# Are you average? (Part 3)

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| Year level  Strand(s)  Lesson length  CD Code | Year 8  Statistics  55 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)**,** [AC9M8ST03](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=AC9M8ST03&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. |
| 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. |
| 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. |
| **Resources** | Are you average teacher’s slides (PowerPoint)  Are you average template (Excel)  Teacher’s notes and examples (Word)  Assessment rubric (Word)  Digital devices (tablets or computers)  Collated student data |

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 learn to compare variations in distributions and proportions obtained from random samples of the same size drawn from a population and recognise the effect of sample size on this variation. ([AC9M8ST03](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=AC9M8ST03&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/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)) |
| General capabilities  Cross-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)) * Consider alternatives ([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=AC9M8ST03&general-capability-code=CCT&element-code=CCTGEN&sub-element-index=0&sub-element-code=CCTGENB&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick)) |
| 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. |
| 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 hook  10 mins | Access the downloadable Teacher’s slides and Teacher’s notes and example document in the What you need section in the online lesson.  **Introduction**  Begin by showing slide 2 and 3 from the Teacher’s slides to refer to the stage of the statistical investigation process, which is ‘Consider and communicate.’ Explain that students will be analysing and representing their ideas in report form (and to the class if time allows).  **Learning hook**   * Move to slide 4 and ask the questions: What do you notice? What do you wonder? with respect to the images of different graphs shown. * Ask students to write down three things they notice, think and wonder about the graphs shown. * Discuss their responses and write some on the board. These might include trends shown, patterns in the data, missing information, what the data is, or what types of data is shown. * These graphs have been created from a made-up data set. Explain how they could represent many sets of data, such as, favourite pets, food, types of movie, number of siblings for a class (pie chart); temperature or number of visitors in a holiday town (line graph); or scores on a test or timed activity, for example, how many skips in a minute (stem-and-leaf plot). |
| Explore  40 mins | **Consider and communicate**  Ensure all students in the class have access to the full data set collected in Are you Average: Part 2. It is best if you have collated the data before the class has begun. Distribute the downloadable Assessment rubric.  Show slide 5, which explains the main activity. In their groups, students analyse the data and write a brief report to answer the question ‘Who is average at our school?’ This report can be created digitally using a shared platform such as Google Docs or Google Sheets, or on paper. The report should:   * introduce the activity * explain the sampling technique and data collection method used * present at least one graph showing the data collected * calculate and refer to different measures of spread and location. * describe the shape of the data distribution * draw conclusions about the whole population * compare the results with your initial estimate * explain how your findings could be used (who and why would someone want to know about the heights of the students at our school).   Note: examples might include the uniform shop (for ordering the correct size clothes – in which case mode will be useful), the Principal or Deputies (for ordering new furniture and planning room usage for a small room), students (to know if they are above average), a drama teacher (for ordering costumes), a music teacher (for ordering instruments).  Rotate between the groups, offering advice and assistance.  **Differentiation** (enable): provide an Excel template to assist students in graphing and finding measures of spread and centre.  **Differentiation** (extension): students present multiple analyses of the data, for example, by year group and gender. Students can also compare the data with height data from Centers for Disease Control and Prevention (CDC): *Data Table of Stature-for-age Charts*, extracted from [Males, Ages 2–20 Years](https://www.cdc.gov/growthcharts/html_charts/statage.htm#males) and [Females, Ages 2–20 Years](https://www.cdc.gov/growthcharts/html_charts/statage.htm#females). |
| Summary and reflection  5 mins | * Review the five phases of a statistical investigation (slide 2). * One question, one insight (slide 6). Ask students to write down one question they have about the statistical investigation process, and one insight or key discovery that they made during the lesson. This could be about the data, the process or the implications of their findings. Collect the students’ writing or have them email it to you. |
| Assessment | The following assessment opportunities are suggested for this 3-part investigation.  Students work in groups to collate data and record their findings in a report to be assessed. Distribute the assessment rubric for guidance.  Students can present their findings to the class if time allows. |