

## PROBABILITY MATTERS


Ages 4 to 7 (Level 1)

<b>Description:</b>	The learner will explore the concept of chances and probability and learn how to calculate probability.
<b>Leading question:</b>	Can you design a game using probability?
<b>Age group:</b>	6 - 7
<b>Subjects:</b>	Mathematics, Art and Design, Social Sciences, Science
<b>Total time required:</b>	5 hours over 4 days
<b>Self-guided / Supervised activity:</b>	Medium supervision
<b>Resources required:</b>	A4 papers, Cardboard, pencil, colors, ruler, any dish or tray in the shape of a medium or big circle, glass, 4 buckets, scissors, and colored balls.

Day	Time	Activity and Description
1	10 minutes	<p>Introduce the concept of chances and probability</p> <p>Ask the learner some questions but make sure that</p> <ul style="list-style-type: none"> <li>● Some of the questions have one answer</li> <li>● Some answers are either true or false</li> <li>● Some questions have multiple choices, which means students must choose the correct answer.</li> <li>● Some have no right or wrong answers.</li> </ul> <p>Some of the questions could be (use some, not all).</p> <ol style="list-style-type: none"> <li>1- What is your name?</li> <li>2- How many sisters/brothers do you have?</li> <li>3- How many wings does a bird have?</li> <li>4- How many tails does a cat have?</li> <li>5- Do fish live in the desert? True or False</li> <li>6- Can snakes run? True or False</li> <li>7- Does an elephant have a trunk? True or False</li> <li>8- Do airplanes need railways to travel on? True or False</li> <li>9- Choose the correct answer: Falcons can (fly walk swim)</li> <li>10- Choose the correct answer: A football team has (3 11 14) players.</li> <li>11- If I have two pencils, one is red and one is green, which one would you choose?</li> <li>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?</li> </ol>

	15 minutes	<p>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?</p> <p>Ask the learner to reflect on questions 11, 12, and 13.</p> <ul style="list-style-type: none"> <li>- Explain to the learner that there are outcomes (the possible result of an experiment or trial) in life that there are no rights or wrongs.</li> <li>- By the end of this project the learners will learn how to calculate possibilities or probability for each outcome.</li> <li>- Probability is how likely something is to occur; for example, how confident can we be that it is going to rain tomorrow.</li> </ul> <p>Activity 1: Coin Creation</p> <p>Ask the learner to design his/her own two coins. The learner can ask his parents/any adult for a coin and think about how they would create his/her own two coins.</p> <p>Below are some instructions on how the learner can create their own coins:</p> <ul style="list-style-type: none"> <li>● Learner needs to find a household item shaped like a small circle, then use it to draw two circles on cardboard. Cut out those two circles.</li> <li>● Draw two animals: one lives in the sea (dolphin, shark, etc.) and the other animal lives on land (sheep, cow, fox, etc.)</li> <li>● On one side draw the head of the animal and on the other side draw the tail of the same animal for each coin.</li> <li>● Ask the learner to color with any colors of their choice the animals as well, because they are going to play some games with those coins</li> </ul>								
	20 minutes	<p>Activity 2: Understanding Chance</p> <ul style="list-style-type: none"> <li>- Choose one of the two coins to toss 6 times and each time write which side it landed on: heads or tails.</li> <li>- Ask the learner to count how many times the coin landed on heads or tails out of the six times. This data can be captured in a table like the one in the example below for easy understanding.</li> <li>- Then the learner can calculate the probability or chances of getting one outcome e.g., probability of coin toss landing on the head of the coin</li> </ul> <p>For example, if the learner got 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> <p><math>P(H) = \frac{4}{6}</math> or P (H) is 4 out of 6 times.</p> <table border="1" data-bbox="435 1724 1419 1898"> <thead> <tr> <th>Number of tosses</th> <th>Dolphin Coin</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>H</td> </tr> <tr> <td>2</td> <td>T</td> </tr> <tr> <td>3</td> <td>H</td> </tr> </tbody> </table>	Number of tosses	Dolphin Coin	1	H	2	T	3	H
Number of tosses	Dolphin Coin									
1	H									
2	T									
3	H									

	15 minutes	4	H																					
		5	H																					
		6	T																					
		<p>Draw a similar table for your own coin toss and calculate:</p> <ul style="list-style-type: none"> <li>- The probability of the coin landing on the head</li> <li>- The probability of the coin landing on the tail</li> </ul> <p>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 the learner tosses the coin.</p> <p>For example:</p> <table border="1"> <thead> <tr> <th>Number of tosses</th> <th>Dolphin Coin</th> <th>Rabbit Coin</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>H</td> <td>T</td> </tr> <tr> <td>2</td> <td>H</td> <td>H</td> </tr> <tr> <td>3</td> <td>T</td> <td>H</td> </tr> <tr> <td>4</td> <td>H</td> <td>H</td> </tr> <tr> <td>5</td> <td>T</td> <td>T</td> </tr> <tr> <td>6</td> <td>H</td> <td>H</td> </tr> </tbody> </table> <p>How many times did we toss a coin? 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)?</p> <p>In the above table (HH)=3 (TT)=1 (HT)=2 and the total number of tosses = 2x6 = 12 times.</p> <p>So, this is how we calculate the probability <math>P(HH)=\frac{3}{12}</math> <math>P(TT)=\frac{1}{6}</math> <math>P(HT)=\frac{2}{6}</math></p> <ul style="list-style-type: none"> <li>- Add the probability of HH, TT, HT</li> <li>- Explain that when we add the probabilities of the 6 tosses, it will equal <math>\frac{6}{6}</math> and this is for all outcomes when we add all the probabilities the numerator will be equal to the denominator which is equal to 1.</li> </ul> <p>Optional: Draw a similar table for your own two-coin tosses and calculate:</p> <ul style="list-style-type: none"> <li>- The probability of both coins landing on the head, P(HH)</li> <li>- The probability of both coins landing on the tail, P(TT)</li> <li>- The probability the coins land on heads and tails P(HT or TH)</li> </ul> <p><b>Game 1 :</b> Learners can teach other siblings and friends. They can design creative coins and compete by tossing the two coins 8, 10, and 12 times and recording those outcomes in their tables.</p>		Number of tosses	Dolphin Coin	Rabbit Coin	1	H	T	2	H	H	3	T	H	4	H	H	5	T	T	6	H	H
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3	T	H																						
4	H	H																						
5	T	T																						
6	H	H																						

		They can declare the one who got more HH as the winner in first round Players can repeat different rounds with different outcomes as the winner.												
2	25 minutes	<p>Ask the learner to draw a circle on cardboard, and cut out this circle.</p> <ul style="list-style-type: none"> <li>• 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. or any other colors of their own choice)</li> <li>• Draw a line and cut it out to use as a pointer.</li> <li>• 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.)</li> <li>• Assist the learner in developing a table for this experiment. Spin the pointer and write down the color the learner got each time.</li> </ul> <table border="1" data-bbox="488 751 1401 1146"> <tr> <td>1</td> <td>Red</td> </tr> <tr> <td>2</td> <td>Green</td> </tr> <tr> <td>3</td> <td>Blue</td> </tr> <tr> <td>....</td> <td></td> </tr> <tr> <td></td> <td></td> </tr> <tr> <td></td> <td></td> </tr> </table> <ul style="list-style-type: none"> <li>• Learner will find out what the chances are for each color if they repeat it for 10 and 20 times</li> </ul> <p>For example: let's say out of 10 times the pointer landed on green 3 times so <math>P(G) = \frac{3}{10}</math> and so on.</p> <p>If the pointer landed on red 6 times out of 20 times <math>P(R) = \frac{6}{20}</math></p> <p>Learners will now reflect on and find out that the addition of probability of all the four colors in each experiment will be <math>\frac{10}{10}</math> in the first one and <math>\frac{20}{20}</math> in the second one.</p> 	1	Red	2	Green	3	Blue	....					
1	Red													
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....														
	25 minutes	<b>Game 2:</b>												

	15 minutes	<p>Learner teaches and guides friends or family members to build their own spinners and play:</p> <p>Players need to have the same colors so they can record and count who got the highest number of the same colors when they spin the pointer 10 times, 20 times, etc...</p> <p>They can do many rounds and whoever gets highest number of a specific color in each round wins</p> <p>Or</p> <p>Learner develops his/her own spinner examples (still circular shape, but it has more than 4 equal parts (draw 6 or 8 equal parts) and instead of colors he/she could draw different items like a flower, ball, car, etc.).</p> <p>Develop a poster that presents the tables and probability calculations.</p> <p><b>Critique and revision:</b></p> <p>Learners should present all the day's work to their parents or family members for feedback and suggestions for improvement. The parents or family members provide feedback using the following format:</p> <ul style="list-style-type: none"> <li>● Praise: What did you like about the learner's work?</li> <li>● Question: Any questions or clarifications you have about the work?</li> <li>● Suggestions: In what areas does the learner need to improve their work?</li> </ul>												
3	5 minutes  10 minutes  10-20 minutes	<p>Revision:</p> <ul style="list-style-type: none"> <li>- Use one coin for an experiment. What are the possible outcomes that can happen?</li> <li>- Answer: Heads or Tails. There are only two possible outcomes. In this case the probabilities of outcomes are equal</li> </ul> <p>Activity 1</p> <p>Ask the learner: Are the following outcomes likely to happen or unlikely to happen?</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 80%;">1. Fish can walk.</td> <td>Unlikely</td> </tr> <tr> <td>2. Train flies.</td> <td>Unlikely</td> </tr> <tr> <td>3. Cats have 4 legs</td> <td>Likely</td> </tr> <tr> <td>4. Lion lays eggs</td> <td>Unlikely</td> </tr> <tr> <td>5. Human has two eyes</td> <td>Likely</td> </tr> <tr> <td>6. Square has 5 sides.</td> <td>Unlikely</td> </tr> </table> <p>Activity 2</p>	1. Fish can walk.	Unlikely	2. Train flies.	Unlikely	3. Cats have 4 legs	Likely	4. Lion lays eggs	Unlikely	5. Human has two eyes	Likely	6. Square has 5 sides.	Unlikely
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	10 minutes	<ul style="list-style-type: none"> <li>● Ask the learner to draw two circles on a sheet of paper or on the floor and label one circle 'likely' and the other circle 'unlikely'.</li> <li>● Ask the learner to think about the different activities/outcomes that are likely or unlikely to happen or not happen in their lives and take note of them.</li> <li>● Inside the 'likely' circle, draw outcome/s that are likely to happen e.g. a bird with two wings...</li> <li>● Inside the 'unlikely' circle, draw outcome/s is unlikely to happen e.g., a bird with three wings.</li> </ul> <p>Alternatively,</p> <ul style="list-style-type: none"> <li>● Ask the learner to play a game with a friend or sibling. Draw two big circles on the floor: On one circle write 'Yes' and on the other circle write 'No' Ask one of the players to shout one letter of the alphabet. If: - It is one of the letters in the word 'likely', players should jump into the 'yes' circle - It is not one of the letters in the word 'likely', players should jump into the 'no' circle.</li> </ul>
	20 minutes	<p>Activity 3 Draw 6 circles/balls and color them with 3 different colors (for example: 3 red, 2 blue and 1 green) and place them in a bag. Close your eyes and pull out one ball.</p> <ul style="list-style-type: none"> <li>- Which circle/ball is most likely to be withdrawn? Why do you think it is the most likely to be withdrawn?</li> <li>- Answer: Pulling out a red ball is a likely outcome because there are more red balls in the bag.</li> <li>- Which circles/balls are likely to be withdrawn the least? Why do you think it is the least likely to be withdrawn?</li> <li>- Answer: Green because it is only one ball. Pulling out a green ball is an unlikely outcome because the chance of it happening is low.</li> </ul> <p>In the colored balls experiment the outcomes are unequal outcomes because there are 3 Reds, 2 Blues and 1 Green.</p> <p><b>Game 3:</b></p> <ul style="list-style-type: none"> <li>● Line up some household items (for example 4 large buckets, 3 medium and one small). Place the buckets in a 3-meter line in the order of large -&gt; medium -&gt; small or vice versa.</li> <li>● Each player should throw a ball 5 times while recording the targeted bucket.</li> <li>● Whoever targets the small bucket most wins.</li> <li>● Ask the learner to develop a game that they can use likely/unlikely outcomes</li> </ul>

		<ul style="list-style-type: none"> <li>Some questions to use for likely/unlikely outcomes:  What is the likelihood that--- What object is more likely to appear.... The object that is least likely to appear is...  Be creative!</li> </ul>
4	20 minutes	Ask the learner to think about the 4-5 games they have played and created in the last 3 days that you use all the concepts they have learned.
	40 minutes	Ask the learner to design and build a “game club” to put all the games that they have developed. <ul style="list-style-type: none"> <li>Invite friends/siblings to visit the club and play the games.</li> <li>The learner can put a price on each game they want to play so that the learner can gain skills of how to start a business</li> </ul>
	15 minutes	<p><b>Overall Project Reflection:</b> The learner will now think about all the exercises they have done for the past 3 days and take note of “TWO” of the following:</p> <ul style="list-style-type: none"> <li>What is the most important thing that you have learnt through this project?</li> <li>What did you find challenging, puzzling or difficult to understand?</li> <li>What question would you most like to discuss?</li> <li>What is something you found interesting?</li> </ul>
Assessment Criteria:		<ul style="list-style-type: none"> <li>- Creativity in designing the coins and using drawings of 2 animals’ for heads and tails.</li> <li>- Creativity in designing their spinner and poster.</li> <li>- Calculate accurately the probabilities of different basic outcomes in different experiments or games.</li> <li>- Creativity in designing the “game club”.</li> </ul>

Topics/concepts covered	<ul style="list-style-type: none"> <li>- Art and design: creating coins and a spinner</li> <li>- Chance and probability</li> <li>- Likelihood and unlikelihood</li> <li>- Data collection and summarizing of data from events</li> <li>- Critical thinking skills</li> <li>- Creativity</li> </ul> <p>Communication</p>
Additional enrichment activities:	If students have internet they can play this game online <a href="http://www.scottle.edu.au/ec/viewing/L2384/index.html#">http://www.scottle.edu.au/ec/viewing/L2384/index.html#</a>

## Ages 8 to 10 (Level 2)

<b>Description:</b>	The learner will explore the concept of the chances and probability and learn how to calculate probability.	
<b>Leading question:</b>	Can you design a game using probability?	
<b>Age group:</b>	8 to 10	
<b>Subjects:</b>	Mathematics, Art and Design, Social Sciences, Science, Physical Education	
<b>Total time required:</b>	5 hours over 5 days	
<b>Self-guided / Supervised activity:</b>	Medium supervision	
<b>Resources required:</b>	A4 papers, cardboard, pencil, colors, ruler, household items: any dish or circle shaped tray, glass, scissors, glue, empty plastic bottles.	
<b>Day</b>	<b>Time</b>	<b>Activity and Description</b>
1	10 minutes	<p>Introduce the concept of chances and probability</p> <p>- Ask the learner some questions but make sure that</p> <ul style="list-style-type: none"> <li>● Some of the questions have one answer</li> <li>● Some answers are either true or false</li> <li>● Some questions have multiple choices, which means students must choose the correct answer.</li> <li>● Some have no right or wrong answers.</li> </ul> <p>Some of the questions could be (use some, not all).</p> <ul style="list-style-type: none"> <li>● What is your name?</li> <li>● How many sisters/brothers do you have?</li> <li>● How many wings does a bird have?</li> <li>● How many tails does a cat have?</li> <li>● Do fish live in the desert? True or False</li> <li>● Can snakes run? True or False</li> <li>● Does an elephant have a trunk? True or False</li> <li>● Do airplanes need railways to travel on? True or False</li> <li>● Choose the correct answer: Falcons can (fly walk swim)</li> <li>● Choose the correct answer: A football team has (3 11 14) players.</li> <li>● If I have two pencils, one is red and one is green, which one would you choose?</li> <li>● 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?</li> <li>● 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?</li> </ul>



	<p>15 minutes</p>	<p>Ask the learner to reflect on questions 11, 12, and 13.</p> <ul style="list-style-type: none"> <li>● Explain to the learner that there are outcomes (the possible result of an experiment or trial) in life that there are no rights or wrongs.</li> <li>● By the end of this project the learners will learn how to calculate possibilities or probability for each outcome.</li> <li>● Probability can be defined as the extent to which an event is likely to occur, measured by the ratio of the favorable cases to the whole number of cases possible.</li> </ul> <p>Activity 1</p> <p>Ask the learner to design his/her own two coins The learner can ask his parents/any adult for a coin and think about how they would create his/her own two coins.</p> <p>Below are some instructions on how the learner can create their own coins:</p> <ul style="list-style-type: none"> <li>● Learner needs to find any household shaped like a small circle then use it to draw two circles on cardboard. Cut out those two circles.</li> <li>● Draw two animals: one lives in the sea (dolphin, shark, etc.) and the other animal lives on land (sheep, cow, fox, etc.)</li> <li>● On one side draw the head of the animal and on the other side draw the tail of the same animal for each coin.</li> <li>● Ask the learner to color (with a color of their own choice) the animals as well, because they are going to play some games with those coins.</li> </ul>						
	<p>20 minutes</p>	<p>Activity 2</p> <p><b>One coin experiment</b></p> <ul style="list-style-type: none"> <li>● Choose one of the two coins to toss 6 times and each time write which side it landed on: heads or tails.</li> <li>● Ask the learner to count how many times the coin landed on heads or tails out of the six times. This data can be captured in a table like the one in the example below for easy understanding.</li> <li>● Then the learner can calculate the probability or chances of getting one outcome e.g., probability of coin toss landing on the head of the coin</li> </ul> <p>For example, if the learner got 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> <p><math>P(H) = \frac{4}{6}</math> or P (H) is 4 out of 6 times.</p> <table border="1" data-bbox="435 1770 738 1890"> <tr> <td>1</td> <td>H</td> </tr> <tr> <td>2</td> <td>T</td> </tr> <tr> <td>3</td> <td>H</td> </tr> </table>	1	H	2	T	3	H
1	H							
2	T							
3	H							

4	H
5	H
6	T

**b) 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 the learner tosses 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 (HH)=3 (TT)=1 (HT)=2

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

- Ask the learners to add the probability of HH, TT, HT, what do they observe when they add them up?
- Answer: When we add the probabilities of the 6 tosses, it will equal

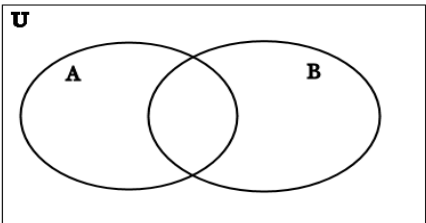
$\frac{6}{6}$  and this is for all outcomes when we add all the probabilities the numerator will be equal to the denominator which is equal to 1.

**c) Three coin experiment**


Repeat tossing three coins 6 times

- On a table of 4 columns, write down what the outcomes are of each trial

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

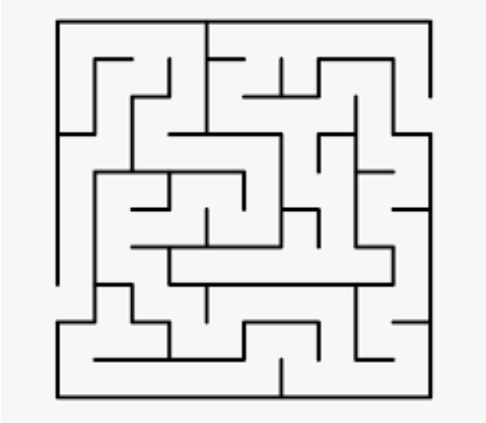
	15 minutes	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="width: 25px; height: 25px; text-align: center;">6</td> <td style="width: 25px; height: 25px; text-align: center;">T</td> <td style="width: 25px; height: 25px; text-align: center;">T</td> <td style="width: 25px; height: 25px; text-align: center;">T</td> </tr> </table> <p>For example the three coins landed on heads 2 out of 6 trials That means <math>P(\text{HHH}) = \frac{2}{6}</math></p> <p>Learners also need to create a table like one above for their own coin tosses and calculate the following outcomes:</p> <ul style="list-style-type: none"> <li>- All three coins landed on tails TTT</li> <li>- Coins landed on two tails, and one heads TTH or HTT or THT</li> <li>- Coins landed on two heads, and one tails HHT or THH or HTH</li> </ul> <p>Remember that the sum of all the probabilities will eventually equal to one</p> <ul style="list-style-type: none"> <li>● Ask the learner to reflect on the three experiments. What are the expected outcomes in each experiment?</li> </ul> <p>Solution: Learner discovers that</p> <ul style="list-style-type: none"> <li>● One coin experiment has 2 possible outcomes <math>2 \times 1</math> (T or H)</li> <li>● Two-coin experiment has 4 possible outcomes <math>2 \times 2</math> (HH, HT, TH, TT)</li> <li>● Three coins landed eight possible outcomes <math>2 \times 2 \times 2 = 8</math> (HHH, HHT, HTH, HTT, THH, THT, TTH, and TTT)</li> <li>● Some outcomes will not happen so there is no right or wrong. The calculation of the outcome equals zero. previous example <math>P(\text{THT}) = 0</math></li> </ul>	6	T	T	T
6	T	T	T			
2	10 minutes	<p>Ask the learner to draw two circles to represent the following:</p> <ul style="list-style-type: none"> <li>- In a classroom, there are 10 students who like football, 6 students who like basketball and 4 students who like both basketball and football.</li> <li>- 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 <b>VENN diagram</b>. We use it to represent probability.</li> </ul> <div style="text-align: center;">  </div> <p><math>U</math> = total number of students in the classroom = 20 Football, <math>A = 10</math>, Basketball, <math>B = 6</math>, Football and basketball = 4</p> <p>Ask the learners to then:</p>				

	10 minutes	<ul style="list-style-type: none"> <li>• Calculate the probability of students that like football. Answer: <math>P(\text{football or A}) = \frac{10}{20} = \frac{1}{2}</math></li> <li>• Calculate the probability of students that like basketball. Answer: <math>P(\text{basketball or B}) = \frac{6}{20} = \frac{3}{10}</math></li> <li>• Calculate the probability of students that like basketball and football Answer: <math>P(\text{football and basketball}) = \frac{4}{20} = \frac{1}{5}</math> always simplify fractions.</li> </ul> <p>Activity 1</p> <ul style="list-style-type: none"> <li>• Ask the learners to draw a Venn diagram to represent their favorite colors/animals/household items or any other item they choose and his/her friend's favorite colors/animals/household items or any other item they choose.</li> <li>• If there are common colors/animals/household items or any other item they choose, the diagram will be similar to the above diagram.</li> <li>• Calculate probability of the learner's favorite colors/animals/household items or any other item they choose and of his friend's favorite colors/animals/household items or any other item they choose.             <ul style="list-style-type: none"> <li>• If there are no common favorite color/animals/household items or any other item they choose the diagram will be two separate circles</li> </ul> </li> </ul> <div data-bbox="620 1024 922 1234" style="text-align: center;"> </div> <ul style="list-style-type: none"> <li>• Calculate the probability of his/her own favorite colors/animals/household items or any other item they choose</li> <li>• Calculate the probability of his friend favorite colors/animals/household items or any other item they choose</li> </ul>
	10 minutes	<p><b>Game 1:</b></p> <ul style="list-style-type: none"> <li>• Ask the learner to teach their friends and family members how to design 3 creative coins and play different rounds of the game, for example:             <ol style="list-style-type: none"> <li>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.</li> <li>2. Tossing 2 coins, 30 times. The player who has the highest number of two coins landed on heads and tails P(HT) wins</li> <li>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</li> </ol> </li> </ul>
	15 minutes	

		<p><b>Critique and revision:</b></p> <p>Learners should present all the day’s work to their parents or family members for feedback and suggestions for improvement. The parents or family members provide feedback using the following format:</p> <ul style="list-style-type: none"> <li>● Praise: What did you like about the learner’s work?</li> <li>● Question: Any questions or clarifications you have about the work?</li> <li>● Suggestions: In what areas does the learner need to improve their work?</li> </ul>												
3	20 minutes	<p><b>Activity 1</b></p> <ul style="list-style-type: none"> <li>● Ask the learner to find a circle shaped household item, the bigger the better (dish, tray, bicycle wheel) to draw a circle on cardboard paper, then cut out this circle</li> <li>● 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.)</li> <li>● Draw a line and cut it out to use as a pointer.</li> <li>● 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.)</li> </ul>  <ul style="list-style-type: none"> <li>● Assist the learner in creating a table for this experiment. Spin the pointer and calculate the probability for each color if they repeat it for six times</li> </ul> <table border="1" data-bbox="490 1402 1403 1797"> <tr> <td>1</td> <td>R</td> </tr> <tr> <td>2</td> <td>G</td> </tr> <tr> <td>3</td> <td>B</td> </tr> <tr> <td>4</td> <td>G</td> </tr> <tr> <td>5</td> <td>B</td> </tr> <tr> <td>6</td> <td>R</td> </tr> </table>	1	R	2	G	3	B	4	G	5	B	6	R
1	R													
2	G													
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5	B													
6	R													



	<p>10 minutes</p>	<p>- Color your dice with a color of your own choice.</p> <p>The outcomes of rolling a dice are (1, 2, 3, 4, 5, 6)</p> <ul style="list-style-type: none"> <li>• Draw a table of two columns like the one below and roll the dice 10 times</li> <li>• Record the outcome of each roll</li> </ul> <p>Example of the table:</p> <table border="1" data-bbox="488 573 924 903"> <thead> <tr> <th>Roll</th> <th>Number on Dice</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>4</td> </tr> <tr> <td>2</td> <td>6</td> </tr> <tr> <td>3</td> <td>...</td> </tr> <tr> <td>... 10</td> <td>...</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>• Calculate the probability of getting 4 or 1, <math>P(4)</math> or <math>P(1)</math> e.g., if 4 showed up 2 times on the dice, then <math>P(4) = \frac{2}{10} = \frac{1}{5}</math></li> <li>• Calculate the probability of all the outcomes you had in this experiment depending on the numbers that showed up on the dice each time it was rolled.</li> <li>• Add them all and reflect. What do you observe when you add them up? Answer: The sum is 10/10 which is equal to 1.</li> </ul>	Roll	Number on Dice	1	4	2	6	3	...	... 10	...
Roll	Number on Dice											
1	4											
2	6											
3	...											
... 10	...											
	<p>20 minutes</p>	<p><b>Game 3:</b> who will get to the end first</p> <ul style="list-style-type: none"> <li>• Ask the learner to teach a friend to draw and create a dice.</li> <li>• On the floor draw two mazes divided into steps with some cushions or chairs (make sure both mazes are the same difficulty). See an example of a maze below:</li> </ul>										

	<p>15 minutes</p>	<div style="text-align: center;">  </div> <ul style="list-style-type: none"> <li>• Each player rolls his dice according to the number the dice lands on and moves that amount of steps.</li> <li>• The one who finishes first wins.</li> </ul> <p><b>Critique and revision:</b></p> <p>Learners present all the day’s work to their parents or family members for feedback and suggestions for improvement. The parents or family members provide feedback using the following format:</p> <ul style="list-style-type: none"> <li>• Praise: What did you like about the learner’s work?</li> <li>• Question: Any questions or clarifications you have about the work?</li> <li>• Suggestions: In what areas does the learner need to improve their work?</li> </ul>																																																	
<p>5</p>	<p>10 minutes</p>	<p>Today we are going to learn how to compute probability when we roll two dice and create our own game club.</p> <p><b>Activity 1</b> Make a second dice and color it.</p> <p><b>Challenge:</b></p> <ul style="list-style-type: none"> <li>• Ask the learner to discover how many possible outcomes can happen when you roll two dice on the same time The answer is 36 outcomes (1, 2). (1, 1), (1, 3). (1, 4)....</li> </ul> <table border="1" data-bbox="495 1577 956 1816"> <thead> <tr> <th></th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> </tr> </thead> <tbody> <tr> <th>1</th> <td>(1,1)</td> <td>(1,2)</td> <td>(1,3)</td> <td>(1,4)</td> <td>(1,5)</td> <td>(1,6)</td> </tr> <tr> <th>2</th> <td>(2,1)</td> <td>(2,2)</td> <td>(2,3)</td> <td>(2,4)</td> <td>(2,5)</td> <td>(2,6)</td> </tr> <tr> <th>3</th> <td>(3,1)</td> <td>(3,2)</td> <td>(3,3)</td> <td>(3,4)</td> <td>(3,5)</td> <td>(3,6)</td> </tr> <tr> <th>4</th> <td>(4,1)</td> <td>(4,2)</td> <td>(4,3)</td> <td>(4,4)</td> <td>(4,5)</td> <td>(4,6)</td> </tr> <tr> <th>5</th> <td>(5,1)</td> <td>(5,2)</td> <td>(5,3)</td> <td>(5,4)</td> <td>(5,5)</td> <td>(5,6)</td> </tr> <tr> <th>6</th> <td>(6,1)</td> <td>(6,2)</td> <td>(6,3)</td> <td>(6,4)</td> <td>(6,5)</td> <td>(6,6)</td> </tr> </tbody> </table>		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)
	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)																																													
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6	(6,1)	(6,2)	(6,3)	(6,4)	(6,5)	(6,6)																																													



	20 minutes	<ul style="list-style-type: none"> <li>- Roll the two dice 10 times. Draw a table and calculate the probability of P (6, 3), P (5, 1), and P (3, 2).</li> <li>- Remember that if one of the outcomes did not happen the probability equals zero.</li> </ul> <p>Create your own game using one or two dice. Be creative!</p> <p>Try the game and play it with other players. Remember to write down and draw the details of your game.</p>
	30 minutes	<p><b>OR Another idea</b></p> <p><b>Game 4 :</b></p> <p>Learner looks around the house to collect 3 empty, equal sized, plastic bottles</p> <p>Ask the learner: 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.</p> <ul style="list-style-type: none"> <li>- Fill two plastic bottles halfway with water.</li> <li>- Flip both bottles at the same time. What are the possible outcomes of this experiment? They are top, bottom and side of the bottle.</li> <li>- Which outcome has more chances of happening? Which outcome has less chances of happening? Why?</li> <li>- The chances of the bottle landing on its side has more chances to happen, so we would say this outcome is 'likely' to happen.</li> <li>- The chances of the bottle landing on its top has less chances to happen, so we would say this outcome is 'unlikely' to happen.</li> <li>- 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.</li> <li>- Each player flips the two water bottles at the same time 10 times</li> <li>- The one who lands the bottles on the bottom most wins.</li> <li>- Add more difficult levels after if the learner wants to continue playing.</li> </ul>
	30 minutes	<p>Now ask the learner to create their own "game club" and display all the games they have created. Invite friends or siblings to join and play all the games they have created.</p>
	15 minutes	<p><b>Overall Project Reflection:</b></p> <p>The learner will now think about all the exercises they have done for the past 3 days and take note of "TWO" of the following:</p> <ul style="list-style-type: none"> <li>• What is the most important lesson you have learnt through this project?</li> <li>• What do you find challenging, puzzling or difficult to understand?</li> <li>• What question would you most like to discuss?</li> </ul>

	<ul style="list-style-type: none"> <li>• What is something you found interesting?</li> </ul>
Assessment Criteria:	<ul style="list-style-type: none"> <li>- Creativity in designing the coins using drawing of animals (heads and tails)</li> <li>- Creativity in designing spinners and posters.</li> <li>- Accurately calculating the probabilities of different basic outcomes in different experiments.</li> <li>- Creativity in designing the game club.</li> <li>- Drawing accurate squares.</li> <li>- Building an accurate 3D shape (cube).</li> <li>- Creativity in developing new games using probability.</li> </ul>

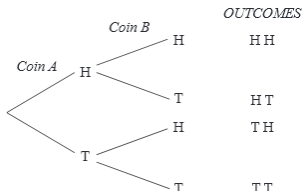
Topics/concepts covered	<ul style="list-style-type: none"> <li>- Art and design: Creating coins, spinners and dices</li> <li>- Creating games</li> <li>- Chance and probability</li> </ul>
Learning outcomes:	<ul style="list-style-type: none"> <li>- Learners will create coins and dice and use them to understand chance and calculate probability.</li> <li>- Learners will create a spinner and use it to understand and compute probabilities</li> <li>- Collect data on the chances of an outcome using tables.</li> <li>- Understanding how to use a Venn diagram to represent and calculate the probability of outcomes.</li> <li>- Investigate chance processes and develop, use, and evaluate probability models.</li> </ul>
Required previous learning:	<ul style="list-style-type: none"> <li>- Counting up to 100.</li> <li>- Drawing a straight line.</li> <li>- Multiplication tables</li> <li>- Knowledge of the different types of animals (live in sea or land)</li> </ul>
Inspiration:	
Additional enrichment activities:	<p>Learners can develop more games using probability and add to their club.</p> <p>Play this game online:  <a href="https://www.youtube.com/watch?v=4IQpe3J-2AU">https://www.youtube.com/watch?v=4IQpe3J-2AU</a></p>

### Ages 11 to 14 (Level 3)

<b>Description:</b>	Learners will explore the concept of the chances and probability and learn how to calculate probability. Learners will also recognize the importance of probability in daily life.
<b>Leading question:</b>	What is the importance of probability in our daily life?
<b>Age group:</b>	11 to 14
<b>Subjects:</b>	Math, Art and Design, Social Sciences, Science, Physical Education
<b>Total time required:</b>	6 hours over 5 days
<b>Self-guided / Supervised activity:</b>	Medium supervision
<b>Resources required:</b>	Papers, cardboard, pencils, colors, rulers, glue.

Day	Time	Activity and Description
1	25 minutes	<p>Ask the learner what their favorite sport is.</p> <ul style="list-style-type: none"> <li>- Try to ensure that the chosen sport is a match-based sport composed of two teams (football, American football, volleyball, Cricket, basketball, etc.)</li> <li>- Literacy extension: Ask the learner to write an essay describing his/her favorite sport in detail including some diagrams. Make sure it includes all the details such as: how many players are needed to play, what are the rules, who wins in the match, etc.</li> </ul>
	20 minutes	<p>Ask the learner:</p> <ul style="list-style-type: none"> <li>● How does the match kick-off? (mostly they toss a coin)</li> <li>● Why do you think they need to toss a coin? Explain</li> </ul> <p>Ask the learner to play a match of their own favorite sport with friends and family members a specific number of times. Before starting the match, ask the learner if they played 6 games with the opposing team, how many games would they win? Why?</p>

	<p>20 minutes</p> <p>20 minutes</p>	<p>Example: My team will win 5 out of the 6 games or <math>\frac{5}{6}</math> because we have better goalkeepers and strikers. This means if my team plays 6 matches we will win 5 out of the 6 and we will lose 1. So the probability is <math>\frac{5}{6}</math>.</p> <ul style="list-style-type: none"> <li>- Set out to play the sport a specific number of times,</li> <li>- Ask each family member to predict how many times each of their teams is going to win</li> <li>- Record the result of each time the sport has been played,</li> <li>- And award a prize for the correct match winning prediction.</li> </ul> <p>Conclusion:</p> <ul style="list-style-type: none"> <li>- Probability is very important in sports, some sports use probability in kick-off. The most popular use of probability in sports is through betting, which is a large profit industry.</li> <li>- In probability there is no right or wrong, it is all about chances.</li> </ul> <p>Ask the learner what the outcomes are if you toss one coin. What are the outcomes if you toss two coins?</p> <p>Ask the learner to draw:</p> <ul style="list-style-type: none"> <li>- A diagram that represents flipping one coin.</li> <li>- A diagram that represents tossing two coins.</li> </ul> <p>Give the learner feedback and clarify why his/her diagrams work or didn't work.</p> <p>Tell the learner they can use a tree diagram for probability.</p> <ul style="list-style-type: none"> <li>● If you flip one coin once, the outcome will be either heads or tails</li> <li>● If you toss two coins this is a <b>tree diagram</b> of outcomes of all the potential outcomes</li> </ul> <div data-bbox="535 1323 836 1522" data-label="Diagram"> </div> <ul style="list-style-type: none"> <li>● Explain to the learner how to calculate the probability of each outcome</li> </ul> <div data-bbox="511 1617 836 1869" data-label="Diagram"> </div>
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		<p>To calculate the probability of an outcome, we have to ask, when a coin is tossed, what are possible outcomes (the possible result of a coin throw)?</p> <p>Answer: There are two possible outcomes, and you can only one of them at each throw therefore, the probability of heads P(H) or tails P(T) for one coin is <math>\frac{1}{2}</math>.</p> <ul style="list-style-type: none"> <li>The probability of the outcomes being either heads or tails is <math>\frac{1}{2}</math> so if you are looking at the tree and calculate <math>P(HH) = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}</math> or <math>P(HT) = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}</math></li> </ul> <p>Alternatively, we can count how many times we see the outcome we desire to compute on the tree diagram. See below:</p>  <p>e.g., for P(HH), for two coin toss, you have 4 potential outcomes and HH only appears once, therefore, <math>P(HH) = \frac{1}{4}</math></p> <ul style="list-style-type: none"> <li>Ask the learner to draw a tree diagram of tossing 3 coins and calculate the probability of all outcomes.</li> <li>Ask the learner to create their own experiment. <ul style="list-style-type: none"> <li>- Draw the tree diagram</li> <li>- Calculate the probability of all outcomes.</li> </ul> </li> </ul> <p><b>Critique and revision:</b></p> <p>Learners present all the day's work to their parents or family members for feedback and suggestions for improvement. The parents or family members provide feedback using the following format:</p> <ul style="list-style-type: none"> <li>Praise: What did you like about the learner's work?</li> <li>Question: Any questions or clarifications you have about the work?</li> <li>Suggestions: In what areas does the learner need to improve their work?</li> </ul>
2	20 minutes	<p><b>Task 1</b></p> <p>Ask the learner to draw a table with two rows.</p> <ul style="list-style-type: none"> <li>In the first row: write the remaining 4 days of the week</li> <li>In the second row: observe and record the weather for the next 4 days and show the weather with a drawing in each day. Note down if it is cloudy, windy, sunny or rainy.</li> </ul>

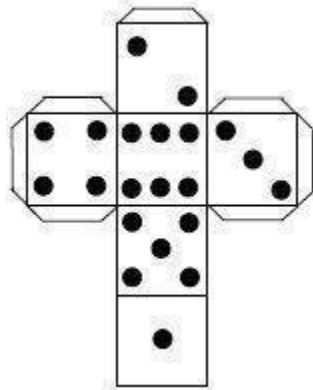
20  
minutes

**Task 2**

Today we are going to make dice to develop games.

Design a cube:

- Ask the learner to 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.



Color your dice with a color of your own choice.

What are the chances of rolling the dice?

How do you calculate the probability of which side the dice will land on?

(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. What do you observe after adding them up?

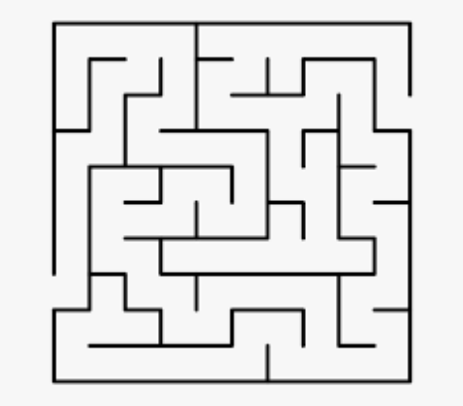
Answer: The sum is  $10/10$  which is equal to 1.

Learners can draw a table like the one below:

Roll	Number on Dice
1	4
2	6
3	...
... 10	...

**Game 1:** who will get to the end first?

- Ask the learner to teach a friend to draw and create a dice.

	<p>15 minutes</p>	<ul style="list-style-type: none"> <li>On the floor draw two mazes (see example of a maze below) divided into steps with some cushions or chairs (make sure both mazes are the same difficulty)</li> </ul>  <ul style="list-style-type: none"> <li>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.</li> </ul>
<p>3</p>	<p>10 minutes</p> <p>10 minutes</p>	<ul style="list-style-type: none"> <li>Teacher asks the learner to reflect on the last two days. What did you learn? What did you enjoy most? Why?</li> <li><b>Remind learners to record today's weather to complete the weather table in the table created on Day 2.</b></li> </ul> <p><b>Challenge:</b> Ask the learner to discover how many possible outcomes can happen when you roll two dice at the same time. The answer is 36 outcomes (1, 2). (1, 1), (1, 3). (1, 4)....</p>

		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
<b>1</b>	(1,1)	(1,2)	(1,3)	(1,4)	(1,5)	(1,6)	
<b>2</b>	(2,1)	(2,2)	(2,3)	(2,4)	(2,5)	(2,6)	
<b>3</b>	(3,1)	(3,2)	(3,3)	(3,4)	(3,5)	(3,6)	
<b>4</b>	(4,1)	(4,2)	(4,3)	(4,4)	(4,5)	(4,6)	
<b>5</b>	(5,1)	(5,2)	(5,3)	(5,4)	(5,5)	(5,6)	
<b>6</b>	(6,1)	(6,2)	(6,3)	(6,4)	(6,5)	(6,6)	

- Roll the two dice 10 times.  
- Draw a table and record all the outcomes.

Example:

Trial	Dice 1	Dice 2
1	3	4
2	1	5
3		
4....	..	..

15 minutes

Calculate the probability of the outcomes. How many times did each outcome happen in the 10 rolls of the dice?

- Add all the probabilities of all outcomes. What do you observe? Answer: the sum will equal  $\frac{10}{10} = 1$
- What are the chances of rolling two dice and get (7,2)  
Answer: zero.

25 minutes

**Literacy extension:** Ask the learner to think through some of the common applications of probability in real life. Learners can consult adults and other family members in case they are not sure of some of the applications. Learners should write a 1-page essay on the applications of probability in real life.

Common applications include:

- One of the important applications of probability is developing games which require chances.
- Some games are for entertainment and having fun.
- Some games include profit and making money (clubs, casinos)
- Predicting the occurrence of events (weather, sports betting)
- Probability is very important in predicting the characteristics of the family tree.
- It is also very important in disease diagnoses to improve the chances of protection and cure.



	15 minutes	<p>Ask the learner to list some games that require dice/s. Develop your own game using one dice or two dices (be creative!) Play the game with friends/siblings.</p> <p><b>Critique and revision:</b></p> <p>Learners present all the day's work to their parents or family members for feedback and suggestions for improvement. The parents or family members provide feedback using the following format:</p> <ul style="list-style-type: none"> <li>● Praise: What did you like about the learner's work done?</li> <li>● Question: Any questions or clarifications you have about the work?</li> <li>● Suggestions: In what areas does the learner need to improve their work?</li> </ul>
4	10 minutes  40 minutes	<p>Today learners will look at one of the applications of probability in real life</p> <ul style="list-style-type: none"> <li>● <b>Remind learners to record today's weather to complete the weather table in the table created on Day 2.</b></li> </ul> <p>Ask the learner to draw their family tree on a big poster (up to their grandparents or great-grandparents). Learners will work with their parents to find out the following information about each of their family members.</p> <ul style="list-style-type: none"> <li>- Name</li> <li>- Age</li> <li>- Relation to the learner</li> <li>- Choose three characteristics such as (skin color, height, eye color, hair style...)</li> </ul> <p>And then create a family tree like below:</p>

		<div style="text-align: center;"> <pre> graph TD     Ali["Ali, 4 years, yellow skin, 2ft, blue eyes"] --- Parents     Parents --- John["John, 44 years, white skin, 7ft, blue eyes"]     Parents --- Sheila["Sheila, 40 years, black skin, 5ft, brown eyes"]     John --- GP1[" "]     John --- GP2[" "]     Sheila --- GP3[" "]     Sheila --- GP4[" "]     style GP1 fill:none,stroke:none     style GP2 fill:none,stroke:none     style GP3 fill:none,stroke:none     style GP4 fill:none,stroke:none             </pre> </div> <p>The learner will now relate their own characteristics (skin color, height, eye color...) to their family tree.</p> <p>What are the chances of the learner's future children having a characteristic (eye color, hair style, height...?) that many people in the family have?</p> <p><b>Critique and revision:</b></p> <p>Learners present all the day's work to their parents or family members for feedback and suggestions for improvement. The parents or family members provide feedback using the following format:</p> <ul style="list-style-type: none"> <li>● Praise: What did you like about the learner's work done?</li> <li>● Question: Any questions or clarifications you have about the work?</li> <li>● Suggestions: In what areas does the learner need to improve their work?</li> </ul>
5	15 minutes	<p>Activity of weather prediction</p> <ul style="list-style-type: none"> <li>● <b>Remind learners to record today's weather to complete the weather table in the table created on Day 2.</b></li> <li>● Calculate the probability of each outcome: sunny, rainy, windy and cloudy in the last 4 days?</li> <li>● Explain that to calculate it they have to use however many times each outcome occurs in the 4 days and divide it by the number of days.</li> </ul> <p>Example: If it was sunny for 2 days out of 4 days that means the probability is <math>\frac{2}{4}</math> and calculate the percentage by multiplying it by 100 <math>\frac{2}{4} \times 100 = 50\%</math> So we can predict that for next week's weather, the probability it will be sunny is 50%.</p>

	<p>15-20 minutes</p> <p>30 minutes</p> <p>15 minutes</p>	<p>Ask the learner, what do we learn from this weather prediction activity? What are the benefits of being able to predict the weather?</p> <p>Some answers would include:</p> <p>Probability is very important in predicting the weather through the year so we can:</p> <ul style="list-style-type: none"> <li>● Know what season to plant our crops</li> <li>● What to wear for the next week</li> <li>● when to travel to certain areas or places</li> <li>● Know in advance the chances of floods, hurricanes for protective measures</li> </ul> <p>Ask the learner to go to their communities or in their extended family members and count how many people have diabetes (or any other inherited disease)</p> <ul style="list-style-type: none"> <li>● Calculate the percentage of diabetics in the community.</li> <li>● If the percentage is 20% that means, there is a very low chance of diabetics in the next generation. We call this outcome 'unlikely'</li> <li>● If the percentage is above 50% that means there is a very high chance of diabetics in the next generation. We call this outcome 'likely'</li> </ul> <p>Ask the learner, what did we learn about the occurrence of disease from this example? What would be the benefits of being able to know how many people suffer from a specific disease within the community?</p> <p>Answer: Probability is important in measuring and curing. So that we know if we will have more diabetics in the next generation to prepare plans for cure and prevention.</p> <p>Imagine our daily life without probability or chances Draw a table that compares our life with and without probability in it.</p> <p><b>Overall Project Reflection:</b> The learner will now think about all the exercises they have done for the past 3 days and take note of "TWO" of the following:</p> <ul style="list-style-type: none"> <li>○ What is the most important lesson you have learnt through this project?</li> <li>○ What did you find challenging, puzzling or difficult to understand?</li> <li>○ What question would you most like to discuss?</li> <li>○ What is something you found interesting?</li> </ul>
<p>Assessment Criteria:</p>		<ul style="list-style-type: none"> <li>- Creativity in designing posters to explain learning outcomes.</li> <li>- Calculate accurately the probabilities of different basic outcomes in different experiments.</li> <li>- Drawing accurate squares.</li> <li>- Building an accurate 3D cube.</li> <li>- Creativity in developing new games using probability.</li> <li>- Communication skills in the presentation of knowledge.</li> </ul>

	<ul style="list-style-type: none"> <li>- Probability and chance</li> <li>- Art and design: creating a cube/dice</li> <li>- Probability trees</li> <li>- Applications of probability in daily life</li> <li>- Game creation</li> <li>- Critical thinking,</li> <li>- Creativity</li> </ul> <p>Communication</p>
Learning outcomes:	<ul style="list-style-type: none"> <li>- Learners will use coins and dice to understand and calculate probabilities of occurrence of events.</li> <li>- Learners will understand the applications of probability in real life</li> <li>- Learners will be able to collect and summarize data on chances of daily life outcomes using tables</li> <li>- Learners will learn more about their families and different genetic features that they commonly have in their family.</li> <li>- Learners will learn how to use tree diagrams and probability trees to think through chance problems.</li> <li>- Enhance the learner's critical thinking, creativity and communication skills.</li> </ul>
Required previous learning:	<ul style="list-style-type: none"> <li>- Calculation of probability for simple experiments (coins)</li> <li>- Draw 2D shapes (square, rectangle)</li> <li>- Drawing tables.</li> <li>- Writing skills.</li> <li>- Multiplication (mental math)</li> </ul>
Additional enrichment activities:	<ul style="list-style-type: none"> <li>- Watch this video- application of probability <a href="https://www.youtube.com/watch?v=_sY3ZRxBaM">https://www.youtube.com/watch?v=_sY3ZRxBaM</a></li> <li>- Mendel genes and inheritance <a href="https://www.youtube.com/watch?v=jVlfbQdrmhE">https://www.youtube.com/watch?v=jVlfbQdrmhE</a></li> </ul>