PROBABILITY MATTERS (LEVEL 2)

Description	The learner will explore the concept of chances and probability and learn how to calculate probability.
Leading Question	Can you design a game using probability?
Total Time Required	5 hours over 5 days
Supplies Required	A4 papers, cardboard, pencil, colors, ruler, household items: any dish or circle shaped tray, glass, scissors, glue, empty plastic bottles.
Learning Outcomes	1. Calculate the probabilities of tossing a coin/coins. 2. Calculate the probabilities of spinning a spinner. 3. Calculate the probability of rolling one dice and two dices. 4. Collect data on the chances of an outcome using tables. 5. Draw a square. 6. Draw and create a 3D cube. 7. Defining the process of recycling materials. 8. Understanding how to use a Venn diagram to represent and calculate the probability of outcomes.
Previous Learning	• Counting up to 100. • Drawing a straight line. • Multiplication tables • Knowledge of the different types of animals (live in sea or land)

DAY 1

Today you will learn about what chances and probability are.

Suggested Duration	Activity and Description
10 minutes	• Introduce the concept of chances and probability • Here are some questions to learn about probability. Note that: - Some of the questions have one answer - Some answers are either true or false - Some questions have multiple choices that means you must choose the correct answer.

	- Some have no right or wrong answers. ● Questions: 1- What is your name? 2- How many sisters/brother do you have? 3- How many wings does a bird have? 4- How many tails does a cat have? 5- Do fish live in the desert? True or False 6- Can snakes run? True or False 7- Does an elephant have a trunk? True or False 8- Do airplanes need railways to travel on? True or False 9- Choose the correct answer: Falcons can (fly walk swim) 10- Choose the correct answer: A football team has (3 11 14) players. 11- If I have two pencils, one is red and one is green, which one would you choose? 12- If there are three pieces of biscuits with the same taste but different shapes: one is shaped like a circle, one is shaped like a car, one is shaped like a flower, which one will you choose? 13- If there are two storybooks one about batman (or any hero that the learner is familiar with) and one about traveling around the world which one would you choose? ● Reflect on questions 11, 12, and 13. - There are outcomes in life that there are no rights or wrongs. - By the end of this project you will learn how to calculate possibilities or probability for each outcome.
15 minutes	● Design your own two coins: - Find any household shaped like a small circle then use it to draw two circles on cardboard. Cut out those two circles. - Draw two animals: one lives in sea (dolphin, shark, etc.) and the other animal lives on land (sheep, cow, fox, etc.) - On one side draw the head of the animal and on the other side draw the tail of the same animal for each coin. - Color the animals as well, because you are going to play some games with those coins
20 minutes	● **One Coin Experiment** ● Draw 2 columns and write numbers from 1-6 in the first column (number of tosses of the coin) ● Choose one of the two coins to toss 6 times and each time write which side it landed on: heads or tails. ● Count how many times the coin landed on heads or tails out of the six times. ● Example if you get heads 4 times out 6, explain how we calculate the probability or chances of heads falling 4 out of 6. Older learners with knowledge of writing fractions can write:

- P (H) = $\frac{4}{6}$ or P (H) is 4 out of 6 times.

1	H
2	T
3	H
4	H
5	H
6	T

- **Two coin Experiment**
- Repeat the same activity with two coins by tossing the two coins and on a table of three columns write what the outcomes are each time you toss the coin. For example:

	Dolphin	Rabbit
1	H	T
2	H	H
3	T	H
4	H	H
5	T	T
6	H	H

- How many times did both coins land on heads (HH)? How many times did both coins land on tails (TT)? How many times did the coins land heads and tails (HT) or (TH)?
- In the above table above table P(HH)=3 P(TT)=1 P(HT)=2

So this is how we calculate the probability P(HH)= $\frac{3}{6}$ P(TT)= $\frac{1}{6}$ P(HT)= $\frac{2}{6}$

  - Add the probability of HH, TT, HT
  - Explain that when we add the probabilities of the 6 tosses, it will equal $\frac{6}{6}$ and this is for all outcomes when we add all the probabilities the numerator will be equal to dominator which equal 1.

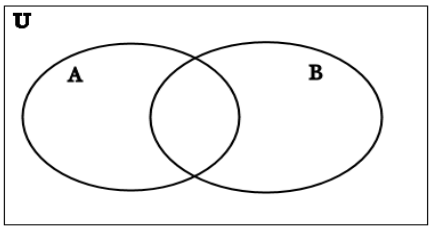
- **Three coin Experiment**
- Repeat the same activity with three coins
- On a table of 4 columns, write down what the outcomes are of each trial.
- For example, the three coins landed on heads 2 out of 6 trials
- That means P(HHH)= $\frac{2}{6}$
- Calculate the following outcomes:

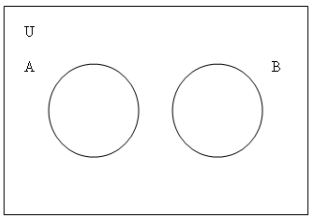
- All three coins landed on tails TTT
- Coins landed on two tails and one heads TTH or HTT or THT
- Coins landed on two heads and one tails HHT or THH or HTH

- Remember that the sum of all the probabilities will eventually equal to one.
- Reflect on the three experiments, what are the expected outcomes in each experiment?
- Solution:
  - One coin experiment has 2 possible outcomes 2 x 1 (T or H)
  - Two coin experiment has 4 possible outcomes 2 x 2 (HH,HT,TH,TT)
  - Three coins landed eight possible outcomes 2 × 2 × 2 = 8 (HHH, HHT, HTH, HTT, THH, THT, TTH, and TTT)
  - Some of outcomes will not happen so there is no right or wrong. The calculation of the outcome equals to zero. previous example P(THT)= 0

DAY 2

Today you will learn about Venn diagrams.

Suggested Duration	Activity and Description
10 minutes	● Draw two circles to represent the following: ● In a classroom, there are 10 students who like football, 6 students who like basketball and 4 students who like both basketball and football.  ● Circle A represents students that like football, circle B represents students that like basketball and the center where the two circles intersect, represents the students that like both football and basketball. We call this a VENN diagram. We use it to represent probability. - Calculate the probability of students that like football. P(f)=$\frac{10}{20}$= $\frac{1}{2}$ - Calculate the probability of students that like basketball. P(b)= $\frac{6}{20}$= $\frac{3}{10}$

	- Calculate the probability of students that like basketball and football - P (fb) = $\frac{4}{20}$= $\frac{1}{5}$ always simplify fractions.
10 minutes	● Draw a Venn diagram to represent your favorite colors and your friend's favorite colors. ● If there are common colors, the diagram will be similar to the diagram. ● Calculate the probability of your favorite colors and your favorite colors. ● If there are no common favorite colors, the diagram will be two separate circles.  ● Calculate the probability of your favorite colors ● Calculate the probability of your friend's favorite colors.
10 minutes	● Use the Venn diagram to separate shapes. It can be different items in different shapes, or 2D shapes or 3D shapes. ● Draw your Venn diagram and calculate the probability of each shape.
10 minutes	● Teach your friends and family members how to design 3 creative coins and play different rounds of the game, for example: 1. Toss 2 coins, 20 times. Players will draw their table and record the outcomes. Then the player who has the highest number of the two coins landed Heads P (HH) wins. 2. Tossing 2 coins, 30 times. The player who has the highest number of two coins landed on heads and tails P(HT) wins 3. Tossing 3 coins, 20 times. Each player will draw their table and record the outcomes. The player who has the highest number of 3 coins landed with two heads and one tails P(HHT) wins

DAY 3

Today you will create a spinner and play a game with it.

Suggested Duration	Activity and Description

20 minutes

- Draw a circle on cardboard and cut out this circle.
  - Divide the circle into four equal parts by drawing two lines that intersect in the center of the circle. Color each part with a different color (red, green, blue, yellow, etc.)
  - Draw a line and cut it out to use as a pointer.
  - In the center of the circle, make a hole with a pencil and use a thread to locate this pointer to the center of the circle. It should not be too tight and not too loose but easy to spin it. (Use a pin instead of thread if that does not work.)

  - Develop a table for this experiment. Spin the pointer and calculate the probability for each color if they repeat it for six times

• 1	• Red
• 2	• Green
• 3	• Blue
• ….	•

- Calculating Probability: E.g. If you use the spinner 6 times, and the pointer lands on green 2 times out of 6: P(G)= $\frac{2}{6}$
- if the pointer landed on red 2 times out of 6: P(R) = $\frac{2}{6}$ and so on
- Reflect and find out that the addition of the probability of all four colors in each experiment will be $\frac{6}{6}$.

20 minutes

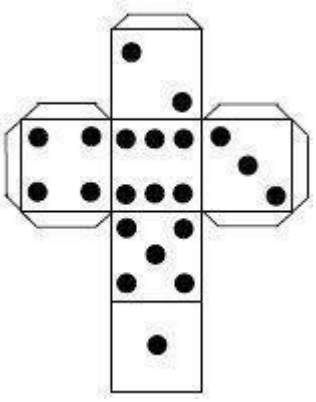
- Draw a new circle and cut it out. Divide it into 8 parts.
- Draw 8 different items with the same theme like school stationary, kitchen items, food items, clothes, etc.
- Teach your friends and family to create their own spinner with same theme.
- Each player spins the spinner 20 times and writes it down in their own piece of paper and then find out the outcomes.

15 minutes

- If a friend sent you a message saying “I heard that probability is very interesting topic, I wish I knew more about it”, could you write a paragraph to explain what you have learnt with simple examples?

DAY 4

Today you will learn about the probability of outcomes based on dices.

Suggested Duration	Activity and Description
5 minutes	• Revision: - What did you like the most in the last 3 days? - What did you not like? - What did you learn?
15 minutes	• Design a cube: • Draw, cut and glue the below to make their own dice, the lines will be folded and stuck together in the shape of a cube. 
10 minutes	• The outcomes of rolling a dice are (1, 2, 3, 4, 5, 6) • Draw a table of two columns and roll the dice 10 times • Record the outcome of each roll • Calculate the probability of getting 4 or 1, P(4) or P(1) • Calculate the probability of all the outcomes you had in this experiment • Add them all and reflect. The sum is 10/10 which is equal to 1.

• Roll	• Number on Dice
• 1	• 4
• 2	• 6
• 3	• …
• … 10	• …

20 minutes	● Who will get to the end first? - Teach a friend to draw and create a dice. - On the floor draw two mazes divided into steps with some cushions or chairs (make sure both mazes are the same difficulty) - Each player rolls his dice according to the number the dice lands on and moves that amount of steps. - The one who finishes first wins.

DAY 5

Today you will create a game club with your new games!

Suggested Duration	Activity and Description
5 minutes	● Reflect on how you calculated the probability of outcomes for the experiments you have done in the last 4 days.
10 minutes	● Make a second dice and color it. ● Challenge: Discover how many possible outcomes can happen when you roll two dices on the same time. ● The answer is 36 outcomes (1, 2). (1, 1), (1, 3). (1, 4)…. - Roll the two dices 20 times. Draw a table and calculate the probability of P (6, 3), P (5, 1), and P (3, 2). - Remember that if one of the outcomes did not happen the probability equals zero.
20 minutes	● Create your own game using one or two dices. Be creative! ● Try the game and play it with other players. Remember to write down and draw the details of your game.
30 minutes	● Collect 3 empty, equal sized plastic bottles. ● How can we get rid of any item made of plastic? Make sure that the discussion includes the definition of recycling and what other different materials need to be recycled.

	1	2	3	4	5	6
1	(1,1)	(1,2)	(1,3)	(1,4)	(1,5)	(1,6)
2	(2,1)	(2,2)	(2,3)	(2,4)	(2,5)	(2,6)
3	(3,1)	(3,2)	(3,3)	(3,4)	(3,5)	(3,6)
4	(4,1)	(4,2)	(4,3)	(4,4)	(4,5)	(4,6)
5	(5,1)	(5,2)	(5,3)	(5,4)	(5,5)	(5,6)
6	(6,1)	(6,2)	(6,3)	(6,4)	(6,5)	(6,6)

	- Fill two plastic bottles halfway with water. - Flip both bottles at the same time. What are the possible outcomes of this experiment? They are top, bottom and side of the bottle. - Which outcome has more chances of happening? Which outcome has less chances of happening? Why? - The chances of the bottle landing on its side has more chances to happen, so we would say this outcome is 'likely' to happen. - The chances of the bottle landing on its top has less chances to happen, so we would say this outcome is 'unlikely' to happen. - Tell the learner to ask friends and family members to each fill 2 bottles halfway with water. Make sure all bottles are the same size. - Each player flips the two water bottles at the same time 10 times - The one who lands the bottles on the bottom most wins. - Add more difficult levels after if the learner wants to continue playing.
30 minutes	● Create your own "game club" and display all the games you have created. Invite friends and siblings to join and play all the games you have created.

ASSESSMENT CRITERIA

- Creativity in designing the coins using drawing of animals (heads and tails)
- Creativity in designing spinner and poster.
- Accurately calculating the probabilities of different basic outcomes in different experiments.
- Creativity in designing the game club.
- Drawing accurate squares.
- Building accurate 3d shape (cube).
- Creativity in developing new games using probability

ADDITIONAL ENRICHMENT ACTIVITIES

- Develop more games using probability to add to their "game club"
- If students have internet they can play this game online: https://www.youtube.com/watch?v=4IQpe3J-2AU