Would you rather …?

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| Year levelStrand(s)Lesson length CD code | Year 10Statistics60 mins[AC9M10ST04](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-10/content-description?subject-identifier=MATMATY10&content-description-code=AC9M10ST04&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=3&subjects-start-index=0&view=quick) |
| Lesson summary | In this lesson, students collect data, creating and analysing two-way tables, by playing the popular game ‘Would you rather…?’ And you get to find out if your students would rather be in a Marvel or DC movie: With great power, comes great responsibility! |
| Learning intention | Students gain knowledge of how to record data in and complete a two-way table. Students understand how to extract data from a two-way table, analysing and describing trends in the data by using percentages and fractions to understand association. |
| Success criteria | By the end of this lesson, students can:collect their own data in a two-way tableextract data from two-way tables answering questions that begin with ‘how many’, ‘what fraction’ and ‘what percentage’extract and describe data in two-way tables using ‘and’ and ‘or’ statements, including exclusive/inclusive or statementsidentify and begin to analyse/explain association between two variables.  |
| Why are we learning about this? | Two-way tables are used extensively to present research and identify links between two possibly connected variables. For example, a company might conduct market research and realise that Product A is particularly popular with an older age group, while Product B appeals to younger customers, indicating that the type of product and age of customers is connected. They can then use that knowledge to target their marketing accordingly. Other uses include public health (disease incidence versus smoking), in education (school high/low performance versus socio-economic status) or even sports science (injuries versus preventative training program).  |
| Prerequisite student knowledge and language | Prior to this lesson, it is assumed that students have:knowledge of tally charts and frequency tablesan understanding of how to change a fraction to a percentage (although this is revised)previous knowledge of two-way tables. (This is tested via a pre-assessment activity.) |
| Resources | Teacher’s slides (PowerPoint)What do you know? worksheet (Word)Would you rather …? investigation worksheet (Word)Squares of paper |

Curriculum information

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| Achievement standard | [Students represent the distribution of data involving 2 variables, using tables and comment on possible association.](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-10?view=quick&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=3&subjects-start-index=0) |
| Content description(s) | Students construct two-way tables and discuss possible relationship between categorical variables. [AC9M10ST04](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-10/content-description?subject-identifier=MATMATY10&content-description-code=AC9M10ST04&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=3&subjects-start-index=0&view=quick) |
| General capabilitiesCross-curriculum priority | **General capabilities**Critical and creative thinkingInterpret concepts and problems ([Level 6](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-10/general-capability-snapshot?subject-identifier=MATMATY10&content-description-code=AC9M10ST04&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=3&subjects-start-index=0&view=quick))Draw conclusions and provide reasons ([Level 6](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-10/general-capability-snapshot?subject-identifier=MATMATY10&content-description-code=AC9M10ST04&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=3&subjects-start-index=0&view=quick))Identify, process and evaluate information ([Level 6](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-10/general-capability-snapshot?subject-identifier=MATMATY10&content-description-code=AC9M10ST04&general-capability-code=CCT&element-code=CCTINQ&sub-element-index=0&sub-element-code=CCTINQB&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=3&subjects-start-index=0&view=quick)) |
| Areas of challenge | * Some students may struggle to differentiate between AND and OR statements and inclusive/exclusive OR statements.
* Students can find difficulties creating and selecting ‘Would you rather …?’ questions or choosing inappropriate questions – perform a web search of ‘Would you rather’ questions and offer a list for students to choose from and employ proactive classroom management strategies.
* Some students have difficulty with time management during student-led tasks. Use a visible timer to help keep students on task and progressing through the activity.
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| Strategies | [Collaborative learning](https://www.mathematicshub.edu.au/plan-teach-and-assess/teaching/teaching-strategies/collaborative-learning/) [Explicit teaching](https://www.mathematicshub.edu.au/plan-teach-and-assess/teaching/teaching-strategies/explicit-teaching/) |

Lesson structure

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| Learning hook20 mins | Note: use the downloadable teacher’s slides to support this lesson. Pre-prepare the lesson by downloading and printing the accompanying worksheets. There are two duplicate ‘What do you know?’ activities per A4 worksheet. **Introduction**Begin the lesson by distributing the ‘What do you know?’ worksheet and have students spend 5 to 10 minutes answering the questions. Note that slides 2 and 3 present the questions and slide 4 presents the answers. Ask students to swap worksheets with a classmates and go through the answers briefly together. Collect the worksheets to review students’ answers to gain an insight into their current knowledge.**Learning hook** (slide 5) Would you rather …? Explain that we are going to play a game called ‘Would you rather…?’ Students choose from one of two options, and they **must** choose one even if they are both unappealing. Have students answer by standing or sitting (for example, option A stand, option B sit) or hands on heads or hips.Ask a selection of questions, for example:* Would you rather … have $1,000,000 now or $10,000 a month for the rest of your life?
* Would you rather … spend all day chilling or being active?
* Would you rather … star in a Marvel or DC movie?
* Would you rather … be the best athlete who ever lived or the best singer?
* Would you rather … spend a day without people or without your phone?
* Would you rather … eat steak every day or ice-cream every day?
* Would you rather … be rich and working in a job you hate or be poor and working in a job you love?
* Would you rather … be on [*Survivor*](https://parade.com/tv/survivor-season-45)or on *The Voice*?
* Would you rather … live at the beach or in the bush?

Ask the students if they think any pairs of questions and answers are related, in that similar groups of people might give the same answers to the questions. For instance:* perhaps people who want to live in the bush are more active, while beach people would rather spend all day chilling?
* perhaps people who want to be the best athlete would rather be on *Survivor*, while those who want to be the best singer would rather be on *The Voice*.

Explain that displaying the answers to two questions in a two-way table can help identify associations and commonalities between two different variables. Go to slide 6. **Two-way tables**Distribute small squares of paper or post-it notes to students and explain you are going to ask them two ‘Would you rather …?’ questions. They need to write the answers to **both** questions on the same piece of paper. The questions need to be closed with two possible answers, for example:* Would you rather … own your own theme park or zoo? Students write ‘theme park’ or ‘zoo’.
* Would you rather … have six months of spring or six months of summer? Students write ‘spring’ or ‘summer’.

Ask the students if they would expect to find any association between these two variables (probably not).Ask the students to form into four groups dependent on students’ answers where students of each group should have written the same answers to both questions. Each group should go to a different corner of the room. Note however it is not necessary for four groups to form if that does not arise.Note that the next part of the lesson can be condensed or explored in more depth based on the findings of the Introduction activity.Display a two-way table on slide 7 (or draw your own) and ask each group in turn:* ‘How many in your group?’
* ‘Where should I write that number in the table?’

Explain that two-way tables sometimes contain a total row and column, and if not, it’s always a good idea to add them.Click the mouse so that the arrows appear and demonstrate how the totals of the rows and columns are calculated by adding down and adding across, including the opportunity to double check calculations by referring to the bottom right corner (for instance, adding down is the same total as adding across).Ask a range of questions to ensure that students understand how to extract the relevant data from the table to answer questions including: how many …?, what fraction …?, what percentage …?, AND and OR style questions. Call on students asking questions such as, ‘Alex, do you prefer a theme park AND summer?’ or ‘Tai, would you answer yes or no if asked if you would rather own a zoo OR prefer summer?’ To identify which groups to include and then link to where the group appears in the table, questions could include:* ‘**How many** students would rather have a theme park?’
* ‘**What fraction** of the students would rather have a theme park?’

Ensure that you explicitly teach the difference between questions that ask, ‘how many’ (answer is a whole number) and ‘what fraction’ (answer is a fraction out of a total). Fraction questions have two steps: finding the whole number (the ‘how many’) to include in the numerator; finding the right total to include in the denominator, which is especially relevant when students study conditional probability.* ‘**What percentage** of the students would rather have a theme park?’

Emphasise that to turn a fraction to a percentage you multiply by 100. Go to slide 7.* ‘**What fraction** of the students would rather own a theme park AND six months of summer?’

Emphasise that an ‘AND’ question means that we are interested in the people who have done BOTH, so we need to look at only one cell in the table to find the numerator of their fraction. * ‘**What fraction** of the students would rather own a theme park OR six months of summer?’

Emphasise that an OR question means that we are interested in the people who have done **one** of the things. By convention, when we say OR it is assumed to be inclusive, that is, we also include people who have done BOTH. In a $2×2$ two-way table, we need to sum three different cells to find the correct numerator. * ‘**What fraction** of the students would rather own a theme park OR summer BUT NOT BOTH?’

An ‘OR’ question needs to clearly state NOT BOTH to be exclusive. For a $2×2$ two-way table this means that they will need to sum two different cells to find the correct numerator. Ask students to review their pre-assessment answers and change them if necessary, before reviewing the answers as a whole class.Repeat the activity with a different set of two ‘Would you rather…’ questions if you feel that your students need more practice creating and extracting data from two-way tables.**Differentiation** (extension): Go further with the following questions, also shown on slide 8.**Changing up the words to go deeper**Conditional probability* What is the probability that a student chosen at random would rather own a theme park, GIVEN that they prefer spring?
* What fraction OF those students who would rather spring, would rather own a theme park?
* What is the probability that a student chosen at random prefers spring, GIVEN that they would rather own a theme park?
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| Explore30 mins | **Would you rather …? investigation**Distribute the Would you rather …? investigation worksheet and explain the following.Students must come up with two ‘Would you rather…?’ questions that they think might show an association and then collect data from the whole class, recording it in a tally chart. Once their tally chart is complete, they turn it into a frequency table (writing the number that corresponds with each tally), adding the totals row and column and then creating a series of questions about their table. They must ensure that their mix of questions includes the key terminology from the lesson:How many …What fraction …What percentage …... would rather …. AND …… would rather … OR …Once they have created their questions, they should swap with a classmate and answer each other’s questions, checking and agreeing upon the answers. It may be helpful for this part of the lesson to use a timer with clear phases. For example:5 minutes to create your two questions and pre-fill your tally chart headers10 minutes to collect class data10 minutes to complete the two-way table and create your questions5 minutes swapping, answering and reviewing questions. |
| Summary and reflection10 mins | Use slide 9 to ask students to think what the words and phrases mean, how they are different, and to make notes in their books about each word and phrase. Point out the two questions: * What have you noticed about the type of data?
* What data best suits a two-way table?

Ask students to contribute their thoughts. The goal is to appreciate that two-way tables are useful when asking two questions or collecting two items of data from a group, but there are only a very limited number of responses (typically two or three) to each question. Generally, this will be categorical data, or possibly discrete numerical data. They are also useful when you think there may be an association between the two variables and you are trying to identify a pattern. |
| Assessment5 mins | The following exit ticket provides an opportunity for assessment. The questions are found in the ‘Would you rather investigation’ worksheet on the final page, which is downloadable from the ‘What you need’ section of the digital lesson.**Exit ticket**The Principal of Smallville School surveyed parents and students on whether the school should keep or scrap the school uniform. The results are included in this two-way table:

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| --- | --- | --- |
|  | Parents | Students |
| Keep uniform | 25 | 5 |
| Scrap uniform | 10 | 60 |

1. Circle the ONE FALSE statement:
2. 35% of the people surveyed were parents.
3. 25% of the people surveyed were parents and want to keep the uniform.
4. 25% of the people surveyed were parents or want to keep the uniform. (This is the FALSE statement.)
5. 40% of the people surveyed were parents or want to keep the uniform.
6. Describe any association you see between these two variables, justifying your answer. –
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