Dice Detectives: Fact Vs Fiction

NEW August 2026

Year level: 5

Approximate number of lessons: 1-2

Learning goals

- engage in chance-based investigations, including those with not equally likely outcomes, by:
    - posing an investigative question
    - anticipating and then identifying possible outcomes for the investigative question
    - generating all possible ways to get each outcome (a theoretical approach), or undertaking a probability experiment and recording the occurrences of each outcome
    - creating data visualisations for possible outcomes
    - describing what these visualisations show
    - finding probabilities as fractions
    - answering the investigative question
    - reflecting on anticipated outcomes

- evaluate others' statements about chance- based investigations, with justification.

Resources

- **Video** - short history
- **Video** on rolling a six
- **Google form (claims about dice)**
- Large paper or a modelling book to record a shared list of ideas.
- A set of data collection sheets for each ākonga, **see Material Masters**.
- Data analysis sheets, one copy to share across groups, **see Material Masters**
- One dice for each ākonga. (Note: Standard plastic dice are preferable if you plan on carrying out the extension activity.)
- Possible extension activity resources: a pyrex jug, water, ice, stirring spoon and a bag of salt.
- Exit tickets, **see Material Masters**, one for each ākonga

Activity - Lesson 1

Introduction

Dice have been around for over 5,000 years. The very first dice were made from sheep bones and were used in ancient Egypt, Mesopotamia, and Rome, not just for games, but to make big decisions and even tell the future. See more on the history of probability in the Probability teachers guide | **Wāhanga | Chapter 2 Tracing the threads of chance: Historical insights for teaching probability**.

A long time ago people played dice games in dusty, dirty streets. The cobblestones were grimy and the dice would get covered in dirt and grit, which could actually change how they rolled. Before a big roll, players started blowing on their dice to clean off the dust and grit. It was completely practical, like blowing dust off your glasses. Over time, people moved their dice games indoors, but kept blowing on the dice anyway, even though there was no dust! Eventually, movies and stories made it look like a special lucky ritual, and people started believing it actually changed their luck. Other claims about dice also developed over time and today there are many things that people do to seemingly create a winning roll of a dice.

This lesson provides ākonga with a context to evaluate other's claims about rolling a single standard dice by undertaking a probability experiment and reflecting on anticipated outcomes.

?PROBLEM:

- Present a short history of dice to ākonga as above. **This** short video (44s) could be used to support discussion. Ask ākonga about the purpose of blowing on the dice. Was it lucky? Did it make the dice more accurate?
- Explore what ākonga already know about dice, where have they seen dice being used before either in real life or within digital media?
- Ask ākonga if they have ever seen someone do something else to a dice to create a lucky roll. Make a shared list of these actions together.

  You may wish to pause the lesson here while you modify the resources to make them responsive to ākonga prior knowledge.

- State that you have found a way to always roll a '6'. Share **this** clip (35s) with ākonga providing them with a few minutes to practise rolling a dice in exactly this way emphasising that each roll is exactly as specified in the video.
- Listen for discussion during the activity about fairness and whether or not this dice is "fair".
- Gather data about ākonga existing beliefs about rolling standard dice. You may like to use or modify a copy of this **google form (claims about dice)** to suit the claims ākonga have made about rolling dice in the shared list.
- Discuss the data that you have gathered, making a summary statement about ākonga perspectives on each claim.
- Pose the investigative question "does the way you roll a dice affect the results?"

PLAN:

- Support ākonga to identify which claims you will investigate and whether you will test each claim at the same time, or allow ākonga to choose which claims they test first individually. Suggested claims are as follows:
    - Claim 1: A six is the hardest number to get.
    - Claim 2: If you roll the dice gently, you will get a low score and if you roll it hard, you will get a high score.
    - Claim 3: Rubbing a dice between your hands will increase the chances of rolling a 6.
    - Claim 4: If you get a six on the first throw, you are less likely to get a six on the next throw.
- Identify the prior knowledge that ākonga have about undertaking a probability experiment. Ideas such as deciding how many times they will do the experiment (how many trials or rolls), what a trial or one repeat looks like of the experiment, how will they record the results of each trial. It is important for ākonga to recall that greater numbers of trials lead to more reliable results.
- Support ākonga to decide how many trials will be carried out, suggestions are on the recording sheets in the material masters.
- For each claim, a fair test is needed. Discuss what makes a test fair.. Create an agreed set of fair testing reminders.

    For example,
    - Keep everything the same except the thing you are testing.
    - Roll the die onto the same flat surface each time.
    - Record every result, do not leave any out.
- Support ākonga to create a recording sheet for each claim keeping their knowledge of probability investigations and fair testing in mind, or you could use the suggested sheets in the Material Masters. If you do utilise the material masters you may need to model how to record as each sheet is slightly different.
- Support ākonga to predict what the data from these trials will look like for each claim creating anticipated outcomes.

DATA:

- Ākonga carry out each investigation recording the data from the probability experiment on the following tables as they roll the dice.

Claim 1: *"A six is the hardest number to get."*			
My name is			
What I will do	Roll the dice 60 times. Each time, record which number comes up by making a tally mark.		
Number rolled		**Tally**	**Total**
1			
2			
3			
4			
5			
6			
Total rolls			
What I found out	*The data shows that...*		

Claim 2: *"Rolling gently gives a low score; rolling hard gives a high score."*			
My name is			
What I will do	Roll the dice 30 times gently (barely flick it). Then roll it 30 times hard (throw it firmly). Record each result as low (1, 2, 3) or high (4, 5, 6).		
Roll type	**Tally of results**	**Low score (1–3) total**	**High score (4–6) total**
Gentle roll			
Hard roll			
What I found out	*The data shows that...*		

Claim 3: *"Rubbing the dice in between your hands makes rolling a 6 more likely."*			
My name is			
What I will do	Roll 30 times WITHOUT rubbing the dice. Then roll 30 times WITH rubbing the dice dramatically before each roll.		
Roll type	**Number of 1s,2s,3s,4s & 5s**	**Number of 6s**	**Total rolls**
Without rubbing the dice			
With rubbing the dice			
What I found out	*The data shows that...*		

Claim 4: *"If you get a six on your first throw, you are less likely to get a six on your next throw."*		
My name is		
What I will do	Roll the dice until a six is achieved. Then roll one more time and record which number comes up by making a tally mark. Repeat this 30 times.	
Number rolled	**Tally**	**Total**
1		
2		
3		
4		
5		
6		
Total rolls		
What I found out	*The data shows that...*	

ANALYSIS:

- Ākonga record a statement about each claim based on the data that they have collected themselves. There is a space for this on each data collection recording sheet from the Material Masters.

  At this point you may wish to stop the lesson and continue the lesson during a second session.

- Kaiako split the class into four groups, one group for each claim.
- Ākonga sort data sheets into piles, one pile for each claim.
- Each group then collates the data for one claim and ponders questions posed on each recording sheet.

    - Group 1/Claim 1 : Ākonga collate the data using the suggested table, see Material Masters, and work out the fraction of times each number on the dice was rolled. They then ponder:
        - Are the fractions roughly equal or not equal?
        - What does this tell you about whether a six is harder to get when rolling a dice?

    - Group 2/Claim 2: Ākonga calculate the grand total of low scores from the dice rolls, see Material Masters, and the grand total of high scores for the dice rolls, for gentle rolls and hard rolls. They then ponder:
        - Is there a difference between the outcomes for gentle rolls and hard rolls of a dice?
        - What does this suggest about whether force affects the result of a roll of a dice?

    - Group 3/Claim 3: Ākonga collate the data from each roll and work out the fraction of times each number on the dice was rolled, see Material Masters. Ākonga compare the data from rubbing and not rubbing. They then ponder:
        - Was there a meaningful difference between rubbing a dice and not rubbing a dice before it was rolled?
        - What does this tell you about rubbing a dice between your hands?

    - Group 4/Claim 4: Ākonga collate data and work out the fraction of times each number on the dice was rolled. They then ponder:
        - What fraction of these rolls had an outcome of 6?
        - Is this close to ⅙?
        - What does this suggest?

- Kaiako support ākonga to share their findings leading discussion with the wider class, using the questions posed on each sheet and stated above as prompts.

CONCLUSION:

- Review both the google form data and the anticipated outcomes of ākonga through discussion.
- Support ākonga to discuss their findings using the following prompts,

    - How do your anticipated outcomes match the experimental outcomes?
    - Which set of experimental outcomes (or claim) surprised you the most? Why?
    - Could your results have been different if you had rolled more times? Why?
    - If a friend told you that rubbing a dice helps to roll a 6, what would you say to them now?
- Support ākonga to answer the investigative question, “Does the way you roll a dice affect what you roll?” providing justifications based upon the data that they have found.
- Emphasise the big idea that all outcomes are equally likely. Explanation in teacher notes.
- Return to the introduction. Did blowing on a dice affect how it rolled back when games were played in dirty streets and dice would be covered in grime and dirt? Does blowing on a dice affect a dice rolling today?
- Ask ākonga to record their thoughts briefly on an exit ticket, see material masters. This provides a brief assessment of this lesson.

Exit ticket — Dice Detectives: Fact Vs Fiction

Answer before you leave

Question

Based on today's experiment, which of the following best explains why rubbing the dice and rolling hard did not change the results?

A Each roll is a separate, random event. Past rolls and how you throw don't affect the outcome.
B We didn't roll enough times, more rolls would have shown the difference.
C The dice were weighted, so the rubbing cancelled out the effect.
D Rolling hard makes the dice land differently, but only sometimes.

Explain your thinking in one sentence:

Name: _____ Date: _____

Notes for teachers

- This lesson is designed as one chunky lesson but really needs to be delivered in three short sessions. The first is a quick intro, possibly a discussion before playtime, which would then give you time to tweak the resources to suit ākonga prior knowledge. The second is about planning and data gathering, and the third is about analysis and drawing conclusions. This third part could also include the extension below.
- Rolling dice can be a particularly noisy lesson. A suggestion is for dice rolls to occur on carpet. You might agree to make ‘all rolls will occur on the carpet’ part of your fair testing reminders.
- This investigation rests on the big idea that when you roll a fair dice every number has exactly a 1 in 6 chance of coming up every single time. It does not matter how hard you roll, whether you blow on it, or what happened on the last roll. The dice has no memory, and luck is not real. All six outcomes are equally likely.
- Sometimes we come across dice that are weighted, such as those found in toy magic boxes. There are countless videos online about how to weight a dice if you are interested. However, sometimes we find weighted dice in our maths trolleys too. If you do come across a dice that is not

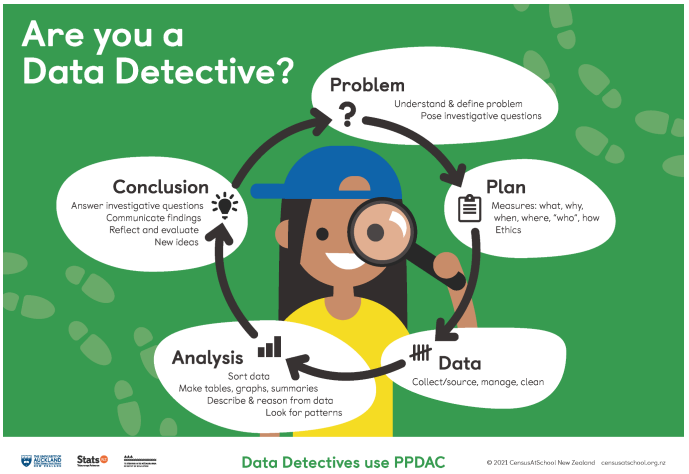
providing equally probable data it may be interesting to test it as an extension activity as below.

Extension:

Testing a possibly weighted dice.

Dissolve as much salt as you can into two cups of water. Allow the water to cool, adding ice cubes can help here but keep in mind this will also change the salt/water ratio. Once cool enough to touch, float the dice in the water. Spin the dice and watch which number appears as facing upwards. Spin multiple times, if this number is always the same number the dice is weighted, if this number changes and provides a range of outcomes then this dice can be deemed fair.

Please note this extension works with plastic standard dice. Other dice such as wooden cubes are too dense for this experiment to work.



https://new.censusatschool.org.nz/resource/data-detective-poster/

Dice Detective:Fact Vs Fiction student materials

Resource list with preparation

Resource	Preparation required	Approx numbers
Student recording sheets for data collection	Print onto paper double sided	One set for each ākonga
Data analysis sheets	Print onto paper double sided	One copy to share across groups
Exit tickets	Print onto paper and cut up	One for each ākonga

Student Recording Sheets for Data Collection (one each per student).

Claim 1: *"A six is the hardest number to get."*			
My name is			
What I will do	Roll the dice 60 times. Each time, record which number comes up by making a tally mark.		
Number rolled	**Tally**	**Total**	
1			
2			
3			
4			
5			
6			
Total rolls			
What I found out	*The data shows that...*		

Claim 2: *"Rolling gently gives a low score; rolling hard gives a high score."*			
My prediction	*I think... (circle one) This is true / It makes no difference / Not sure*		
What I will do	Roll the dice 30 times gently (barely flick it). Then roll it 30 times hard (throw it firmly). Record each result as low (1, 2, 3) or high (4, 5, 6).		
Roll type	**Tally of results**	**Low score (1–3) total**	**High score (4–6) total**
Gentle roll			
Hard roll			
What I found out	*The data shows that...*		

Claim 3: *"Rubbing the dice in between your hands makes rolling a 6 more likely."*			
My name is			
What I will do	Roll 30 times WITHOUT rubbing the dice. Then roll 30 times WITH rubbing the dice dramatically before each roll.		
Roll type	**Number of 1s,2s,3s,4s & 5s**	**Number of 6s**	**Total rolls**
Without rubbing the dice			
With rubbing the dice			
What I found out	*The data shows that...*		

Claim 4: *"If you get a six on your first throw, you are less likely to get a six on your next throw."*		
My name is		
What I will do	Roll the dice until a six is achieved. Then roll one more time and record which number comes up by making a tally mark. Repeat this 30 times.	
Number rolled	**Tally**	**Total**
1		
2		
3		
4		
5		
6		
Total rolls		
What I found out	*The data shows that...*	

Data Analysis Sheets (one set per class).

CLAIM 1: *"A six is the hardest number to get."*

CLAIM 1 DATA COLLATION — CLASS RESULTS							
Student Name	1s	2s	3s	4s	5s	6s	Total Rolls
CLASS TOTALS							

Calculate the fraction of the total number of rolls for each dice outcome.

Fraction = The number of rolls ending in that outcome / total number of rolls altogether.

Dice Outcome	1	2	3	4	5	6
Fraction of total number of rolls.						

CLAIM 1: *"A six is the hardest number to get."*

Questions to ponder…..

Are the fractions roughly equal or not equal?

What does this tell you about whether a six is harder to get?

Is this outcome what you anticipated?

CLAIM 2: *"Rolling gently gives a low score; rolling hard gives a high score."*

CLAIM 2 DATA COLLATION — CLASS RESULTS				
	GENTLE ROLL (30 rolls)		HARD ROLL (30 rolls)	
Student Name	Low Score (1–3)	High Score (4–6)	Low Score (1–3)	High Score (4–6)
CLASS TOTALS				

CLAIM 2: *"Rolling gently gives a low score; rolling hard gives a high score."*
Questions to ponder…..

Is there a difference between gentle rolls and hard rolls?

What does this suggest about whether force affects the result of a throw?

Is this outcome what you anticipated?

CLAIM 3: *"Rubbing the dice in between your hands makes rolling a 6 more likely."*

CLAIM 3 DATA COLLATION — CLASS RESULTS				
	WITHOUT RUBBING (30 rolls)		WITH RUBBING (30 rolls)	
Student Name	1s, 2s, 3s, 4s & 5s	6s	1s, 2s, 3s, 4s & 5s	6s
CLASS TOTALS				

Calculate the percentage of throws with an outcome of 6:

$$\frac{Class\ total\ number\ of\ throws\ with\ an\ outcome\ of\ 6}{Total\ number\ of\ throws\ altogether}$$

Percentage of throws with an outcome of 6 =

$\frac{1}{6}$ = 0.16666666

CLAIM 3: *"Rubbing the dice in between your hands makes rolling a 6 more likely."*

Questions to ponder…..

Was there a meaningful difference between rubbing a dice and not rubbing a dice?

What does this tell you about rubbing a dice between your hands?

Is this outcome what you anticipated?

CLAIM 4: *"If you get a six on your first throw, you are less likely to get a six on your next throw."*

CLAIM 4 DATA COLLATION — CLASS RESULTS							
Student Name	**1s**	**2s**	**3s**	**4s**	**5s**	**6s**	**Total Trials**
CLASS TOTALS							

Calculate the fraction of the total number of rolls for each dice outcome.

Fraction = The number of rolls ending in that outcome / total number of rolls altogether.

Dice Outcome	1	2	3	4	5	6
Fraction of total number of rolls.						

CLAIM 4: *"If you get a six on your first throw, you are less likely to get a six on your next throw."*

Questions to ponder…..

What fraction of these rolls had an outcome of 6?

Is this close to ⅙?

What does this suggest?

Is this outcome what you anticipated?

Exit Tickets

Exit ticket — Dice Detectives: Fact Vs Fiction

Answer before you leave

Question

Based on today's experiment, which of the following best explains why rubbing the dice and rolling hard did not change the results?

A Each roll is a separate, random event. Past rolls and how you throw don't affect the outcome.
B We didn't roll enough times, more rolls would have shown the difference.
C The dice were weighted, so the rubbing cancelled out the effect.
D Rolling hard makes the dice land differently, but only sometimes.

Explain your thinking in one sentence:

Name: _____ Date: _____

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Answer before you leave

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