



Topic
Probability

Key Question
Which color bear are you most likely to draw from a bag?

Learning Goals
Students will:

1. predict the color of the bear they are likely to draw from a bag,
2. draw and record the color of bear they actually draw, and
3. evaluate the likelihood of certain events occurring.

Guiding Document
*NCTM Standards 2000**

- Collect data using observations, surveys, and experiments
- Describe events as likely or unlikely and discuss the degree of likelihood using such words as certain, equally likely, and impossible
- Build new mathematical knowledge through problem solving

Math
Data analysis
probability
Problem solving

Integrated Processes
Observing
Predicting
Collecting and recording data
Interpreting

Problem-Solving Strategies
Work backwards
Guess and check

Materials
Teddy Bear Counters, green and yellow
(see *Management 2*)
Paper lunch sacks
Colored pencils, green and yellow
Student pages



Background Information

This activity provides a way for students to explore basic probability concepts and evaluate the likelihood of simple events occurring. They are given a bag of bears and told the number of each color that it contains. With this knowledge, they can predict, with some degree of accuracy, which color bear they are likely to draw. Because bears are not replaced once they are removed from the bag, the probability of drawing one color over another changes with each person's turn. As students predict and record each turn, they will begin to see how probability works in many real-world situations. Even though it may be very likely that something will happen, if it is not certain, it cannot be relied upon.

Management

1. Prepare enough different bags of bears so that each pair or group of students can have one. (Groups should have a maximum of four players; fewer are preferable.) Be sure to use bags that students cannot see through. Paper lunch sacks work well. Each bag should have a total of 12 bears to correspond to the number of spaces on the student pages. In some bags include more green, in some include more yellow, and in some include an equal number of green and yellow. Be sure there is at least one bear of each color in each bag. Suggested bag compositions are given here.

Bag One	Bag Two	Bag Three
1 yellow 11 green	3 yellow 9 green	4 yellow 8 green
Bag Four	Bag Five	Bag Six
5 yellow 7 green	6 yellow 6 green	7 yellow 5 green
Bag Seven	Bag Eight	Bag Nine
8 yellow 4 green	9 yellow 3 green	11 yellow 1 green

2. If you do not have Teddy Bear Counters, you may use other objects instead, as long as they are uniform and of two different colors—green and yellow.
3. Students will need one copy of the first student page for each different bag they use. Groups should use at least two or three different bags.

Procedure

1. Introduce the activity by telling students the following story:
The *Chewy Candies Café* sells bags of 12 gummy bears for \$1.50. They only make two colors of gummy bears—green and yellow. Every Friday they have a special deal. They will fill your bag with 12 gummy bears—some yellow and some green. They will even tell you how many bears are green and how many are yellow. If you can correctly guess which color bear you will pull out of the bag first, you get the bag for free.
2. Tell students that they are going to be customers at the *Chewy Candies Café* who are trying to get their gummy bears for free. Instead of just trying to guess the color of the first bear drawn from the bag, they will guess the color of every bear they draw from the bag.
3. Distribute the first student page to each student and yellow and green colored pencils and one bag of bears to each pair or group of students.
4. Inform groups of the contents of their bags and have them record the numbers of yellow and green bears by writing down the numbers and coloring in the bears.
5. Describe the process by which students are to record their predictions and actual colors drawn. Before drawing from the bag, each player must guess whether he or she will draw a green bear or a yellow bear. This guess should be based on the knowledge of the contents of the bag and what has already been drawn. For example, if students are playing with a bag of three yellow bears and nine green bears, it is reasonable to guess that on the first turn a green bear will be drawn from the bag. If, after several turns, no yellow bears have been drawn, a student would be able to further conclude that drawing a yellow bear is now more likely because the number of green and yellow bears is closer to equal.
6. Explain that each player is to make a record of his or her guess by coloring in the *Guess* bears either yellow or green. Once a player has made and recorded a guess, he or she is to draw one bear from the bag. The color of the bear actually drawn is recorded in two places. All players record the color in the bears at the bottom of the page, and the player who drew the bear makes a record of it by coloring the *Actual* bear opposite the guess for that round. This recording allows each player to deduce the number of bears of each color still in the bag before each turn.
7. Allow time for students to play several rounds, each with a different bag of bears. They will each need one copy of the first student page for every game played.
8. Once students have had several experiences, distribute the second student page. Give each group enough additional bears so that they have 12 of each color.
9. Explain the challenge and give groups time to complete it. Make sure that they know that each group member should start with all 12 bears in the bag before drawing one as a sample.
10. Distribute the final two student pages to allow students to apply their knowledge and analyze their experiences.
11. Close with a time of class discussion and sharing where you go over the questions and have students explain their thinking.

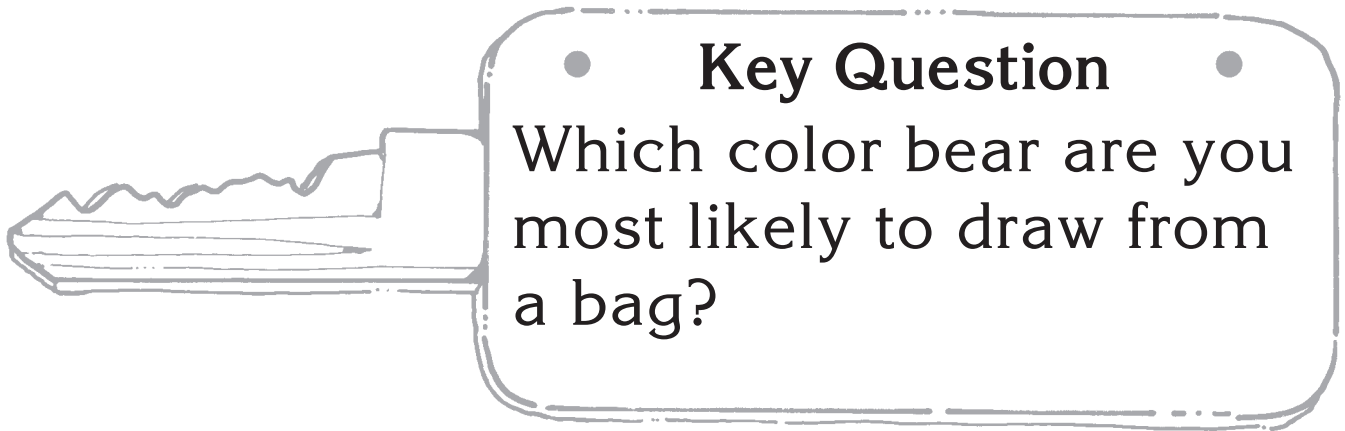
Connecting Learning

1. How did you guess what color of bear you were going to draw? How often were you right?
2. Were you more often correct at the beginning or end of a round? Why do you think this is?
3. For which bags of bears was it easiest to predict the color of the first bear? ...hardest? Why?
4. What do you need to do to make it impossible to draw a green bear? ...certain?
5. Describe a bag from which it would be unlikely to draw a green bear. ...likely to draw a green bear.
6. In the bags your group created, did anyone ever draw a color that was impossible? Why or why not? Did anyone ever draw a color that was unlikely?

Extensions

1. Increase the number of bears and/or the number of colors of bears.
2. Have students describe the probability of pulling each color from the different bags as ratios and fractions. For example, there is a 7:12 chance of drawing a yellow bear from this bag, or the probability of getting green is $\frac{1}{2}$.

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Key Question

Which color bear are you most likely to draw from a bag?

Learning Goals

Students will:

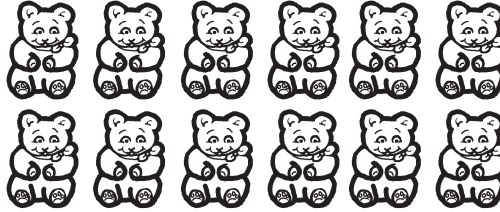
1. predict the color of the bear they are likely to draw from a bag,
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3. evaluate the likelihood of certain events occurring.





Our bag has _____ yellow bears and _____ green bears.

Color the number of yellow and green bears you have in your bag.

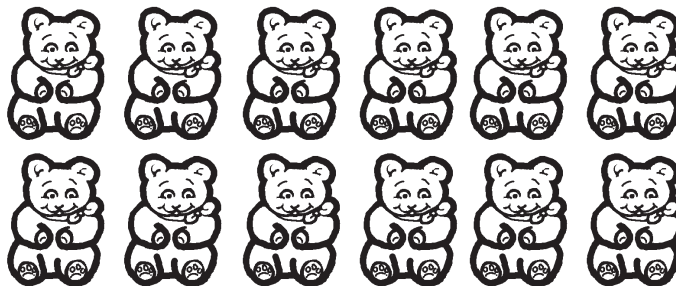


Guess what color bear you will draw and show what color you did draw.



Guess		Actual	
Guess		Actual	
Guess		Actual	
Guess		Actual	
Guess		Actual	
Guess		Actual	


Color the bears to match what has been picked by you or your partner(s).

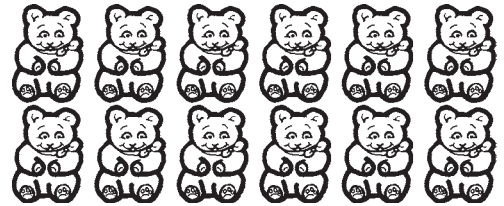




For each challenge, create a bag of 12 bears. Color the bears to show what you put in the bag. Test your bag by drawing one bear. Record its color.


1. Fill a bag so that it is **impossible** to draw a yellow bear.

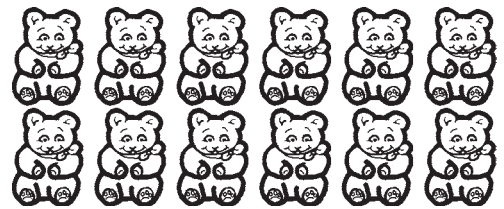
What color bear did you draw? 



Show the bears in your bag.


2. Fill a bag so that it is **likely** (not certain) you will draw a green bear.

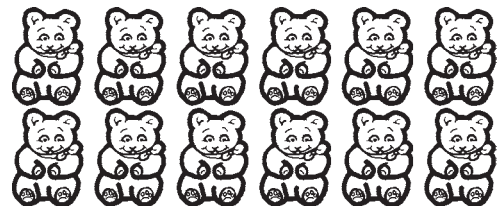
What color bear did you draw? 



Show the bears in your bag.


3. Fill a bag so that it is **certain** you will draw a yellow bear.

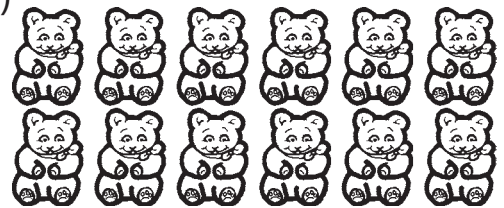
What color bear did you draw? 



Show the bears in your bag.

4. Fill a bag so that it is **unlikely** (not impossible) you will draw a green bear.

What color bear did you draw? 



Show the bears in your bag.



Read the statements. Circle the face that shows the correct response.

1. There are 12 yellow bears and 0 green bears. I drew a yellow bear.



Impossible



Unlikely



Likely



Certain

2. There are 8 green bears and 4 yellow bears. I drew a green bear.



Impossible



Unlikely



Likely



Certain

3. There are 0 yellow bears and 12 green bears. I drew a yellow bear.



Impossible



Unlikely



Likely



Certain

4. There are 3 green bears and 9 yellow bears. I drew a green bear.



Impossible



Unlikely



Likely



Certain



1. In one round, what was the most yellow bears you picked?

2. How many yellow bears were in your bag that round?

3. Was it more likely for you to draw a green bear or a yellow bear? Why?



4. In one round, what was the most green bears you picked?

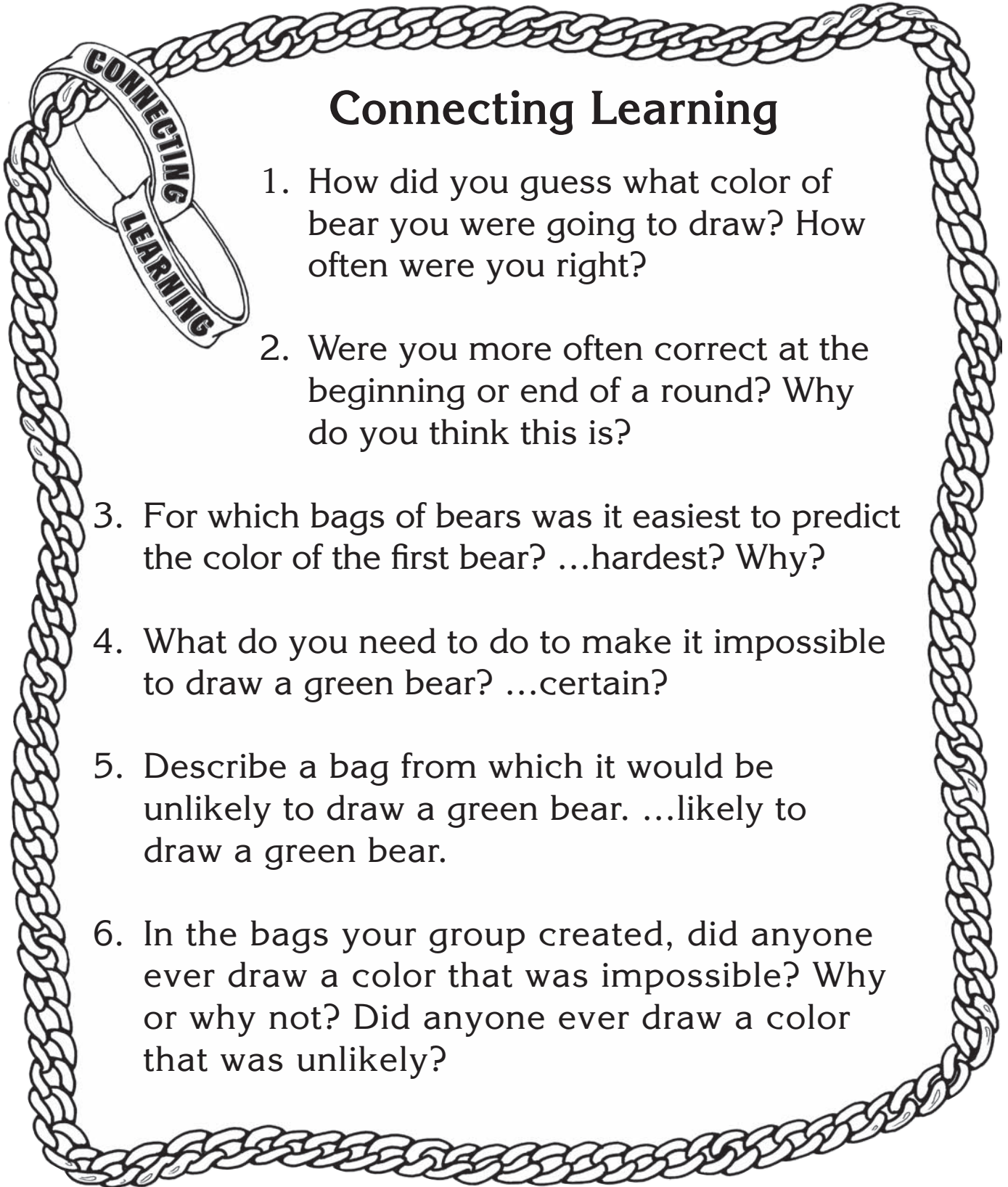
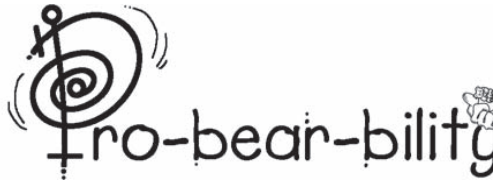
5. How many green bears were in your bag that round?

6. Was it more likely for you to draw a green bear or a yellow bear? Why?

7. How often did you correctly guess the color of the bear you drew?



8. Did you have more correct guesses at the beginning of a round or the end of a round? Why?



Connecting Learning

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