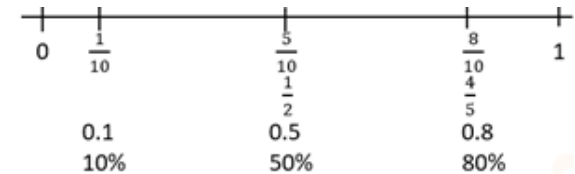


# PROBABILITIES, RELATIVE BENEFITS.

## INVESTIGATIONS OVERVIEW PAGE

THIS PAGE IS A SUMMARY OF THE INVESTIGATIONS THAT STUDENTS MAY ENGAGE IN TO DEEPEN THEIR RELATIONAL UNDERSTANDING. INVESTIGATIONS WITH INSTRUCTIONS TO STUDENTS FOLLOW ON SUBSEQUENT PAGES.

- In pairs children have a 10-sided die and record the chance of rolling each number ( $\frac{1}{10}$ , 0.1, 10%) / an even number ( $\frac{5}{10}$  or  $\frac{1}{2}$ , 0.5, 50%) / a number greater than 2 ( $\frac{8}{10}$  or  $\frac{4}{5}$ , 0.8, 80%), etc as a fraction, as a decimal and as a percentage on a number line, for example,

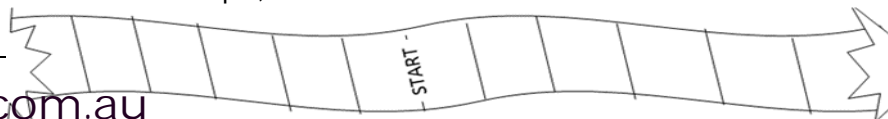


Reflection: How can we record chance as fractions, decimals and percentages on a number line?

- In pairs, children create a spinner with 10 sections. They colour a different number of sections different colours, for example, 3 red, 2 yellow, 1 black and 4 blue. They record the chance of spinning each colour as a fraction, as a decimal and as a percentage on a number line. Reflection: How can we record chance as fractions, decimals and percentages on a number line?
- In pairs, children have 2 coins. They conduct a chance experiment to determine the 4 possible combinations from 1 toss (HH, TT, HT, TH). They record the chance of tossing each combination as a decimal and as a percentage on a number line. Reflection: How can we record chance as fractions, decimals and percentages on a number line?
- In pairs children are given a board game. They play the game to investigate whether it is a fair game and how it was designed to allow for fairness. They time the length of time it takes to finish the game and discuss whether this is an appropriate length of time. Reflection: How did the creators of the board game ensure it was fair?
- In small groups, use the data from the chance experiments conducted above involving 10-sided dice or 10 section spinners or 2 coins or in Chance and Data 17 involving 2 dice (odd vs even sums, sums of 2, 3, 4, 5, 6 vs sums of 8, 9, 10, 11, 12 with 7 used to 'select a card'), 3 dice (odd vs even sums, sums of, 3, 4, 5, 6, 7, 8, 9, 10, vs sums of 11, 12, 13, 14, 15, 16, 17, 18), spinners (spinner could have more of one colour than other colours), and coins (toss 2 coins HH vs TT vs HT) to design a game of chance where one player has a greater chance of winning than the other players OR where each player has an equal chance of winning.

Considerations and possible steps in designing a game of chance:

- Decide on a theme, for example, a pirate ship in the middle with a treasure island at one end and a shark at the other; or a desert with water at one end and dying of thirst at the other. For example,



Groups design their own dice or spinners for one player to have a greater chance of winning than the other players OR for each player to have an equal chance of winning. For example,

- 2 dice, with odd totals meaning moving that number of spaces to the left and even totals meaning moving that number of spaces to the right (unfair).
- a spinner with 2 colours, with one colour meaning moving that number of spaces to the left and the other colour meaning moving that number of spaces to the right (fair).

Groups decide on any special spaces on their game, for example, 'move left 1' etc. They consider where to place these strategically to allow for one player to have a greater chance of winning than the other players OR for each player to have an equal chance of winning. For example,

- an equal number of 'move left' and 'move right' (fair)
- an unequal number of 'move left' and 'move right' (unfair)
- the number spaces to be moved could be greater to the left than the right, 'move 2 spaces to the left' 'move 1 space to the right' (unfair)

Groups decide on the optimum number of spaces and moves to ensure the game does not finish in only a few moves but also does not go forever, for example, 5 - 10 minutes. This could be done with chalk on a hard surface outside so that they are physically moving and adding / removing spaces as necessary. Groups roll their die / spin their spinner, players move along the game board, groups members keep records of the number of moves each player makes and the time taken, then varies the number of spaces (including special spaces) to lengthen / shorten the game to what they consider an optimum time.

Each group then designs their game with the optimum number of spaces. They create their game on a large sheet of card. They consider attractiveness, setting out, rule recording and display, player pieces, spinner / dice design, packaging, portability.

Groups play their own game. They record each player's chance of winning as a fraction, as a decimal and as a percentage on a number line.

Groups swap games and play one another's games. They identify whether the game was designed for one player to have a greater chance of winning than the other players OR for each player to have an equal chance of winning. They record each player's chance of winning as a fraction, as a decimal and as a percentage on a number line. NB: If more than 1 class in the school designs games of chance for one player to have a greater chance of winning than the other players OR for each player to have an equal chance of winning, classes could swap games, play one another's games, identify chance of winning, and record each player's chance of winning on a number line.

Reflection: How did you ensure your game was fair, or gave one player a greater chance of winning?

- In pairs children investigate apps that allow players to ga

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- mble – sometimes with real money. Reflection: Do you think that gambling apps are designed to be fair or unfair to the player?
- In pairs children investigate the odds (chance) of winning public lotteries – the odds are recorded on the entry forms. They record these odds on a number line as fractions, decimals and percentages. Reflection: Why do you think they have to put the odds on the entry forms?
- In pairs children investigate the odds (chance) of winning on gaming machines – the odds are recorded on the machines. They record these odds on a number line as fractions, decimals and percentages. Reflection: Why do you think it is the law to state the odds of winning in a visible place?
- In pairs, children investigate the odds of winning on sports betting. They record these odds on a number line as fractions, decimals and percentages. Reflection: Why do you think that people participate in betting activities where the odds of winning are so low?
- In pairs, children investigate the amount of revenue a club makes from poker machines, a bookie or the TAB makes from sport betting, the state makes from lotteries, etc. Reflection: Why do you think that traditionally, clubs are very resistant to changes in laws that make odds more transparent to players?
- Engage children in a discussion about responsible gambling – only gambling an amount that you are prepared to lose, predicting that players will lose more often than they will win because the game has been designed to give the organiser a greater chance of winning. Reflection: Why do you think people gamble when the odds of winning are so poor?
- Engage children in a discussion about the advertising of gambling during sports telecasts. Discuss how advertising during a time when the audience is engaged emotionally increases the chance that irresponsible gambling will occur. Reflection: How did the discussion change the way you think about advertising during sport?
- Engage children in a discussion about chance in other areas of life, for example, getting caught when breaking the law. Discuss whether people think they will get caught when they are breaking the law. If possible consider asking a community police officer to bring data on the percentage of crimes that are solved. (A very high percentage of law breakers do not think they will get caught, demonstrating that they have no understanding of using data to predict chance!) Reflection: How do you think an understanding of how to use data to predict chance may help you to make decisions in real life situations?

# Probabilities, Relative Benefits

Have a 10-sided die

Record the chance of rolling each number as a fraction, as a decimal and as a percentage on a number line.

Record the chance of rolling an even number as a fraction, as a decimal and as a percentage on a number line.

Record the chance of rolling a number greater than 2 as a fraction, as a decimal and as a percentage on a number line.

Reflection: How can we record chance as fractions, decimals and percentages on a number line?

# Probabilities, Relative Benefits

Create a spinner with 10 sections.

Colour a different number of sections different colours, for example, 3 red, 2 yellow, 1 black and 4 blue.

Record the chance of spinning each colour as a fraction, as a decimal and as a percentage on a number line.

Reflection: How can we record chance as fractions, decimals and percentages on a number line?

# Probabilities, Relative Benefits

Have 2 coins.

Conduct a chance experiment to determine the 4 possible combinations from 1 toss.

Record the chance of tossing each combination as a decimal and as a percentage on a number line.

Reflection: How can we record chance as fractions, decimals and percentages on a number line?

# Probabilities, Relative Benefits

Have a board game.

Play the game to investigate whether it is a fair game and how it was designed to allow for fairness.

Time the length of time it takes to finish the game and discuss whether this is an appropriate length of time.

Reflection: How did the creators of the board game ensure it was fair?

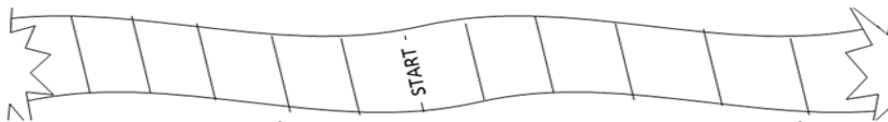
# Probabilities, Relative Benefits

Form small groups,

Use the data from the chance experiments conducted involving 10-sided dice or 10 section spinners or 2 coins or 2 dice or coins to design a game of chance where one player has a greater chance of winning than the other players OR where each player has an equal chance of winning.

Considerations and possible steps in designing a game of chance:

- ▶ Decide on a theme, for example, a pirate ship in the middle with a treasure island at one end and a shark at the other; or a desert with water at one end and dying of thirst at the other. For example,



- ▶ Design your own dice or spinners for one player to have a greater chance of winning than the other players OR for each player to have an equal chance of winning. For example,
  - ▶ 2 dice, with odd totals meaning moving that number of spaces to the left and even totals meaning moving that number of spaces to the right (unfair).
  - ▶ a spinner with 2 colours, with one colour meaning moving that number of spaces to the left and the other colour meaning moving that number of spaces to the right (fair).
- ▶ Decide on any special spaces on your game, for example, 'move left 1' etc. Consider where to place these strategically to allow for one player to have a greater chance of winning than the other players OR for each player to have an equal chance of winning. For example,
  - ▶ an equal number of 'move left' and 'move right' (fair)
  - ▶ an unequal number of 'move left' and 'move right' (unfair)
  - ▶ the number spaces to be moved could be greater to the left than the right, 'move 2 spaces to the left' 'move 1 space to the right' (unfair)
- ▶ Decide on the optimum number of spaces and moves to ensure the game does not finish in only a few moves but also does not go forever, for example, 5 - 10 minutes. This could be done with chalk on a hard surface outside so that you are physically moving and adding / removing spaces as necessary. Roll your die / spin your spinner, have players move along the game board, keep records of the number of moves each player makes and the time taken, then vary the number of spaces (including special spaces) to lengthen / shorten the game to what you consider an optimum time.
- ▶ Now design your game with the optimum number of spaces. Create your game on a large sheet of card. Consider attractiveness, setting out, rule recording and display, player pieces, spinner / dice design, packaging, portability.
- ▶ Play your group's game. Record each player's chance of winning as a fraction, as a decimal and as a percentage on a number line.
- ▶ Swap games other groups and play their games. Identify whether the game was designed for one player to have a greater chance of winning than the other players OR for each player to have an equal chance of winning. Record each player's chance of winning as a fraction, as a decimal and as a percentage on a number line.

Reflection: How did you ensure your game was fair, or gave one player a greater chance of winning?



# Probabilities, Relative Benefits

Investigate apps that allow players to gamble – sometimes with real money.

Reflection: Do you think that gambling apps are designed to be fair or unfair to the player?

# Probabilities, Relative Benefits

Investigate the odds (chance) of winning public lotteries – the odds are recorded on the entry forms.

Record these odds on a number line as fractions, decimals and percentages.

Reflection: Why do you think they have to put the odds on the entry forms?

# Probabilities, Relative Benefits

Investigate the odds (chance) of winning on gaming machines – the odds are recorded on the machines.

Record these odds on a number line as fractions, decimals and percentages.

Reflection: Why do you think it is the law to state the odds of winning in a visible place?

# Probabilities, Relative Benefits

Investigate the odds of winning on sports betting.

Record these odds on a number line as fractions, decimals and percentages.

Reflection: Why do you think that people participate in betting activities where the odds of winning are so low?

# Probabilities, Relative Benefits

Investigate the amount of revenue a club makes from poker machines, a bookie or the TAB makes from sport betting, the state makes from lotteries, etc.

Reflection: Why do you think that traditionally, clubs are very resistant to changes in laws that make odds more transparent to players?

# Probabilities, Relative Benefits

Engage in a discussion about responsible gambling – only gambling an amount that you are prepared to lose, predicting that players will lose more often than they will win because the game has been designed to give the organiser a greater chance of winning.

Reflection: Why do you think people gamble when the odds of winning are so poor?

# Probabilities, Relative Benefits

Engage in a discussion about the advertising of gambling during sports telecasts. Discuss how advertising during a time when the audience is engaged emotionally increases the chance that irresponsible gambling will occur.

Reflection: How did the discussion change the way you think about advertising during sport?

# Probabilities, Relative Benefits

Engage in a discussion about chance in other areas of life, for example, getting caught when breaking the law. Discuss whether people think they will get caught when they are breaking the law. If possible consider asking a community police officer to bring data on the percentage of crimes that are solved. (A very high percentage of law breakers do not think they will get caught, demonstrating that they have no understanding of using data to predict chance!)

Reflection: How do you think an understanding of how to use data to predict chance may help you to make decisions in real life situations?