YuMi Deadly Maths

Year 6 Teacher Resource:

SP – Loaded dice

Prepared by the YuMi Deadly Centre
Faculty of Education, QUT

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YuMi Deadly Maths Year 6 Teacher Resource: **SP – Loaded dice**

ACKNOWLEDGEMENT

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Year 6 Statistics and Probability

Loaded dice

Learning goal	Students will conduct chance experiments, record data into a frequency table and represent data using a column graph.
Content description	Statistics and Probability – Chance • Conduct chance experiments with both small and large numbers of trials using appropriate digital technologies (ACMSP145)
Big idea	Probability – chance vs certainty
Resources	Maths Mat, cardboard digits 1–12, two dice (different colours), Unifix cubes, frequency graphs (12 columns), 12 coloured pencils, chalk, digital tools, streamers of two colours, spreadsheets

Reality

Local knowledge	Discuss the different games of chance that students have played, e.g. Snakes and Ladders, Ludo, card games, Monopoly. Describe the chance elements.
Prior experience	Check students' understanding of chance terminology, construction of frequency tables and possible outcomes.
Kinaesthetic	Extend the Maths Mat by including a column for digits 1 and 12 on each of the vertical sides. Place the digits 1–12 along the bottom row of the mat. Form two teams of 12 students; have another student designated as the "recorder" of results. Chance experiment: Students take turns to throw the two dice. The numbers thrown are added and the student goes and stands in one square of that column; e.g. if a 3 and a 4 are thrown, one student stands on a square in column 7. After all 24 students have thrown the dice, the recorder adds a Unifix cube to a sheet of paper (marked and numbered into 12 columns) for each sum thrown to construct a column graph for digits 1–12. Then draw lines around the cubes to show outlines for each digit's sum of the dice. Repeat the experiment a number of times. Compare the graphs. Discuss: *Are the results what you expected? Which digits are occurring as the sum of the dice most frequently and least frequently? Can you give an explanation for this?*

Abstraction

Body	Investigation to develop an understanding of the way choice can impact the outcome: Draw a 2 × 6 grid on the concrete with squares numbered 1–12 (large enough to hold 2–4 students per square). Students form two equal teams and decide on a team name. Students may be placed anywhere on the grid with multiple students standing on any square. Each team decides how to place its students on the squares 1–12. Teams make predictions regarding the best numbers on which to place students. Students take turns in throwing the two dice. When the sum of the values is added, each team must remove one student from the corresponding grid square, if the team has a student there. The winner is the first team to remove all of its players. Repeat the process a number of times. Use Unifix cubes or digital tools to develop a stacked bar graph to display and analyse the results. *Were any changes to the placement in the grid being made? How did this affect the outcome, if at all? Can you explain how your choices helped or blocked your chances of winning? What factor/s do you need to take into account?* Reverse: Play "Make it". Identify team members with a coloured streamer. As a number is called, students from each team must combine in as many ways as possible to make that number using only the digits that appear on the faces of a die [1–6], e.g. 4: 1 red and 3 blue, 2 red and 2 blue, 3 red and 1 blue; 9: 6 red and 3 blue, 5 red and 4 blue, 4 red and 5 blue, 3

red and 6 blue. Teams make predictions regarding the number with the most number of combinations of addends. Give three to four examples.

Hand

Two players: Unifix cubes, two dice, spreadsheet bisected by a horizontal line and divided vertically into 12 columns numbered along the horizontal line.

Players take turns to roll the two dice, add the values, place a Unifix cube in the sum's column above the line and record the addends in the appropriate column below the horizontal line. Continue to roll the dice, placing a Unifix cube above the line but recording the addends in descending rows only if they are different from those already there. Students predict the overall shape of the columns in the graphs. *Why is this so? What number gives the best possible outcome for sums of the two dice? If given a choice of numbers, which ones will help you to win? How does chance affect the game? How can choice affect the outcome of the game?*

After many throws of the dice, provided sufficient dice rolls have occurred, students will notice a bell curve both above and below the horizontal line.

Mind

Story: *You are playing a game of Ludo. See in your mind the attempts you have in throwing a six to begin. See how many attempts you had to get the exact number to get home. How would you describe the game – chance or choice? Why did you choose that answer?*

Creativity

Students create a board game using two dice where there are elements of chance and choice.

Mathematics

Language/ symbols

chance, predict, trial, chance experiment, frequencies, frequency table, likelihood, possible outcomes, column graph, probability, relative frequency, observed frequency

Practice

1. Feud: In pairs with two dice
   Players take turns to throw dice. Add values. If the sum is 2, 3, 4, 10, 11, 12 Player 1 receives one point. If the sum is 5, 6, 7, 8, 9 Player 2 receives one point. The first player to 10 points wins. After many games, ask:
   (a) *Is the game fair?*
   (b) *Does it matter whether you are Player 1 or Player 2?*
   (c) *How could you arrange the players' numbers to make the game fairer?*
2. Worksheet: Interpret statistics from a frequency graph.
3. Two-dice difference experiment: Two dice, pad and pencil or spreadsheet. Conduct an experiment of 50 trials and record results after each trial in a frequency table. Roll two dice and calculate the difference between the values – take the low from the high. Tally the cumulative results and construct a column graph.

Trial	Results						Cumulative Results					
	0	1	2	3	4	5	0	1	2	3	4	5
1												
2												
etc.												

Connections

Relate to probability, graphs and statistics.

Reflection

Validation

Students check where games of chance and choice occur in the world; e.g. Casino, Pokies, horse racing, sport.

Application/ problems

Provide applications and problems for students to apply to different real-world contexts independently; e.g. Dice Bingo: two dice, Bingo board, counters.

Rules: 2 to 4 players. Throw a double 6 to start. A counter may be placed on a square where the throw of the two dice can be either added, subtracted or multiplied to make that square's number. Player to fill last square calls Bingo.

5	8	20	7	12
30	16	0	18	4
11	2	6	9	15
1	10	24	3	Bingo

Extension

Flexibility. Use different operations to predict favourable results in chance experiments.

Reversing. Students are able to move between telling a chance story ↔ acting it out ↔ writing and graphing chance outcomes ↔ interpreting statistics in a frequency graph, starting from and moving between any given point.

Generalising. *While chance is random, there are factors that can influence the outcome*.

Changing parameters. Use three dice, dice that have 9 faces or spinners. Calculate probability.

Teacher's notes

- Remind students that observed frequency is the number of times something actually occurs when a chance experiment is conducted; e.g. if you rolled a die 20 times and a 6 came up three times, the observed frequency for that event is three.
- Students need to be taught the skill of visualising: closing their eyes and seeing pictures in their minds, making mental images; e.g. show a picture of a blue die, students look at it, remove the picture, students then close their eyes and see the blue die in their mind; then make a mental picture of a red die.
- Suggestions in Local Knowledge are only a guide. It is very important that examples in Reality are taken from the local environment that have significance to the local culture and come from the students' experience of their local environment.
- Useful websites for resources: www.rrr.edu.au; https://www.qcaa.qld.edu.au/3035.html
- Explicit teaching that **aligns with students' understanding** is part of every section of the RAMR cycle and has particular emphasis in the Mathematics section. The RAMR cycle is not always linear but may necessitate revisiting the previous stage/s at any given point.
- Reflection on the concept may happen at any stage of the RAMR cycle to reinforce the concept being taught. Validation, Application, and the last two parts of Extension should not be undertaken until students have mastered the mathematical concept as students need the foundation in order to be able to validate, apply, generalise and change parameters.