The Probability Games

Primary: (ages 7 – 11)	Mathematics

In this activity, students begin with an exercise designed to illustrate how curiosity, observation, imagination and resilience can help you predict the likelihood of certain events taking place. In a follow-up series of activities, they apply this understanding to explore how likely it is that someone in the class has a name which appears in the top ten baby's names in the year of their birth, that someone in the class has the same name as one of their classmates' brothers and sisters, and that one of their classmates will be absent the following day.

Time allocation	2 lesson periods
Subject content	Understanding how to calculate probabilities from the evidence available (and when an accurate probability cannot be calculated) Understanding the relevance of probability to their lives Computational skills in calculating probabilities
Creative and critical thinking	This unit has a **creativity** and **critical thinking** focus: • Generate and play with ideas to envision how to solve maths problems • Appraise and review thinking, acknowledge uncertainty, consider alternative perspectives, and reflect on steps taken
Other skills	Communication, Collaboration, Persistence/Perseverance
Key words	probability; likelihood; certainty; uncertainty; predictions; curiosity; guessing

Products and processes to assess

Students engage in discussions and produce a series of calculations about probability. At the highest levels of achievement, they are able to use both their imagination and the principles of probability to generate ideas, appraise their thinking and reflect thoughtfully on certainty and uncertainty. They consider several ways of formulating and answering problems, understand the strengths and limitations of their work, and are open to the ideas of others

This plan suggests potential steps for implementing the activity. Teachers can introduce as many modifications as they see fit to adapt the activity to their teaching context.

Step	Duration	Teacher and student roles	Subject content	Creativity and critical thinking
1	Lesson period 1	Working in groups, students are given a small part of a bigger image. They have to study the image carefully and predict what they will see when they are given the big image. They are asked to come with a list of four predictions. The prediction should be: What they are certain will be in the full image, what is likely to be in the full image but can't be certain, what is unlikely to be in the full image and finally what they are sure will not be in the full image. They are then handed the relevant full image and give themselves a score. Then, still working in their groups the pupils should reflect on what strategies helped them predict accurately what would happen and why they got things wrong. They should focus on how their imagination and curiosity helped them identify possible solutions and the role of persistence in finding good solutions.	Observing closely and drawing conclusions from their observations Predicting outcomes from their observations.	Generating ideas for predictions Appraising and acknowledging uncertainty and checking accuracy Reflecting on steps taken to solve a maths problem
2		The small images are then redistributed so that each group gets a new image which is part of a much bigger image. They go through the same process. This time they have to come up with six predictions. One would be certain to be true, one would be certain to be untrue, and the others should be a mix of likely and unlikely. Again they should give themselves a score. This time the reflection should take the form of a whole class discussion, in which groups can share their success and errors, and discuss the strategies that made them successful.	Observing closely and drawing conclusions from their observations Predicting outcomes from their observations and developing strategies on basis of their experience	Playing with several approaches to a maths problem (e.g. using probability to generate predictions) Considering several perspectives o approaching a maths problem Appraising and acknowledging uncertainty and reflecting on steps taken
3	Lesson period 2	Only about 25% of children have a name which features among the 10 most popular. The class should work out what is the probability of one of them having a name in the top ten from their country. Once they have worked out the probability, they should look the list of top ten names in the year of their birth and see what they find.	Understanding the principles of probability Making simple accurate calculations	Playing with several approaches to a maths problem Envisioning how to solve meaningfully a maths problem
4		Then each student should come to the front of the class, write their name and how many brothers and sisters they have. The class should then add up the total number of brothers and sisters. Each student then has to estimate how many of those brothers and sisters have the same name as someone in the class (if they have the same name as another brother or sister this does not count). Each student writes their guess on a piece of paper. Then they are asked to reveal their estimate, and explain why they decided on that figure. What made them think that?	Thinking logically and explaining their thinking	Envisioning how to solve meaningfully a maths problem Identifying and questioning their own assumptions
5		Then each student comes forward and writes the first letter of the names of all their	Identifying which guessing	Envisioning how to solve

		brothers and sisters. Looking at this information, students are allowed a second guess as to how many have the same name as a child in the class. This they also write on their piece of paper. Again the students are invited to reveal whether they have changed their guess, and if so why.	strategies are most successful and why	meaningfully a maths problem Appraising uncertainty and reflecting on chosen approach relative to possible alternatives
6		Then each student comes forward again and writes the second letter of the names of all their brothers and sisters. Students are allowed another guess. The reasons for any changes are again discussed. Finally, the full names of all the brothers and sisters are revealed. The accuracy of everyone's predictions are analysed and discussed in group discussion.	Building experience of the principles of probability	Appraising uncertainty and reflecting on chosen approach relative to possible alternatives
7	Lesson period 3	The students are asked to predict how likely it is that at least one pupil will be absent from class tomorrow. Then they are provided with a table showing on which days since the beginning of the academic year at least one child was absent from class. From this they should try and estimate the probability of at least one child being absent tomorrow. The groups should then look at whether the probability of at least one child being absent is different in different months. From this they should re-estimate the likelihood of at least one child being absent tomorrow. The teacher may decide to close the activity with a reflection (either in writing or in discussion) of what the students have learned about probability and how they used creative and critical thinking to complete the challenges.	Interpreting evidence and using it as the basis of logical thinking	Envision how to solve meaningfully a maths problem Reflecting on steps taken to solve a maths problem

Resources and examples for inspiration

Web and print

> Access to web to research the 10 most popular names in the year you were born

Other

> Print out of selection of images and part images attached to this activity description
> Table of days on which at least one child was absent since the beginning of the academic year

| | **Creativity and critical thinking rubric for mathematics** | | • Mapping of the different steps of the lesson plan against the OECD rubric to identify the creative and/or critical thinking skills the different parts of the lesson aim to develop | |

	CREATIVITY **Coming up with new ideas and solutions**	**Steps**	**CRITICAL THINKING** **Questioning and evaluating ideas and solutions**	**Steps**
INQUIRING	Make connections to other maths concepts or to ideas from other disciplines	1	Identify and question assumptions and generally accepted ways to pose or solve a maths problem	4
IMAGINING	Generate and play with several approaches to pose or solve a maths problem	1-3	Consider several perspectives on approaching a maths problem	2,5,6
DOING	Pose and envision how to solve meaningfully a maths problem in a personally novel way	3,4,5,7	Explain both strengths and limitations of different ways of posing or solving a math problem based on logical and possibly other criteria	1,2,5,6
REFLECTING	Reflect on steps taken to pose and solve a maths problem	1,7	Reflect on the chosen maths approach and solution relative to possible alternatives	1,2,5,6