**Sleepy statistics: Analysis (Part 2)**

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| **Year level**  **Strand(s)**  **Lesson length**  **CD Code** | * 7 * Statistics * 60 minutes * [AC9M7ST02](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-7_year-8_year-9_year-10/content-description?subject-identifier=MATMATY7&content-description-code=AC9M7ST02&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick),[AC9M7ST03](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-7_year-8_year-9_year-10/content-description?subject-identifier=MATMATY7&content-description-code=AC9M7ST03&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** | In this second of two lessons, students represent their acquired sleep data using a back-to-back stem-and-leaf plot and draw conclusions based on statistical analysis.  In the previous lesson, Sleepy statistics: Part 1, students acquire data as they conduct a sleep audit over a two-week period. |
| **Learning intention** | * We are learning how to create and interpret a stem-and-leaf plot and a two-column bar chart (using technology). * We will interpret and use data displays to compare datasets. * We will learn how different bedtime behaviours affect the quantity and quality of sleep and understanding the importance of statistical analysis in real-world data representation. |
| **Success criteria** | By the end of this lesson, students can:   * record and organise data in a table * create a stem-and-leaf plot by hand * use digital tools to create a two-column bar chart * calculate mean, median and range accurately from a stem-and-leaf-plot * analyse and make conclusions to compare two datasets from graphs. |
| **Why are we learning about this?** | We live in a data-driven world, where statistics are everywhere and graphs are a helpful way to summarise and visualise data. Understanding and interpreting graphs is an important skill that allow us to quickly interpret and analyse information in real-world situations.  Understanding sleep patterns is crucial for health and wellbeing. By statistically analysing personal data, we can make informed decisions on daily habits, promoting healthier lifestyles. |
| **Prerequisite student knowledge and language** | It is expected that students have:   * a basic understanding of data representation methods such as tables * an ability to calculate time differences, for example, finding the difference between 9.45pm and 6.50am and converting times in hours and minutes to minutes * an ability to calculate mean, median and range for a dataset * an understanding of place and place value. |
| **Resources** | * Teacher’s slides (PowerPoint) * Frayer model worksheet (Word) * Sleepy statistics bar graph spreadsheet (Excel) * Sleep diaries filled in by students * computers or tablets with access to Excel |

Curriculum information

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| Achievement standard | [By the end of Year 7, students plan and conduct statistical investigations involving discrete and continuous numerical data, using appropriate displays](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-7?view=advanced&strand-selections=MATMAT-statistics_MATMAT-probability&hide-ccp=0&hide-gc=0&detailed-content-descriptions=0&side-by-side=1&strands-start-index=0&subjects-start-index=0). Students interpret data in terms summary statistics. |
| Content description(s) | Students create different types of numerical data displays including stem-and-leaf plots using software where appropriate; describe and compare the distribution of data, commenting on the shape, centre and spread including outliers and determining the range, median, mean and mode. [AC9M7ST02](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-7_year-8_year-9_year-10/content-description?subject-identifier=MATMATY7&content-description-code=AC9M7ST02&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 data for discrete and continuous numerical variables; analyse and interpret distributions of data and report findings in terms of shape and summary statistics. [AC9M7ST03](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-7_year-8_year-9_year-10/content-description?subject-identifier=MATMATY7&content-description-code=AC9M7ST03&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 | **General capabilities**  Numeracy:   * Interpreting and representing data ([PL5](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-7_year-8_year-9_year-10/general-capability-snapshot?subject-identifier=MATMATY7&content-description-code=AC9M7ST02&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=0&subjects-start-index=0&view=quick)) and ([PL6](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-7_year-8_year-9_year-10/general-capability-snapshot?subject-identifier=MATMATY7&content-description-code=AC9M7ST03&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=0&subjects-start-index=0&view=quick))   Digital Literacy:   * Interpret data ([PL5](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-7_year-8_year-9_year-10/general-capability-snapshot?subject-identifier=MATMATY7&content-description-code=AC9M7ST02&general-capability-code=DL&element-code=DLI&sub-element-index=0&sub-element-code=DLIC&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick)) * Select and operate tools ([PL5](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-7_year-8_year-9_year-10/general-capability-snapshot?subject-identifier=MATMATY7&content-description-code=AC9M7ST02&general-capability-code=DL&element-code=DLMO&sub-element-index=0&sub-element-code=DLMOC&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:   * Interpret concepts and problems ([PL5](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-7_year-8_year-9_year-10/general-capability-snapshot?subject-identifier=MATMATY7&content-description-code=AC9M7ST03&general-capability-code=CCT&element-code=CCTANA&sub-element-index=0&sub-element-code=CCTANAA&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick)), * Draw conclusions and provide reasons ([PL5](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-7_year-8_year-9_year-10/general-capability-snapshot?subject-identifier=MATMATY7&content-description-code=AC9M7ST03&general-capability-code=CCT&element-code=CCTANA&sub-element-index=1&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 ([PL5](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-7_year-8_year-9_year-10/general-capability-snapshot?subject-identifier=MATMATY7&content-description-code=AC9M7ST03&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))   **Related subject areas:**  Science ([AC9S7I02](https://v9.australiancurriculum.edu.au/f-10-curriculum.html/learning-areas/science/year-7/content-description?subject-identifier=SCISCIY7&content-description-code=AC9S7I02&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick)), Health and Physical Education ([AC9HP8P10](https://v9.australiancurriculum.edu.au/f-10-curriculum.html/learning-areas/health-and-physical-education/year-7_year-8/content-description?subject-identifier=HPEHPEY78&content-description-code=AC9HP8P10&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:   * think all forms of data representation can be used interchangeably * find keeping consistent data recording difficult * experience difficulty using digital spreadsheets.   The following interventions are suggested. Teacher’s can:   * highlight the purpose and effectiveness of different graphical representations – for instance, asking students what kind of data a stem-and-leaf plot could be effectively used for (categorical data, single/double-digit numerical data) and highlighting how other graphs, such as, pie charts might be a poor choice * check in with students each lesson to remind them to update their sleep diaries and consider emailing parents to remind them to support their children in completing the diary * Model how to input data into software and generate graphs. Spreadsheets are pre-populated with inbuilt calculations in hidden tabs. |
| Strategies | [Mathematical investigation](https://www.mathematicshub.edu.au/plan-teach-and-assess/teaching/teaching-strategies/mathematics-investigation/)  [Questioning](https://www.mathematicshub.edu.au/plan-teach-and-assess/teaching/teaching-strategies/questioning/) |

Lesson structure

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| Learning hook  15 mins | Note: Use the teacher’s slides to complement your lesson.  **Comparing data**   * Begin by asking students to give a thumbs up/down/sideways if they think they got more/less/same sleep in Week 2. Ask them to get out their sleep diaries and explain that they will create two different types of graphs to analyse their data, starting with using a spreadsheet to create a two-column bar graph. * Email or assign the Excel bar graph template and demonstrate to students how to enter their data and to answer the question ‘What patterns does your graph show?’ You can demonstrate this using slide 2 from the teacher’s slides. * Have students enter their data from their sleep diaries into the spreadsheet. They should now have two weeks’ worth. Ensure they save their file, or have them take a screenshot to save and submit later. |
| Explore  35 mins | Move to slide 3, and explain that the second graph type they will use is called a back-to-back stem-and-leaf plot.  Show the students the example of a back-to-back stem-and-leaf plot and ask them what is different and what is similar to the stem-and-leaf plot we saw before. Key points to elicit from the discussion are that:   * each side shows a different dataset, so a back-to-back stem-and-leaf is used to compare two similar datasets * the numbers always increase from the centre outwards.   Have students once again use their data from Week 1 and Week 2 to produce a back-to back stem-and-leaf plot (on paper), and to calculate the mean, median and range for Week 2 (or for both weeks if they haven’t already done this for Week 1). They will need to compare the Week 2 measures with those from Week 1 and answer these questions (slide 4):   * How does your sleep patterns vary across the days of the week? * How did you sleep patterns change between Weeks 1 and 2?   Have students share their findings in pairs and then conduct a group discussion about the students’ sleep patterns. Expected findings might include that students sleep more on weekend versus weekday nights and that there has been some (modest?) improvement in sleep in Week 2.  Next, students find the summary stats calculations in the spreadsheet (slides 5–7) by right clicking on the tab, selecting Unhide and choosing the Summary statistics tab. They should now see the mean, median and range calculations and be able to verify their Week 1 and Week 2 calculations. The teacher can choose to explore the underlying Excel commands with the students by clicking on the pink cells.  Explain that the class will prepare another back-to-back stem-and-leaf plot for the whole-class average (mean) for Week 1 and Week 2 (slide 8). Elicit the highest and lowest values of the whole class (to help decide the scale for the stems). Create a template of the stem on the whiteboard and have students come and write their averages for Weeks 1 and 2 in an unordered back-to-back stem-and-leaf plot.  Students create an ordered back-to-back stem-and-leaf plot for the whole-class data in their exercise books and answer the following questions:   1. Ruby says, ‘there is a lot of variety in the amount of sleep people in our class get.’   State whether you agree or disagree, explaining your answer with supporting summary statistics.   1. Khalid says, ‘We are not getting enough sleep but we can improve it.’   State whether you agree or disagree, explaining your answer with supporting summary statistics. |
| Summary and reflection  10 mins | Lead a whole-class discussion, asking what the students have learned. This can include:   * the benefits or usage of the two different types of graph explored today when comparing datasets * the ease of preparing graphs or making calcualtions using a spreadsheet * the differences between a regular and back-to-back stem-and-leaf plot * how individual data compares to class averages * the health implications of their findings on daily routines and habit. |
| Assessment | The formative assessment task below is an interesting way to evaluate student engagement in the whole investigation and highlight whether they have reached a deeper understanding of the concepts for this lesson.  Students complete a Frayer model for a stem-and-leaf plot. Download the handout and distribute it to students, or ask them to draw up the diagram in their exercise books to complete the task. |