The Plumb Stones Game

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Subject Area:	Mathematics	
Strand:	Statistics and Probability	
Grade Level:	Six	
WNCP:	**Outcome SP6.2:**	Demonstrate understanding of probability by: • determining sample space • differentiating between experimental and theoretical probability • determining the theoretical probability • determining the experimental probability comparing experimental and theoretical probabilities.
	Indicators:	b. List the sample space (possible outcomes) for an event (such as the tossing of a coin, rolling of a die with 10 sides, spinning a spinner with five sections, random selection of a classmate for a special activity, or guessing a hidden quantity) and explain the reasoning. e. Explore and describe examples of the use and importance of probability in traditional and modern games of First Nations and Métis peoples. f. Predict the likelihood of a specific outcome occurring in a probability experiment by determining the theoretical probability for the outcome and explain the reasoning. g. Compare the results of a probability experiment to the expected theoretical probabilities. h. Explain how theoretical and experimental probabilities are related.

Materials:

One set of game pieces for each group of students.

One basket for each group of students or a piece of leather approximately 30 cm by 30 cm.

Teacher Preparation:

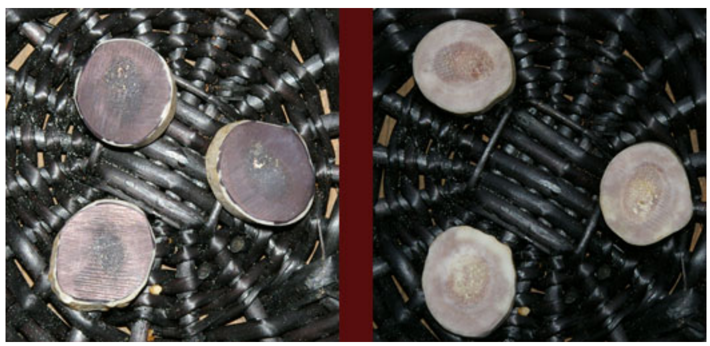
Rather than using a basket or a piece of leather to toss the pieces it may be easier to toss them on a table or the floor as you would dice.

In the example score sheet below Alison took 13 tosses to reach a score of 7. In the process she received a score of zero, 7 times. Hence from this instance of the game, the experimental probability that the game results in a zero score is $\frac{7}{13}$ or 0.54.

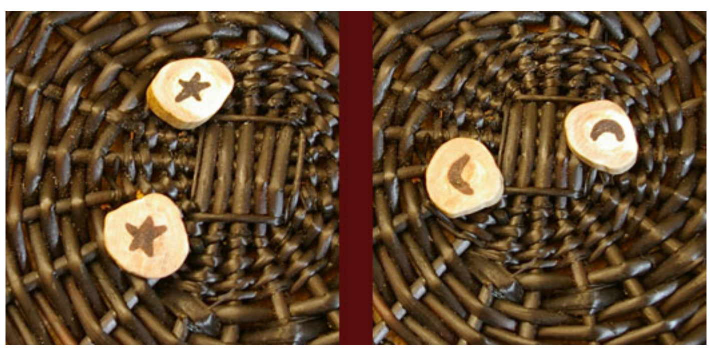
Activity/Lesson Ideas:

Games were common among the different Aboriginal groups of North America and were often given or traded between groups. Give your students the PowerPoint presentation, which provides information on Aboriginal games, both traditional and modern day games. This game was taught to us by Lamarr Oksasikewiyin from Laronge Saskatchewan. He told us that the original game pieces were plumb seeds but we have used slices of deer antler. You might use plastic or wooden disks that you can find in a craft store.

There are five game pieces, three of which are marked on one side and unmarked on the other side



and the other two pieces have a star on one side and a moon on the other.

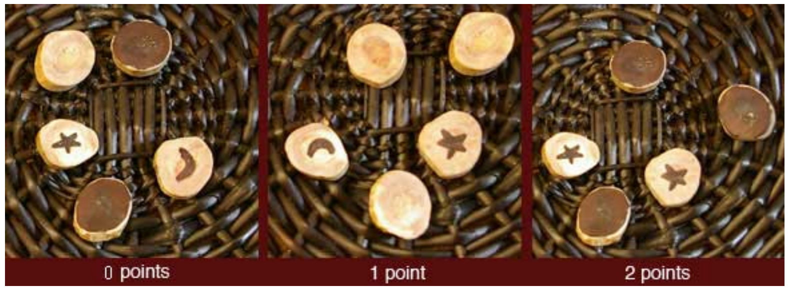


All five game pieces are placed in a bowl and the players take turn gently flipping the bowl so that the pieces are all in the air and then land in the bowl. If the pieces are not all in the air during the toss then no score is recorded and the bowl passes to the next player.

Scoring:

For a non-zero score to be recorded all three marked-unmarked pieces must land the same way up, either all marked or all unmarked. If these three pieces show a mixture of marked and unmarked sides then a zero score is recorded and the bowl passes to the next player. If the all three marked-unmarked pieces land the same way up then the other two pieces determine. If they match, two stars or two moons, then the player receives 2 points. If they are unmatched then the the player receives 1 point. If a player scores then he or she plays again. Before starting the players should decide how long the game will last, possible until one player reaches 11 points.

Examples:



Divide your class into groups of 4 or 5 students and provide each group with a set of five game pieces. Have each group play the game a few times to get accustomed to the scoring.

Many of the Aboriginal games of chance take a long time to complete. This is the case with the plumb stones game. To reach a score of 11 as is suggested above, a player can expect to toss the pieces almost 30 times. To shorten the game and simplify the probability calculations, for this lesson we have changed the game slightly. Students will play with 4 game pieces, the two star-moon pieces and two of the marked-unmarked pieces. The scoring is similar to the 5 piece game.

Scoring:

For a non-zero score to be recorded both marked-unmarked pieces must land the same way up, either all marked or all unmarked. If these two pieces show a mixture of marked and unmarked sides then a zero score is recorded for that player and the bowl passes to the next player. If both marked-unmarked pieces land the same way up then the other two pieces determine the score. If they match, two stars or two moons, then the player receives 2 points. If they are unmatched then the the player receives 1 point. If a player scores more than zero then he or she plays again.

Play:

The play is divided into two parts, 1 and 2.

1. First, toss one of the marked-unmarked pieces and then the second marked-unmarked piece. If they don't match, a score of zero is recorded and the game pieces are passed to the next player. If they match then proceed to the second part of the game.

2. Toss the first star-moon piece and then the second star-moon piece. Record the score is determined by the scoring rules explained above. Then the same player plays again.

Have each group of students play this version of the game until each player reaches a score of 7. Use the score sheet to keep the score, including how many times a player received a score of zero. Have each student calculate, from the score sheet, the experimental probability of obtaining a score of zero. Have each student report their data on a larger class score sheet. From this combined data calculate the experimental probability of obtaining a score of zero.

Discuss with the entire class the sample space for the first part of the game. The sample space has four possible outcomes.

First Toss	Second Toss
	
	
	
	

Questions/Discussion:

Have the students describe each item in the sample space in words.

Using the fact that

$$\text{Theoretical probability} \quad \frac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}}$$

calculate the theoretical probability that a play of the game results in a zero score.

Compare the results to the experimental probabilities calculated above.

Why is there more than one experimental probability and only one theoretical probability?

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Example Score Sheet:

	Round	Score	Score	Score	Score
Name		Alison			
	1	1			
	2	0			
	3	1			
	4	2			
	5	0			
	6	0			
	7	0			
	8	1			
	9	1			
	10	0			
	11	0			
	12	0			
	13	1			
	14				
	15				
	16				
	17				
	18				
	19				
	20				

Score Sheet:

	Round	Score	Score	Score	Score
Name					
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	11				
	12				
	13				
	14				
	15				
	16				
	17				
	18				
	19				
	20				