# Prediction palette

Students begin by making a prediction of the colour inside their chocolate. Throughout the lesson, they collect data and discuss strategies to improve their predictions. The difference between dependent and independent events is also discovered.

Students have the option to use at least one digital device per pair to interact with a class spreadsheet and/or Desmos during this lesson.

## Visible learning

The Spreadsheet Prediction Palette accompanies this lesson. The password to edit the spreadsheet is ‘nswdoe’.

### Learning intentions

* To be able to use data to improve predictions.
* To understand the difference between dependent and independent events.

### Success criteria

* I can collect data for an experiment in a frequency table.
* I can use data to improve my strategy when making a prediction.
* I can describe the difference between dependent and independent events.
* I can identify dependent and independent events.

### Syllabus outcomes

A student:

* develops understanding and fluency in mathematics through exploring and connecting mathematical concepts, choosing and applying mathematical techniques to solve problems, and communicating their thinking and reasoning coherently and clearly **MAO-WM-01**
* solves problems involving probabilities in multistage chance experiments and simulations **MA5-PRO-C-01**

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## Activity structure

### Launch

1. Show students the video ‘Milly's Amazing Ability to Guess Clinker Colours’ (2:59) ([bit.ly/Amazingability](https://bit.ly/Amazingability)).
2. After watching the video, pose the following questions for students to Think-Pair-Share ([bit.ly/thinkpairsharestrategy](https://bit.ly/thinkpairsharestrategy)):
* Why was Milly's guessing ability surprising?
* If you guessed 3 times, how many times would you expect to be correct?
* Is there a strategy you could use to guess correctly?
1. Select non-volunteer students to share some of their discussion with the whole class.

### Explore

#### Class predictions

##### Equipment

* 1 chocolate coated coloured candy (with centres green, yellow or pink) per student

Note any allergies within your class.

##### Method

1. On a whiteboard or similar, set up a table like the one below to record results.

Table 1 – record of correct and incorrect predictions

|  |  |
| --- | --- |
| Number of correct predictions | Number of incorrect predictions |
|  |  |

1. Give each student in the class a chocolate.
2. As a class, ask each student to take turns guessing the colour of the centre of their chocolate, either green, yellow or pink. Once they have guessed, they then take a bite into their chocolate to see if they are correct or incorrect (they can break the chocolate open if they prefer not to eat). One student can be selected as the results recorder. They will be tallying the results of the number of correct and incorrect predictions on the board.

During this whole class activity, students should be encouraged to discuss and make comments on each student’s prediction. For example, “I wouldn’t predict green, since there have just been 2 greens in a row.”

Each student could also be asked to give reasons for their predictions. For example, “I chose yellow since there hasn’t been a yellow in a while.”

1. Once all students have made their predictions and the total correct or incorrect guesses has been recorded, leave this table displayed for the entirety of the lesson.
2. Have a class discussion using prompting questions that may include:
* Do you think you are more likely to guess correctly or incorrectly if you are first to guess or last to guess? Give reasons why.
* Does it seem like there is the same number of each colour? If not, which appears to be the most common?
* Is there a strategy you can use to correctly guess the colour more often?

A similar activity can be run with your class using a similar coloured treat.

Instead of guessing the colour inside the chocolate, students can close their eyes and guess the colour they will draw from a bag. To mimic this activity, the sample space should consist of 3 colour choices.

If chocolates cannot be used for this activity, the Desmos activity ‘What colour should I guess?’ ([bit.ly/ColourGuess](https://bit.ly/ColourGuess)) simulates the experience.

Before starting this activity, you will need to set up a Desmos classroom ([bit.ly/desmosclassroomstrategy](https://bit.ly/desmosclassroomstrategy)) and use the pacing feature to restrict the students to slides 1–5. See the link for more information on how to use the pacing feature ([bit.ly/DesmosConversations](https://bit.ly/DesmosConversations)).

#### Collecting data

##### Equipment

* Packet(s) of chocolate coated colour centred candy (green, yellow or pink) split into small bags of 6–10 chocolates. Each group of 3 students will need a bag and the number of chocolates in each bag should be consistent for each group.
* *Prediction palette* spreadsheet

The Desmos activity ‘What colour should I guess?’ ([bit.ly/ColourGuess](https://bit.ly/ColourGuess)) also simulates this experience.

##### Method

1. Assign students into visibly random groups of 3 ([bit.ly/visiblegroups](https://bit.ly/visiblegroups)) and give each group a small bag of chocolates.
2. Ask each group to consider the whole-class activity and make a prediction on what they think will be the most common colour to appear. Each group is to record this and write down at least one reason for their choice.
3. Each group is to bite or break each chocolate in their bag and record the results of the colour using the *Prediction Palette* spreadsheet. See Appendix A ‘Using the spreadsheet’ for tips on how to share spreadsheets with a class. Be sure to assign a number to each group so they know which sheet to complete.
4. The spreadsheet requires students to record the frequency of each of the 3 colours in their packet and identify the most common colour in their packet. Encourage groups to analyse the column graph produced within the spreadsheet and to explore other graphical representations within the spreadsheet.
5. Once each group has recorded the colours in their bag, ask each group to use their data to develop a new strategy to increase their chances of predicting the correct colour chocolate.

For example, students may decide to always choose green if the frequency for green was highest or only choose yellow or pink if these colours had the higher frequency.

1. Conduct a class discussion. Some prompting questions could include:
* Was your group’s prediction strategy correct?
* How might your group’s data change your strategy in guessing the most common colour chocolate?
* Do you have enough data to improve your strategy?
* Would additional data help improve your strategy and why?
* If predicting the colour each time, what might impact your prediction on colour choice?
1. Direct students to the final tab in the spreadsheet which contains the class data.
2. Give students time to discuss the whole-class data within their group. Students could discuss the following prompting questions:
* How does each group’s data compare?
* From each group’s graph, was the most common colour consistent with the whole class data?
* How might the class data improve your strategy of correctly predicting the colour of the chocolate?
* Could any group’s data be described as an outlier?
* If this experiment was repeated, would the data look the same?
* After groups have had some time to discuss, initiate a sharing of ideas and reasoning using the Pose-Pause-Pounce-Bounce question strategy (PDF 557KB) ([bit.ly/posepausepouncebounce](https://bit.ly/posepausepouncebounce)).

### Summarise

1. Explain to students that they are going to test their strategy using the data collected by the class using a simulation.

Repeated trials of a simulation were explored in the Stage 4 outcome MA4-PRO-C-01, although students may need to revise this term.

The NESA Glossary describes a simulation as a re-creation of random phenomena used to collect probability data through either physical or virtual manipulatives such as spinners, coins and cards or computer-generated simulations which can be performed many times (NESA 2022).

1. Explain to the students that you are going to use a virtual (or physical) dice ([mathigon.org/polypad#random](https://mathigon.org/polypad#random)) to simulate the chocolates.
2. Ask students to consider how a regular dice could be used to simulate the colours of the chocolate. Students should be encouraged to reflect on the class data when determining this.

A suggested option is, if a 1 or 2 is rolled it represents a yellow chocolate, if a 3 or 4 is rolled it represents a pink chocolate and if a 5 or 6 is rolled it represents a green chocolate. This is assuming that each bag had approximately an even number of each colour.

1. Have students recall their strategy for choosing the correct chocolate as they will be testing this strategy.
2. Use the virtual dice to simulate 10 chocolates, each time having the class predict the colour that it will be prior to the dice being rolled, using their strategy. Record the results in a frequency table.

This can be done using the virtual dice on Polypad. Once you have the virtual dice, select **Tabulate** and a frequency table will appear and automatically record the results.

1. Ask the class to consider:
* Did their strategy work?
* Was the previous data collected helpful with making predictions?
1. Repeat the simulation of 20 chocolates, each time having the class predict the colour that it will be prior to the dice being rolled. Record the results in a similar way.
2. Ask the class to consider and discuss the following:
* How do the results compare to the previous simulation of 10 dice rolls?
* Did your strategy improve with a higher number of dice rolls?
* Was the previous data collected helpful in making predictions each time?
* How is this experiment different from the chocolate experiment?
* Is this simulation fair?
* Is this simulation an accurate representation of a bag of chocolates?

The aim here is for a student to recognise that this simulation is different to their previous experiment. As with the chocolates experiment, their strategy could change based on what has already been pulled out. Whereas with the simulation, the probability is the same each turn. Students may need some further questioning to come to this realisation. Depending on the class data collected.

1. Clearly define the terms below with students, using the NESA Glossary definitions (NESA n.d.).

A **dependent event** is one that relies on another event to happen first. One event influences the probability of another event.

Two events are **independent** if knowing the outcome of one event tells us nothing about the outcome of the other event.

1. Ask students to discuss in a Think-Pair-Share what type of events the chocolate experiment and dice simulation were, either dependent or independent.
2. Once students have had time to consider their answers, have a class discussion using non-volunteer students.

The dice simulation is an example of independent events, because knowing the outcome of one dice roll tells us nothing about the outcome of the next dice roll. The chocolate experiment could be argued to be either dependent or independent, because it is unknown when opening a bag of chocolates how many of each colour is in the bag. Students should be encouraged to consider their class data and may conclude that it is mostly an example of dependent events, although you can never be certain. Despite thinking the previous selection of colours influence our predictions, we can never be certain that each bag contains a specific number of pink, yellow or green chocolates.

### Apply

#### Equipment

* 2 packets of chocolate coated colour centred candy (green, yellow or pink), or at least enough for 1 per student

#### Method

1. Students will now repeat the initial experiment using their strategy to see if they can improve on how many correct guesses there are in the class.
2. Construct a second table on the board like the one below.

|  |  |
| --- | --- |
| Number of correct predictions | Number of incorrect predictions |
|  |  |

1. Walk around the room giving each student in the class a chocolate. When a new packet is opened, continue handing out chocolates and announce it to the entire class that that student is getting a chocolate from a new packet.
2. As a class, ask each student to take turns guessing the colour of the centre of their chocolate, either green, yellow or pink. Once they have guessed they then take a bite into their chocolate to see if they are correct or incorrect (they can break the chocolate open if they prefer not to eat). The result is then recorded in the table, using a tally.
3. When it is time for the student who had the first chocolate from the new packet to make a prediction, draw attention to this. For example, they may predict pink since there hasn’t been pink in a while. As the teacher you can respond with something like, are you sure since your chocolate is from a new packet. Encourage other students from the class to discuss this.

This discussion has the option of exploring mutually exclusive and non-mutually exclusive events which are Path content from the outcome MA5-PRO-P-01.

1. Once all students have made their prediction and it has been recorded, have a final class discussion on how students have used data to improve their predictions over the course of the lesson, using prompting questions that may include:
* Did the data collection activity improve predictions?
* Did knowing that each chocolate could be dependent on the previous selections improve predictions?

## Assessment and differentiation

### Suggested opportunities for differentiation

* Some students may benefit from revising statistical concepts such as frequency, mode and outlier.
* As this lesson includes many activities that have no incorrect answers and is subject to opinion, all students should be able to make an attempt.
* Challenge students to compare 2 different strategies and determine which one they believe may be most effective.
* In the simulation activity, students could be extended to conduct more repeated simulations and be asked to compare each of those. For example, 100 rolls and then 200 rolls.
* Throughout the lesson, students should be challenged to make connections with prior learning from the Stage 4 outcomes MA4-PRO-C-01, MA4-DAT-C-01 and MA4-DAT-C-02.

### Suggested opportunities for assessment

* Monitor responses in class discussions to check for student understanding.
* Students will demonstrate their working mathematically skills during the class discussions when they reason and justify their strategies.
* Some students may require some prompting to explain and justify their strategy.
* If using the Desmos classroom activity, the teacher dashboard can be used to monitor student progress.

### Appendix A

#### Using the spreadsheet

Ideally, students will need shared access to the spreadsheet to be able to collate the results for the class. If this is not possible, the teacher can display a copy of the spreadsheet and students can enter their results or read out their results for the teacher to enter.

##### Sharing spreadsheet files with your class

##### ****Whole-class activities****

Cloud storage is most suitable when you want your whole class to be entering and viewing data in the one spreadsheet file.

1. Cloud storage – Google Drive.

Visit <https://t4l.schools.nsw.gov.au/resources/professional-learning-resources/google-resources/google-drive.html> to watch a short video explaining how to [share Google Drive files with others (0:57)](https://t4l.schools.nsw.gov.au/resources/professional-learning-resources/google-resources/google-drive.html).

1. Cloud storage – One Drive.

Visit <https://t4l.schools.nsw.gov.au/resources/professional-learning-resources/microsoft-resources/microsoft-onedrive.html> to watch a short video explaining how to [share One Drive files with others (1:11)](https://t4l.schools.nsw.gov.au/resources/professional-learning-resources/microsoft-resources/microsoft-onedrive.html).

## References

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