards).
* Begin with the [Who is Mr Average quiz](https://forms.office.com/Pages/DesignPageV2.aspx?subpage=design&FormId=muagBYpBwUecJZOHJhv5kTyy9Zy2r5dPgbyJnDy1vyxUNVFPTVIyNkVVUDYxNjVZVzgyQlRYVzFZTC4u&Token=7e7723b7d5cd4770a0c659b1429239f3). This is a 6-question quiz made in Microsoft Forms. Teachers can duplicate the form, select ‘Collect responses’ and ‘Anyone can respond’ and copy and share the link with their students. Alternatively, slide 2 has the questions for the students to consider.
* Explain that a journalist in the UK collected data about who was Mr Average and travelled across the country trying to find a Mr Average person (they did eventually find him!). Note that this survey was conducted, and the article written in 2007, before it was as common as today for individuals to describe themselves as non-binary. Sensitivity and explanation may need to be given around the use of the phrase ‘Mr Average’.
* Initiate a discussion asking which answers they were most confident about and why (slide 3): ‘Which were hardest to guess? Do you believe all these facts about Mr Average are true? How do you think the journalist collected the data? What do you think the journalist meant by Mr Average? Which statistic do you think is the least reliable?’

**Learning hook**Explain to students that the goal of this lesson is to find out the average height of students at their school, and to see whether they themselves are of average height. This lesson focuses only on height, but the activity could be extended so that students collect an overall picture of an average student at the school by undertaking more extensive data collection. If collecting data on the whole school is problematic, this activity could be amended to relate just to their year group. |
| Explore40 mins | Use an [Explicit teaching](https://www.mathematicshub.edu.au/plan-teach-and-assess/teaching/teaching-strategies/explicit-teaching/) approach to explain the five steps in a statistical investigation (Understand / Plan / Do / Consider / Communicate) (Slide4).**Understand**Ask students the question ‘What is the average height of people at our school?’ and ask them to write answers that are too big / too small / their best estimate (slide 5).Clarify the question (are teachers and other staff included?) and give students an opportunity to revise their estimate if they wish. Consult as a group and decide on their group estimate. Record these.**Plan**Ask students to choose (or allocate them) a question to consider and discuss in their group from the following list (slide 6). Allow five minutes, then have each group present their findings.* **How many** people should we measure?
* How should we choose **who** to measure?
* What **other data** should we collect from them?
* What are the **ethical issues** we need to consider when collecting this data?

At this stage, students may raise issues such as small or very large sample size, difficulties collecting data and ethical issues.* The sample size is dependent on the size of the school – the larger the sample, the more representative it will be, but it will take longer to collect. The sample should ensure that students are chosen from different year groups.
* It may be difficult to collect data from all year groups – teachers may need to ‘recruit’ teachers in other faculties to get permission to visit their class during maths time, or students may need to collect data at lunch or recess. Other data collected could include gender, age or year level.
* Ethical issues could include issues around students in wheelchairs or with other physical disability. Students may be sensitive about their height, especially if short, or if they have repeated a school year. Asking about or categorising by gender may be difficult for non-binary and transgender students.

Explain, using slide 7, that in a random sample, everyone is **equally likely** to be chosen. To choose a **simple random sample**:* assign numbers to the entire population
* use a random number generator on a computer or calculator to choose the sample.

Other sampling strategies and allocate the different strategies to different groups to research. Have them use a drawing with stick figures to explain how the sampling technique operates and to highlight any advantages or disadvantages of the method, focusing on whether it will obtain a representative sample (slide 8). Once the pros and cons of the different methods are discussed, the class votes on which method to use to collect the height data for the school.Divide the class in groups of three as follows. * One group works on determining the sample size based on data presented on the composition of the school – how many students per year group? How many girls and boys?
* One group prepares a data collection sheet either on paper or digitally – what data will be collected, for example, height, year group, gender or age? They determine where the data will be collected.
* One group prepares the instructions for collecting the data. Where will they collect the data? Should height be measured to the nearest cm or 5 cm? Should it be entered as 1.68 m or 168 cm? Should they wear or take off shoes? How will they ensure the same students are not included twice?

At the end of the lesson, there should be clear documents that allow all students to know who to collect data from, how to collect and record the data including the heights and other relevant information about the students in the school.  |
| Summary and reflection5 mins | Use the ‘What are the missing words?’ from slide 9 as a summary activity, either with or without the word bank.* In a statistical investigation, we want to learn about the entire **population** of students at our school.
* To do this, we use **sampling** methods to select a smaller group.
* This process should be done in an **ethical** manner, respecting everyone's privacy and feelings.
* To get the most accurate results, the sample needs to be **representative** of the larger group. There are many ways to choose a sample.
* One way is to choose a **random** sample which means every student has an equal chance of being chosen.

Word bank: ethical, population random, representative, sampling**Differentiation** (enable): Word bank can be used for the summary activity.**Differentiation** (enable): Groups and questions can be allocated to support lower achieving students.**Differentiation** (extension): Choice of questions for assessment activity. |
| Assessment | The following suggestion is given for a mid-sequence assessment opportunity.* Reserve time in your lesson to choose any three questions from Questions 1–7 of the downloadable Teacher’s slides to use as an assessment and summary activity; these increase in complexity. Students can answer on mini-whiteboards, on paper, in their workbooks.
* These slides are animated, and the answers are revealed as you click through with each mouse click.
* Note that these questions could be given as a homework activity or completed as an alternative assessment in the next lesson, Are you Average? Part 2.
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