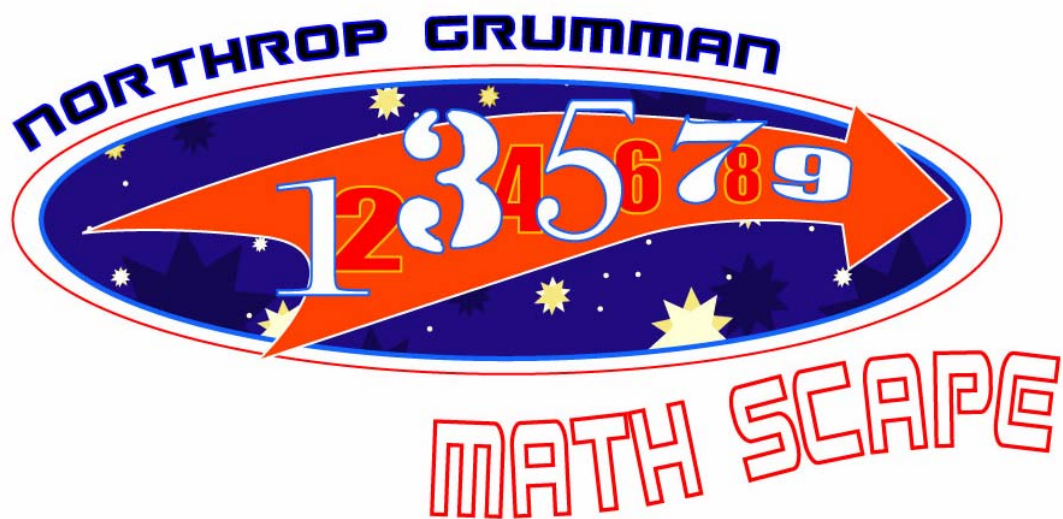


WHAT ARE MY CHANCES?

Investigating Probability In The Third Grade Classroom



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The activities, demonstrations, and instructional materials are designed as part of the Northrop Grumman MathScape Project.

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GOAL

There are two overarching goals for *What Are My Chances?* First, *What Are My Chances?* aims to improve the conceptual and procedural understanding of probability of elementary school students. And second, *What Are My Chances?* aims to increase the experience and proficiency in understanding, performing, analyzing, and summarizing probability experiments.

GRADE LEVELS

The discussion of probability is targeted in grades 3 and 4. The instructional materials presented in *What Are My Chances?* are designed for third grade students.

CALIFORNIA MATHEMATICS CONTENT STANDARDS

The California Mathematics Content Standards guide the curriculum for the mathematics taught in the state's public schools. *What Are My Chances?* is a set of instructional materials designed to enhance conceptual and procedural understanding of probability and to promote the mathematical reasoning for elementary school students. The instructional materials in *What Are My Chances?* align and support the Mathematics Content Standards for California Public Schools. The mathematics standards addressing probability and mathematical reasoning for the third grade are presented below.

Grade Three PROBABILITY

- 1.0** Students conduct simple probability experiments by determining the number of possible outcomes and make predictions.
 - 1.1 Identify whether common events are certain, likely, unlikely, or improbable.
 - 1.2 Record the possible outcomes for a simple event (e.g. tossing a coin) and systematically keep track of the outcomes when an event is repeated many times.
 - 1.3 Summarize and display the results of probability experiments in a clear and organized way (e.g. use a bar graph or line plot).
 - 1.4 Use the results of probability experiments to predict future events (e.g. plot to predict the temperature forecast for the next day).

MATHEMATICAL REASONING

- 1.0 Students made decisions about how to approach problems.**
 - 1.1 Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, sequencing and prioritizing information and observing patterns.
 - 1.2 Determine when and how to break problems into simpler parts.

- 2.0 Students use strategies, skills, and concepts in finding solutions.**
 - 2.2 Apply strategies and results from simpler problems to more complex problems.
 - 2.3 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.
 - 2.4 Express the solution clearly and logically by using the appropriate mathematical notation and terms and clear language; support solutions with evidence in both verbal and symbolic work.
 - 2.6 Make precise calculations and check the validity of the result from the context of the problem.

- 3.0 Students move beyond a particular problem by generalizing to other situations.**
 - 3.1 Evaluate the reasonableness of the solution in the context of the original situation.
 - 3.2 Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving simpler problems.
 - 3.3 Develop generalizations of the results and apply them to other circumstances.

MATHEMATICS CONTENT

Glossary

Data	Information gathered by performing a probability experiment.
Disjoint Events	Two or more events which have no outcomes in common.
Event	The task which is being performed.
Experiment	The process or steps of performing the task.
Experimental Probability	Performing an experiment numerous times and using the outcomes of the experiments to predict the likelihood that an event will occur.
Equally Likely Events	Two or more events for which each outcome has the same chance of occurrence.
Findings	A summary of the outcomes of an experiment.
Frequency	The number of times a particular outcome occurs.
Guess	A statement about the likelihood of an event without using any facts.
Informal Probability	Using words to capture the likelihood that an event will occur.
Mathematical Probability	Using numbers (fractions, decimals, percents, or numerical statements) to capture the likelihood that an event will occur.
Mutually Exclusive Events	Two or more events which have no outcomes in common.
Outcome	The result occurring when an experiment is performed.
Prediction	A statement about the likelihood or chance of an event occurring using facts.
Probability	The likelihood or chance that an event will occur.

Content

Probability

The probability of an event describes the likelihood or chances that an event will occur. There are three types of probability - informal probability, mathematical probability, and experimental probability.

Informal Probability

Informal probability uses words to describe the likelihood of an event. There are two situations when informal probability is useful. The first situation is with children in the elementary school grades who may not be familiar with or proficient in the numerical representations for the probability of an event, such as fractions, decimals, and percents. The second situation is in everyday conversations where words are used to express the likelihood that an event will occur.

For students in the primary grades of elementary school, using words to capture the chances that an event will happen is an appropriate strategy to teach probability. Four categories of word groups are recommended for the initial discussion of probability. They are: IMPOSSIBLE, UNLIKELY, LIKELY, and CERTAIN. In Part One: Speaking the Same Language, students focus on words that can be used to describe the probability of an event and participate in an activity which uses informal probability to describe the chances that an event will occur.

For everyday conversations, adults and children use words to describe the chances that an event will occur. We use words such as "fat chance" and "slim chance" to describe events that are unlikely. We use a phrase such as "when pigs fly" to describe events that are impossible.

Mathematical Probability

Mathematical probability uses numbers to describe the likelihood of an event. The numbers can be in the form of fractions, decimals or percents or may be in a sentence format (such as 1 out of 7 chance).

The formula for finding the probability of an event expressed in a fraction is presented below.

$$P(\text{event}) = \frac{\text{(number of ways to get the event)}}{\text{(number of possible outcomes)}}$$

The denominator of the fraction represents the number of possible outcomes. The numerator of the fraction represents the number of ways in which you can get the desired outcome(s).

Expressing the Probability of an Event

The probability of an event is expressed as a number between 0 and 1, inclusive. If the probability of an event is 0, then the event is impossible and is guaranteed never to happen. If the probability is 1, then the event is a sure thing and is guaranteed to happen each and every time. Examples of probabilities which are zero and one are presented below.

Using a standard six-sided die,

$$P(7) = 0$$

[Note: It is impossible to roll a 7 on a die. This event will never happen.]

$$P(\text{number less than 10}) = 1$$

[Note: Rolling a number less than 10 is certain. This event is guaranteed to happen each and every time.]

The probability of an event ranges from zero to one. Events which have probabilities closer to zero will be less likely to occur and events which have probabilities closer to one will be more likely to occur. Events which have probability of one-half have equal chance of occurring.

Conducting an Experiment

Once the mathematical probability is calculated, the experimenter performs the experiment, records the outcomes, and writes the findings of the experiment. The experimenter examines the prediction about the probability of the event taking place and the findings to determine if the prediction and outcomes are consistent.

The Match Between the Probability of an Event and the Outcomes

The Law of Large Numbers states that if an experiment is performed many, many, many times, the probability (as indicated by the prediction of what will happen when the experiment is performed) and the outcomes of the experiment should be consistent. When examining an experiment, if there is a good match between the prediction (or probability of an event) and the outcomes of an experiment, then the

Law of Large Numbers states that the experiment has been performed a sufficient number of times. If there is not a good match between the prediction (or probability of an event) and the outcomes of an experiment, the Law of Large Numbers states that the experiment has not been conducted a sufficient number of times. No errors have been made if there is not a match between the probability of an event and the outcomes of the experiment. The Law of Large Numbers further states that if the experiment was performed more times, the probability of the event and the outcomes of the experiment would eventually be consistent. It is important to mention to students that if their prediction or probability about the likelihood of an event does not match with the outcomes of the experiment, the students have not made any mistakes. But rather the experiment should be conducted more times so that the probability of the event will match or come close to the outcomes of the experiment.

How many is MANY? There is no specific number which represents the many, many, many times an experiment should be conducted as indicated in the Law of Large Numbers. The vague description is used so that when the probability of an event and the outcomes of the experiment are consistent, this describes MANY, MANY, MANY TIMES.

Experimental Probability

For experimental probability, the experimenter performs an experiment many, many, many times and records the outcomes of the experiment. From the outcomes of the experiment, the experimental probability is determined and expressed in fractional form. The following example illustrates the steps in an experimental probability problem.

Example: What is the chance that I will roll a 5 on a six-sided number cube?

Solution: The experimenter performs the experiment 20 times and records the outcomes. The outcomes are listed in the table below.

Number on the number cube	Number of times it was rolled
1	7
2	6
3	1
4	0
5	4
6	2

From the outcomes, the experimental probability can be determined. The table below presents the experimental probability (EP) of each number on the number cube.

Number on the number cube	Experimental Probability
1	$EP(1) = 7/20$
2	$EP(2) = 6/20$
3	$EP(3) = 1/20$
4	$EP(4) = 0/20$
5	$EP(5) = 4/20$
6	$EP(6) = 2/20$

The Law of Large Numbers states that if an experiment is performed many, many, many times and the experimental probability (EP) for a particular event should be very close to the mathematical probability (P) for the same event. Let's check to see how closely the experimental and mathematical probabilities are for the experiment with data presented in the example and the information is presented in the table below.

Experimental Probability	Mathematical Probability
$EP(1) = 7/20$	$P(1) = 1/6$
$EP(2) = 6/20$	$P(2) = 1/6$
$EP(3) = 1/20$	$P(3) = 1/6$
$EP(4) = 0/20$	$P(4) = 1/6$
$EP(5) = 4/20$	$P(5) = 1/6$
$EP(6) = 2/20$	$P(6) = 1/6$

To determine if the experimental and mathematical probabilities are close in size, the fractions are changed to decimal form so that the numbers can be easily compared. For example, $EP(1) = 7/20$ can be expressed as $EP(1) = .35$. The following table illustrates the experimental probability and mathematical probability for the experiment and states whether or not the mathematical and experimental probabilities are close in size.

Experimental Probability	Mathematical Probability	Close in Size
$EP(1) = 7/20 = .35$	$P(1) = 1/6 \sim .16$	No
$EP(2) = 6/20 = .30$	$P(2) = 1/6 \sim .16$	No
$EP(3) = 1/20 = .05$	$P(3) = 1/6 \sim .16$	No
$EP(4) = 0/20 = .00$	$P(4) = 1/6 \sim .16$	No
$EP(5) = 4/20 = .20$	$P(5) = 1/6 \sim .16$	Yes
$EP(6) = 2/20 = .10$	$P(6) = 1/6 \sim .16$	No

Decimals within .05 or 5% of each other are considered to be a close in size.

If the decimals for the experimental and mathematical probabilities for each outcome are close in size (within 5%), the Law of Large Numbers states that the experiment has been performed a sufficient number of times. If the experimental and mathematical probabilities for at least one outcome is not close in size (within 5%), then the Law of Large Numbers states that the experiment needs to be performed more times. Eventually the experimental and mathematical probabilities will become close in size (within 5%) and when that happens, the experiment has been performed a sufficient number of times.

For this experiment, the experimental and mathematical probability are close in size for the number 5 on the number cube and not close in size for the numbers 1, 2, 3, 4, and 6 on the number cube. The experiment was performed 20 times and the experimental and mathematical probabilities indicate that 20 times is not a sufficient number of times because the experimental and mathematical probabilities are not close in size for each number on the number cube. The Law of Large Numbers indicates that this experiment should be performed more times. Perhaps performing the experiment an additional 20 times (for a total of 40 times) might be a reasonable extension for this experiment. If after 40 outcomes, the experimental and mathematical probabilities for each of the outcomes (1, 2, 3, 4, 5, 6 on the number cube) are close in size, then 40 times was a sufficient number of times to perform this experiment as indicated by the Law of Large Numbers. If after performing the experiment 40 times, the experimental and mathematical probabilities are still not close in size (within 5%) for each number on the number cube, the Law of Large Numbers dictates that the experiment should be conducted more times. When the experimental and

mathematical probabilities for each number on the number cube are close in size (within 5%), the Law of Large Numbers indicates that the experiment was performed a sufficient number of times.

DEMONSTRATION AND ACTIVITIES PROTOCOL

There are three major components for the demonstrations and activities in *What Are My Chances?* They are: Finding The Probability, Performing The Experiment, and Writing The Summary. A description of each is presented below.

Finding The Probability

When students are finding the probability of an experiment, they answer the following questions.

Question #1: ***What do I want to know?***

This question asks students to restate the experiment in their own words.

Question #2: ***What do I already know?***

This question asks students to describe the information they know to be true and/or and prior knowledge about the event being addressed.

Question #3: ***What is the chance?***

This question asks students to describe the probability of an event and explain the reasons that support the claim.

Performing The Experiment

When students are performing the experiment, they answer the following questions.

Question #4: ***What are the steps of the experiment?***

This question asks students to accurately replicate the steps of the experiment.

Question #5: ***What are the outcomes of the experiment?***

This question asks students to list the outcomes of the experiment.

Question #6: ***What are the findings?***

This question asks students to write a statement that summarizes the outcomes of the experiment.

Writing The Summary

When students are writing the summary for an experiment, the three key ideas that are addressed are as follows.

Statement 1: *The Prediction*

The prediction asks students to describe the probability of the experiment and the reason(s) that support their prediction.

Statement 2: *The Findings*

The findings ask students to accurately state the outcomes of the experiment performed.

Statement 3: *The Match Between The Prediction And The Findings*

The match between the prediction and the findings asks students to compare how closely the prediction aligns with the outcomes of the experiment.

SELECTION OF DEMONSTRATIONS, ACTIVITIES AND DISCUSSIONS

A teacher may choose the demonstrations, activities and discussions that are appropriate for his/her students. The Student Workbook (See Appendix B) are written without page numbers so that a teacher may choose some/all of the experiments that are appropriate for the students. Teachers might consider adding page numbers to the Student Workbook prior to distributing the workbooks to students.

PART ONE: SPEAKING THE SAME LANGUAGE

GOAL

The goal of Speaking The Same Language is for students to use words to describe the likelihood of an event and formulate a list of words which capture the probability of the success of an event. There are four categories used to classify the probability of events: **Impossible, Unlikely, Likely, and Certain**. Given an event, students select appropriate words to capture the chance for success of an experiment.

CALIFORNIA MATHEMATICS CONTENT STANDARDS

The content and demonstration in Speaking The Same Language , aligns and supports the following Mathematics Content Standards for California Public Schools.

Grade Three **PROBABILITY**

- 1.0** **Students conduct simple probability experiments by determining the number of possible outcomes and make predictions.**
- 1.1** **Identify whether common events are certain, likely, unlikely, or improbable.**

MATHEMATICAL REASONING

- 2.0** **Students use strategies, skills, and concepts in finding solutions.**
- 2.3** **Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.**
- 2.4** **Express the solution clearly and logically by using the appropriate mathematical notation and terms and clear language; support solutions with evidence in both verbal and symbolic work.**

***MATHEMATICS CONTENT NEEDED BY THE TEACHER PRIOR TO TEACHING
SPEAKING THE SAME LANGUAGE***

A teacher should be able to answer each of following questions:

- What is probability of an event?
- What is informal probability?

DEMONSTRATIONS AND ACTIVITIES

There is one demonstration included in Part One: Speaking The Same Language.

Demonstration #1: Taking A Leap

DEMONSTRATION #1: TAKING A LEAP

Purpose of the Demonstration

The purpose of the demonstration is for students to define probability, formulate words that express the likelihood of an experiment, and categorize the probability of an experiment into four groups - Impossible, Unlikely, Likely and Certain. Students examine an experiment and decide which words are appropriate to use to describe the likelihood for success. Students explain the reasons they chose the words to describe the probability and write a summary for the experiment.

Student Learning Outcomes

1. Students will be able to list several words to describe the probabilities of events that are impossible, unlikely, likely, and certain.
2. Students will be able to make a prediction about the likelihood of an event.
3. Students will be able to explain the reason(s) that supports the prediction about the likelihood of an event.
4. Students will be able to write and recite a summary of an experiment.

Materials for Each Student

None

Preparation of Materials Prior to the Activity

1. Locate a place in the room suitable for the teacher to perform a long jump.
2. Using one color (Red) of masking tape, place a piece of masking tape locating where the teacher will start the long jump.
3. Using a different color (Blue) of masking tape, place another piece of tape approximately 6 inches from the start of the long jump.
4. Using a different color (Yellow) of masking tape, place another piece of masking tape approximately 18 inches from the start of the long jump.
5. Using a different color (Green) of masking tape, place another piece of masking tape approximately 48 inches from the start of the long jump.

Procedures

1. Standing at the start of the long jump (on the red tape), ask students: *“What is the chance that I will be able to jump over the Blue Tape?”*
2. Record student responses on the board or overhead. [Expected Responses: great chance, very likely, very possible]
3. Do not jump.
4. Still standing at the start of the long jump (on the red tape) and ask students: *“What is the chance that I will be able to jump over the Yellow Tape?”*
5. Record student responses on the board or overhead. [Expected Responses: good chance, it can happen]
6. Do not jump.
7. Still standing at the start of the long jump (on the red tape) and ask students: *“What is the chance that I will be able to jump over the Green Tape?”*
8. Record student responses on the board or overhead. [Expected Responses: no way, impossible, unlikely]
9. Inform students: *“When I asked the questions about the chance I will be able to perform the long jump,, I was actually talking about an important math topic called probability.” “Let’s write a definition for probability.”* On the board or overhead, write the definition for probability. *“Probability is the chance (or likelihood) that an event will happen.”* Also include when it is appropriate to discuss probability. On the board or overhead, write, *“We always talk about probability before we conduct the experiment.”* Ask students to write the definition for probability by completing Question 1 for Taking A Leap in the Student Workbook.
10. Inform students, *“Let’s look back to the words that the students gave regarding the probability of the teacher performing the long jump. Now let’s classify the words. Using four headings - Impossible, Unlikely, Likely, and Certain - let’s list other words that can also be used to describe the probability of an experiment.”*
11. The teacher writes the four headings - **Impossible, Unlikely, Likely, and Certain** on the board or overhead and ask students to examine the words they have used to describe the probability of Demonstration #1 – Taking A Leap. Students are asked to place words which describe the likelihood of an event in the appropriate

category (**Impossible, Unlikely, Likely, and Certain**). A sample of the list is listed below.

<i>Impossible</i>	<i>Unlikely</i>	<i>Likely</i>	<i>Certain</i>
Improbable	Possible	Probable	Guaranteed
No chance	Small chance	Great chance	Sure thing
No way	Slim chance	Very good chance	Absolutely

12. Ask students to complete Question 2 for Taking A Leap in the Student Workbook.
13. Using the words in listed in Question 2 for Taking A Leap in the Student Workbook, ask students to select their favorite word in each of the four categories by completing Question 3 for Taking A Leap in the Student Workbook.
14. Looking back at the experiment of the teacher jumping over the different colored tapes, ask students to describe the likelihood of each event. While the teacher poses the following questions to students, the teacher might want to demonstrate the different positions of the long jump. *"What is the chance that the teacher will jump over the blue tape?"* Ask students to complete Question 4 for Taking A Leap in the Student Workbook. [Sample Response: I think the chance that the teacher will jump over the blue is tape is certain because it is a short distance.]
15. Ask students, *"What is the chance that the teacher will jump over the yellow tape?"* Ask students to complete Question 5 for Taking A Leap in the Student Workbook. [Sample Response: I think the chance that the teacher will jump over the yellow tape is probable because it is a long distance.]
16. Ask students, *"What is the chance that the teacher will jump over the green tape?"* Ask students to complete Question 6 for Taking A Leap in the Student Workbook. [Sample Response: I think the chance that the teacher will jump over the green tape is impossible because it is a very long distance.]
17. Teacher and students work together to write the summary for the Taking A Leap Experiment. The summary should include a word to describe the probability of each event of the experiment and a reason that supports the choices. Ask students to write the summary by answering Question 7 for Taking A Leap in the Student Workbook.

Sample Summary

I think the chance that the teacher will jump over the blue tape is very likely because it is a short distance. I think the chance that the

teacher will jump over the yellow tape is probable because it is a long distance. I think the chance that the teacher will jump over the green tape is impossible because is a very long distance.

[Note: The teacher may decide to perform the experiment (jump over the blue, yellow, and green tapes) and include the results of the experiment in the summary. The teacher may also choose to not perform the experiment at this time but wait until other activities are performed and jump over the blue, yellow, and green tapes at a later time. The teacher may then decide to expand the summary of Taking A Leap and include the results of the experiment.]

PART TWO: GETTING THE IDEA

GOAL

The goal of Getting The Idea is for students to examine an event and decide which words are appropriate to describe the likelihood for success. Students explain why they chose the words to describe the probability of an event. Students describe the probability of an event, perform the experiment, list the outcomes, state the findings, and write a summary for the experiment.

CALIFORNIA MATHEMATICS CONTENT STANDARDS

The content, demonstrations, and activity in Getting The Idea, aligns and supports the following Mathematics Content Standards for California Public Schools.

Grade Three

PROBABILITY

1.0 Students conduct simple probability experiments by determining the number of possible outcomes and make predictions.

- 1.1 Identify whether common events are certain, likely, unlikely, or improbable.
- 1.2 Record the possible outcomes for a simple event (e.g. tossing a coin) and systematically keep track of the outcomes when an event is repeated many times.
- 1.3 Summarize and display the results of probability experiments in a clear and organized way (e.g. use a bar graph or line plot).
- 1.4 Use the results of probability experiments to predict future events (e.g. plot to predict the temperature forecast for the next day).

MATHEMATICAL REASONING

1.0 Students made decisions about how to approach problems.

- 1.1 Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, sequencing and prioritizing information and observing patterns.
- 1.2 Determine when and how to break problems into simpler parts.

- 2.0 Students use strategies, skills, and concepts in finding solutions.**
- 2.3 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.
- 2.4 Express the solution clearly and logically by using the appropriate mathematical notation and terms and clear language; support solutions with evidence in both verbal and symbolic work.
- 3.0 Students move beyond a particular problem by generalizing to other situations.**
- 3.1 Evaluate the reasonableness of the solution in the context of the original situation.
- 3.2 Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving simpler problems.

MATHEMATICS CONTENT NEEDED BY THE TEACHER PRIOR TO TEACHING GETTING THE IDEA

A teacher should be able to answer each of following questions:

- What is the probability of an event?
- What is a guess?
- What is a prediction?
- What is informal probability?
- What is mathematical probability?
- What is experimental probability?

DEMONSTRATIONS, ACTIVITIES, AND DISCUSSIONS

There are three demonstrations, one activity, two discussions, and one introduction included in Part Two: Getting the Idea.

Discussion #1: Making a Prediction or Making a Guess

Discussion #2: Using Mathematical Probability

Demonstration #2: The Velvet Pouch

Introduction to Demonstration: #3 Let's Go Hula Hooping
and Demonstration #4: Let's Jump Rope (Optional)

Demonstration #3: Let's Go Hula Hooping (Optional)

Demonstration #4: Let's Jump Rope (Optional)
Activity #1: Spinning Out Of Control

DISCUSSION #1: MAKING A PREDICTION OR MAKING A GUESS

INFORMATION TO SHARE WITH STUDENTS

Guess

A guess is a statement about the likelihood of an event without using facts to support the claim. When students make a guess about an experiment, there are no facts or information that grounds their explanation of the outcomes. In *What Are My Chances?*, a guess will not be used in the discussion of probability.

Prediction

A prediction is a statement about the outcome of an event using facts to support the claim. The facts may result from information that is provided to the students, evidence from previous experiments, or prior knowledge. When asking students to describe the probability of an event, they should use a prediction supported by facts that support the claim.

Am I Predicting Or Guessing? - Examples for Students

For each example, pose a question to students asking the likelihood that an event will occur. If a student is making a guess, when asked to explain the reason that supports their statement, their response may be, "I don't know" or "not sure". If a student is making a prediction, when asked to explain the reason that supports their statement about the likelihood of an event, students will be able to support their statement with valid information, prior knowledge, or evidence of a previous experiment.

Each example is designed in the following format.

- The teacher asks students a question about the probability of an event.
- Students provide words which capture the probability of the success of the event.
- Students provide a reason that supports the choice of words to describe the likelihood of the event.

If a student responds with "I don't know", inform students that they have made a **guess**. If a student responds with a valid reason based on information, prior knowledge, or experience, inform students that they have made a **prediction**.

The following four examples provide students with the opportunity to distinguish between a guess and a prediction.

1. What is the chance that you will have lunch at 12:15 pm today?
[Possible Reasons: The school schedule states that lunch begins at 12:15 pm. We had lunch at 12:15 pm yesterday. We always eat lunch at 12:15 pm.]
Prediction or Guess: **PREDICTION**
2. What is the chance that the principal has three children?
[Possible Reason: I don't know anything about the principal's children.]
Prediction or Guess: **GUESS**
3. What is the chance the teacher had chicken for dinner last night?
[Possible Reasons: I don't know anything about what the teacher had for dinner last night.]
Prediction or Guess: **GUESS**
4. What is the chance that (teacher's name) will be teaching in (room number) tomorrow?
[Possible Reasons: Mrs. Simpson is always in Room 5. Mrs. Simpson was in Room 5 yesterday.]
Prediction or Guess: **PREDICTION**

DISCUSSION #2: USING MATHEMATICAL PROBABILITY

INFORMATION TO SHARE WITH STUDENTS

Mathematical Probability uses numbers to capture the likelihood of an event. There are two forms to express mathematical probability - a fraction (for example, $\frac{3}{4}$) and a statement (for example, 3 out of 4).

Fractional Form

The denominator of the fraction represents the number of possible outcomes. The numerator of the fraction represents the number of ways in which you can get the desired outcome(s).

Experiment #1: What is the chance of getting a tails when tossing a coin? Write the probability in fractional form.

$$P(\text{tails}) = \frac{1}{2}$$

[Note: The 2, in the denominator, represents the number of possible outcomes (head and tails) and the 1, in the numerator, represents the number of ways to get the desired outcome (tails).]

Experiment #2: What is the chance of getting the number 5 when rolling a number cube? Write the probability in fractional form.

$$P(5) = \frac{1}{6}$$

[Note: The 6, in the denominator, represents the number of possible outcomes on the number cube (1, 2, 3, 4, 5, 6) and the 1, in the numerator, represents the number of ways to get the desired outcome (5).]

Experiment #3: What is the chance of getting an odd number when rolling a number cube? Write the probability in fractional form.

$$P(\text{odd number}) = \frac{3}{6}$$

[Note: The 6, in the denominator, represents the number of possible outcomes on the number cube (1, 2, 3, 4, 5, 6) and the 3, in the numerator, represents the number of ways to get the desired outcomes (1, 3, 5).]

Statement Form

The first number, in the statement, represents the number of ways to obtain the desired outcome(s) and the second number, in the statement, represents the number of possible outcomes.

Experiment #4: What is the chance of getting a tails when tossing a coin? Write the probability in statement form.

$$P(\text{tails}) = 1 \text{ out of } 2$$

[Note: The 1 represents the number of ways to get the desired outcome (tails) and the 2 represents the number of possible outcomes (head and tails).]

Experiment #5: What is the chance of getting the number 5 when rolling a number cube? Write the probability in statement form

$$P(5) = 1 \text{ out of } 6$$

[Note: The 1 represents the number of ways to get the desired outcome (5) and the 6 represents the number of possible outcomes on the number cube (1, 2, 3, 4, 5, 6).]

Experiment #6: What is the chance of getting an odd number when rolling a number cube? Write the probability in statement form

$$P(\text{odd number}) = 3 \text{ out of } 6$$

[Note: The 3 represents the number of ways to get the desired outcomes (1,3,5) and the 6 represents the number of possible outcomes on the number cube (1, 2, 3, 4, 5, 6).]

DEMONSTRATION #2: THE VELVET POUCH

Purpose of the Demonstration

The purpose of the demonstration is for students to examine an event, use appropriate words to determine the likelihood that the event will occur, and explain the reasons to support their choice of word(s) to describe the probability of an event. Students state the outcomes of the experiment, report the findings, and write a summary for the experiment.

Student Learning Outcomes

1. Students will be able to explain an experiment in their own words.
2. Students will be able to make a prediction about the likelihood of an event.
3. Students will be able to explain the reason(s) for their prediction of an event.
4. Students will be able to systematically record the outcomes of an experiment.
5. Students will be able to report the findings of the experiment both orally and in writing.
6. Students will be able to write and recite a summary of an experiment.

Materials for the Teacher

Pouch made from any type of fabric, preferably velvet
Approximately 40 small pieces of paper

Materials for Each Student

None

Procedures

1. Distribute one small piece of paper to each student.
2. Ask students to print or write their name on the paper.
3. Collect the papers and place them in The Velvet Pouch.

4. Select a "Special Student" from the class. Ask students to complete Question 1 for The Velvet Pouch in the Student Workbook.
5. Inform students - *"We want to know the chance of selecting our Special Student's name from The Velvet Pouch."*
6. Ask students - *"What do we want to know?"* [Teacher or Student Response: What is the chance of selecting the Special Student's Name from The Velvet Pouch?] Ask students to complete Question 2 for The Velvet Pouch in the Student Workbook.
7. Ask students - *"What do we already know?"* [Teacher or Student Response: The Special Student's Name has a 1 out of 20 chance of being selected from The Velvet Pouch.] Ask students to complete Question 3 for The Velvet Pouch in the Student Workbook.
8. Ask students - *"What is the chance of selecting the Special Student's name from The Velvet Pouch?"* [Expected Response: I think that the chance that we will select the Special Student's Name from The Velvet Pouch is very small because there is a 1 out of 20 chance of selecting the Special Student's Name from The Velvet Pouch.] Ask students to complete Question 4 for The Velvet Pouch in the Student Workbook.
9. Select an assistant to help with the experiment. Ask the assistant to collect the piece of paper from each student and place them in The Velvet Pouch. Shake The Velvet Pouch and ask the assistant to select one piece of paper from The Velvet Pouch. Read and record the name of the student selected on the overhead transparency as students record the information in Question 5 for The Velvet Pouch in the Student Workbook. Place the piece of paper back into The Velvet Pouch and ask the assistant to select another piece of paper. Read and record the name of the student selected. Repeat the experiment until there are 10 outcomes. Record the data by completing Question 5 for The Velvet Pouch in the Student Workbook.
10. Inform the class, *"Let's report the findings. What do we want to share about the chance of selecting the Special Student's name from The Velvet Pouch?"* [Expected Response: When we performed the experiment, we selected the Special Student's Name 1 time.] Ask students to report this information by completing Question 6 for The Velvet Pouch in the Student Workbook.
11. Now let's change the contents of The Velvet Pouch. Add 9 additional pieces of paper with the Special Student's name to The Velvet Pouch. Ask students - *"How many pieces of paper does the Special Student have in The Velvet Pouch now?"* [Expected Response: 10] and then

ask, "How many pieces of paper does the others students have in The Velvet Pouch?" [Expected Response: 1]

12. Ask students: "Now, what is the chance that the Special Student's name will be selected from The Velvet Pouch? Inform students - "Let's notice that the chance of selecting the Special Student's name from The Velvet Pouch has changed. When there are 10 pieces of paper with the Special Student's name on it in The Velvet Pouch the chance of selecting the Special Student's name is much better." Then ask, "Why?" [Expected Response: I think the chance that we will select the Special Student's Name from The Velvet Pouch is probable because there is a 10 out of 29 chance of being selected.] Ask students to complete Question 7 for The Velvet Pouch in the Student Workbook.
13. Let's collect some data. Shake The Velvet Pouch and ask the assistant to select one piece of paper. Read and record the name of the student selected on the overhead transparency as students record the information in Question 8 for The Velvet Pouch in the Student Workbook. Replace the paper into The Velvet Pouch and make another selection. Read and record the name of the student selected. Repeat the experiment until there are 10 outcomes. Record the data by completing Question 8 for The Velvet Pouch in the Student Workbook.
14. Pose the question – "What findings do we want to report about the chance that the Special Student's name will be selected from The Velvet Pouch?" [Expected Response: When we performed the experiment, we selected the Special Student's Name 2 times.] Ask students to report this information by completing Question 9 for The Velvet Pouch in the Student Workbook.
15. Ask students: "What is the chance that we will select your teacher's name from The Velvet Pouch?" [Expected Response: I think the chance that we will select the Teacher's Name from The Velvet Pouch is impossible because the Teacher's Name is not in The Velvet Pouch.] Ask students to complete Questions 10 for The Velvet Pouch in the Student Workbook.
16. Now it's time to state a summary for the experiment. Ask students to complete Question 11 for The Velvet Pouch in the Student Workbook.

Sample Summary

I think that the chance that we will select the Special Student's Name from The Velvet Pouch is very small because there is a 1 out of 20 chance of selecting the Special Student's Name from The Velvet

Pouch. When we performed the experiment, we selected the Special Student name 1 time. There is a good match between our prediction and the outcomes. This is GREAT NEWS!

I think the chance that we will select the Special Student's Name from The Velvet Pouch is probable because there is a 10 out of 29 chance of being selected. When we performed the experiment, the Special Student was selected 2 times. There is not a good match between our prediction and the outcomes. If we perform the experiment many more times, we would have a good match between our prediction and the outcomes. This is GREAT NEWS too!

I think that the chance that we will select the Teacher's Name from The Velvet Pouch is impossible because the Teacher's Name is not in The Velvet Pouch.

INTRODUCTION TO DEMONSTRATION #3: LET'S GO HULA HOOPING AND DEMONSTRATION #4: LET'S JUMP ROPE

Let's Go Hula Hooping and *Let's Jump Rope* are designed to show students the difference between making a prediction and making a guess about the probability of an event. *Let's Go Hula Hooping* and *Let's Jump Rope* are sample demonstrations which focus on a task performed by the teacher. A teacher may select another task to perform if there is one more suitable. When selecting another task, the teacher needs to consider a task that the student would not necessarily know if the teacher can or can not complete the task successfully. After the teacher poses the task that he/she will perform and asks for words that describe the probability of performing the task, students will be making a guess. The teacher then offers pertinent information about his/her ability or experience regarding his/her performance of the task. Using this information, students make a prediction about the likelihood of the teacher successfully completing the task.

In *Let's Go Hula Hooping*, students are asked about the chance that the teacher would be able to hula hoop for 1 minute. At this point, a student response is a guess. Once the teacher offers pertinent information, such as the teacher was a hula hoop champion at age 8, students use this information to make an informed prediction about the likelihood of the teacher performing the experiment successfully. The teacher successfully hula hoops for 1 minute and then asks students the chance that the teacher would be able to hula hoop for 3 minutes. Students now have two pieces of information (teacher is a hula hoop champion at age 8 and the teacher can successfully hula hoop for 1 minute) to make another informed prediction about the chance of the teacher hula hooping for 3 minutes.

In *Let's Jump Rope*, students are asked about the chance that the teacher would be able to jump 5 times without making a mistake, 20 times without making a mistake, and 100 times without making a mistake. Once the teacher offers pertinent information, such as the teacher jumps rope in the gym, students use this information to make an informed prediction about the likelihood of the teacher performing the experiment successfully.

Hula hooping and jumping rope are examples of tasks that can be used. A teacher can select other suitable tasks and a sample of experiments posed in probability question format is presented below.

- What is the chance that the teacher can toss a football through a hula hoop from 20 feet away?

- **What is the chance that the teacher can knit three rows in 2 minutes?**
- **What is the chance that the teacher can make a house of cards using 10 playing cards?**
- **What is the chance that the teacher can play a particular song on the piano, guitar, or harmonica?**
- **What is the chance that the teacher can recite the names of 50 states in the union?**

DEMONSTRATION #3: LET'S GO HULA HOOPING

Purpose of the Demonstration

The purpose of the demonstration is for students to examine an event, use appropriate words to determine its likelihood to occur, and explain why they choose the words to describe its likelihood to happen. Students report the findings. Students use information provided by the teacher and the outcomes of the experiment to determine the probability of an extension of the experiment. Students summarize the probability of an event and outcomes of the experiment in a summary.

Student Learning Outcomes

1. Students will be able to explain an experiment in their own words.
2. Students will be able to make a prediction about the likelihood of an event.
3. Students will be able to explain the reason(s) that support the prediction of the event.
4. Students will be able to record the outcomes of an experiment.
5. Students will be able to report the findings of an experiment both orally and in writing.
6. Students will be able to determine the probability of an extension of an experiment.
7. Students will be able to write and recite a summary of an experiment.

Materials for the Teacher

One hula hoop
Timer, stop watch, or a clock with a second hand

Materials for Each Student

None

Procedures

1. Hold up a hula hoop and inform students for this demonstration they will be asked to describe the chance of the teacher successfully performing the hula hoop for different amounts of time.

2. Ask students - *"What is the chance that I will be able to hula hoop for 1 minute?"* Record their responses on the Let's Go Hula Hooping. Ask students to complete Question 1 for Let's Go Hula Hooping in the Student Workbook.
3. To help students understand the timeframe for the first event, set the timer for 1 minute. (Optional)
4. Ask students - *"Do you think you are making a guess or a prediction?"* [Expected Response: It is a guess.] Then ask, *"Why do you think it is a guess rather than a prediction?"* [Expected Response: It's a guess because I don't know anything about how well the teacher can hula hoop.]
5. Inform students that we want them to be able to make a prediction about the probability of this event. Provide students with information about the teacher's ability or experience in performing the hula hoop. [Information could include: The teacher was a hula hoop champion as a child. The teacher never was able to hula hoop. The teacher has taught his/her child to hula hoop.] Ask students to complete Question 2 for Let's Go Hula Hooping in the Student Workbook. [Sample Response: The was a hula hoop champion when she was 8 years old.]
6. With the information about the teacher's experience hula hooping, now ask students - *"What is the chance that I will be able to hula hoop for 1 minute?"* Ask students to record their response by completing Question 3 for Let's Go Hula Hooping in the Student Workbook. [Sample Response: I think the chance that the teacher will be able to hula hoop for 1 minute is probable because she was a hula hoop champion when she was 8 years old.]
7. The teacher performs the experiment (hula hoop for 1 minute) while an assistant monitors the time. Ask students to record whether or not the teacher was successful by answering Question 4 for Let's Go Hula Hooping in the Student Workbook. [Sample Response: The teacher was successful hula hooping for 1 minute.]
8. Pose the question to students - *"What is the chance that I will be able to hula hoop for 3 minutes?"* Ask students to complete Question 5 for Let's Go Hula Hooping in the Student Workbook.
9. Ask students - *"What two facts do you know about the teacher's experience hula hooping and the outcomes of the teacher hula hooping for 1 minute?"* Ask students to record their response by answering Question 6 for Let's Go Hula Hooping in the Student

Workbook. [Sample Response: The teacher was a hula hoop champion when she was 8 years old. The teacher was successful hula hooping for 1 minute.]

10. Ask students to describe the probability of the teaching hula hooping for 3 minutes by answering Questions 7 for Let's Go Hula Hooping in the Student Workbook. [Sample Response: I think the chance that the teacher will hula hoop for 3 minutes is great because she was a hula hoop champion when she was 8 years old and she was able to hula hoop for 1 minute.]
11. The teacher performs the experiment (hula hoop for 3 minutes) while an assistant monitors the time. Ask students to record whether or not the teacher was successful by answering Question 8 for Let's Go Hula Hooping in the Student Workbook. [Sample Response: The teacher was successful hula hooping for 3 minutes.]
12. (Optional) Let's examine an extension to the events in Let's Go Hula Hooping. Ask students - *"What is the chance that the teacher will be able to hula hoop for 10 minutes?"* Before students respond, state - *"Before you make your prediction, let's think about what the experiments we have just completed has shown us."* Ask students to write the probability that the teacher would be able to hula hoop for 10 minutes by completing Questions 9 for Let's Go Hula Hooping in the Student Workbook. [Sample Response: I think the teacher will be able to hula hoop for 10 minutes is very likely because the teacher was able to hula hoop for 3 minutes.]
13. Students and teacher write the summary for the Let's Go Hula Hooping experiment and students write the summary by completing Question 10 for Let's Go Hula Hooping in the Student Workbook.

Sample Summary

I think that the chance that the teacher will hula hoop for 1 minute is great because she was a hula hoop champion when she was a child. The teacher was successful hula hooping for 1 minute. There is a good match between our prediction and the outcomes. This is GREAT NEWS!!

I think that the chance that the teacher will hula hoop for 3 minutes is good because she was a hula hoop champion when she was a child and she was successful hula hooping for 1 minute. The teacher was successful hula hooping for 3 minutes. There is a good match between our prediction and the outcomes. This is GREAT NEWS!!

DEMONSTRATION #3: LET'S JUMP ROPE

Purpose of the Demonstration

The purpose of the demonstration is for students to examine an event, use appropriate words to determine its likelihood to occur, and explain why they choose the words to describe its probability. Students report the findings and write a summary of the experiment.

Student Learning Outcomes

1. Students will be able to explain an experiment in their own words.
2. Students will be able to make a prediction about the likelihood of an event.
3. Students will be able to explain the reason(s) that support the prediction of the event.
4. Students will be able to record the outcomes.
5. Students will be able to report the findings of the experiment both orally and in writing.
6. Students will be able to write and recite a summary of an experiment.

Materials for the Teacher

One Jump Rope

Materials for Each Student

None

Procedures

1. The teacher holds up the jump rope and asks students, "*What is the chance that I will be able to jump rope 5 times without making a mistake?*" Record some of the responses on the board or overhead. Ask students to answer Question 1 for Let's Jump Rope in the Student Workbook.
2. Ask students - "*Do you think that your answer is a prediction or a guess?*" [Expected Response: It is a guess.] "*Why?*" [Expected Response: We don't know anything about how the teacher jumps rope.]

3. Inform students that we prefer to make a prediction about the probability about the probability of an event. Provide students with information about the teacher's ability or experience jumping rope. [Information could include: The teacher learned how to jump rope as a child. The teacher never was able to jump rope. The teacher has taught his/her child to jump rope. The teacher jump ropes at the gym.] Ask students to complete Question 2 for Let's Jump Rope in the Student Workbook.
4. Ask students - *"What is the chance I will be able to jump rope 5 times without missing?"* Ask students to answer Question 3 for Let's Jump Rope in the Student Workbook. [Sample Response: I think the chance that the teacher will jump rope 5 times without making a mistake is good because the teacher jumps rope at the gym.]
5. The teacher performs the experiment by jumping rope 5 times without making a mistake. Ask students to record the outcome by answering Question 4 for Let's Jump Rope in the Student Workbook. [Sample Response: The teacher was not successful jumping rope 5 times without making a mistake.]
6. Now that students have information about the teacher's experience jump roping and the outcome of the experiment, ask students - *"What is the chance that the teacher will be able to jump rope 20 times without making a mistake?"* Ask students to record this information by answering Question 5 for Let's Jump Rope in the Student Workbook.
7. Ask students - *"What facts do you now know about the teacher jumping rope?"* Ask students to record this information by completing Question 6 for Let's Jump Rope in the Student Workbook. [Sample Response: The teacher jumps rope in the gym. The teacher was not successful jumping rope 5 times without making a mistake.]
8. Ask students - *"What is the chance that the teacher will jump rope 20 times without making a mistake?"* Ask students to record the probability by completing Question 7 for Let's Jump Rope in the Student Workbook. [Sample Response: I think the chance that the teacher will jump rope 20 times without making a mistake is not very likely because the teacher did not jump rope 5 times without making a mistake.]
9. The teacher performs the experiment by attempting to jump rope 20 times without making a mistake. Ask students to record the outcome by answering Question 8 for Let's Jump Rope in the Student

Workbook. [Sample Response: The teacher was not successful jumping rope 20 times without making a mistake.]

- 10.** The teacher and class formulate the summary for Let's Jump Rope. Students write the summary by answering Question 9 for Let's Jump Rope in the Student Workbook.

Sample Summary

I think the chance that the teacher will jump rope 5 times without making a mistake is good because the teacher jumps rope at the gym. The teacher was not successful jumping rope 5 times without making a mistake. There is not a good match between our prediction and the outcome. If the teacher performed the experiment more times we would have a good match. This is GREAT NEWS too!!

I think the chance that the teacher will jump rope 20 times without making a mistake is not likely because the teacher was not successful jumping 5 times without making a mistake. The teacher was not successful jumping rope 20 times without making a mistake. There was a good match between our prediction and the outcome. This is GREAT NEWS!!

ACTIVITY #1: SPINNING OUT OF CONTROL

Purpose of the Activity

The purpose of the activity is for students to independently determine the probability of an event. Students state the problem, make a prediction about the probability that an event will occur, state the rationale for the prediction, perform the experiment, record and graph the outcomes, state the findings, and write a summary for the experiment.

Student Learning Outcomes

1. Students will be able to explain an experiment in their own words.
2. Students will be able to make a prediction about the likelihood of an event and state the probability in words and numbers.
3. Students will be able to state the reason(s) that support the prediction of the likelihood of an event.
4. Students will be able perform an experiment independently.
5. Students will be able to record the outcomes and graph the data.
6. Students will be able to report the findings of the experiment both orally and in writing.
7. Students will be able to write and recite a summary of an experiment.

Materials for the Teacher

Spinning Out Of Control Spinner, printed on an overhead transparency
(See Appendix A for sample spinner)
One large paper clip
One pencil

Materials for Each Student

Spinning Out Of Control Spinner, printed on card stock and laminated
One large paper clip
One pencil

Procedures

1. Place the transparency containing the Spinner Out Of Control on the overhead.
2. Ask students - *"What is the chance that the spinner will land in the yellow area?"* Ask students to complete Question 1 for Spinning Out Of Control in the Student Workbook. [Sample Response: What is the chance that the spinner will land on the yellow area?]
3. Ask students report the information that they know about the experiment by completing Question 2 for Spinning Out Of Control in the Student Workbook. [Sample Response: The yellow area is the largest area on the spinner.]
4. Ask students to choose on appropriate words to describe the chance that the spinner will land in the yellow area by completing Question 3 for Spinning Out Of Control in the Student Workbook. [Sample Response: I think the chance that the spinner will land on the yellow area is very likely because the yellow area is largest area on the spinner.]
5. Ask students to read the directions for Spinning Out Of Control reported in Question 4 for Spinning Out Of Control in the Student Workbook.
Directions for the Experiment:
 - Spin the spinner
 - Record the color of the section where the spinner landed.
 - Repeat the steps until you have 10 outcomes
6. Distribute a spinner to each student.
7. It is now time to perform the experiment. The teacher demonstrates the steps for the spinner experiment. Ask students to locate the center of the spinner (indicated by the black dot). Ask students to place one end of the paper clip at the center of the circle. Then ask students to place the point of a pencil through the paper clip so that the point of the pencil is at the center of the circle. With the hand not holding on to the pencil, ask students to spin the paper clip with their fingers. When the spinner (paper clip) stops spinning, the area in which the spinner (paper clip) lands will be the color used as the outcome of the experiment. [Note: If the spinner lands on the line between two colors, students can either select the color of the region where more of the spinner is located or spin again.]
8. Ask students to perform the experiment by following the directions listed in Question 4 for Spinning Out Of Control in the Student

Workbook. [Note: A teacher may decide if the students will perform the experiment or the teacher may guide students through each time the experiment is performed.]

9. Ask students to list the outcomes of their experiment by completing Question 5 for Spinning Out Of Control the Student Workbook.
10. Ask students to draw a bar graph reporting their outcomes by completing Question 6 for Spinning Out Of Control in the Student Workbook.
 - The Title of the Graph: **Outcomes of the Spinning Out Of Control Experiment**
 - On the horizontal axis, list the colors - **Yellow, Red, and Blue**, which indicates the colors on the spinner.
 - On the vertical axis, list the numbers **1, 2, 3, 4, 5, 6, 7, 8, 9, 10** which represents the frequency (or number of times) that a particular outcome occurs.
 - Using the outcomes recorded in Question 5, draw a bar indicating the frequency of each color on the spinner.
11. Ask students to state the findings of their experiment by completing Question 7 for Spinning Out Of Control in the Student Workbook. [Sample Response: When I performed the experiment, my spinner landed on the yellow area 6 times.]
12. The teacher and class write the summary for Spinning Out Of Control. Students write the summary by completing Question 8 for Spinning Out Of Control in the Student Workbook.

Sample Summary

I think the chance that the spinner will land in the yellow area is very likely because the yellow area is the largest area. When I performed the experiment, the spinner landed on the yellow area 6 times. There is a good match between my prediction and the outcomes. This is GREAT NEWS!!

PART THREE: EXPERIMENTING WITH THE IDEA

GOAL

The goal of Experimenting With The Idea is for students to describe an experiment, make a prediction about the probability that an event will occur, perform the experiment, record the outcomes, state the findings, and write a summary about the experiment. During the activities, students work independently with guidance from the teacher.

MATHEMATICS CONTENT STANDARDS

The content and activities in Experimenting With The Idea, aligns and supports the following Mathematics Content Standards for California Public Schools.

Grade Three

PROBABILITY

- 1.0 Students conduct simple probability experiments by determining the number of possible outcomes and make predictions.**
 - 1.1 Identify whether common events are certain, likely, unlikely, or improbable.
 - 1.2 Record the possible outcomes for a simple event (e.g. tossing a coin) and systematically keep track of the outcomes when an event is repeated many times.
 - 1.3 Summarize and display the results of probability experiments in a clear and organized way (e.g. use a bar graph or line plot).
 - 1.4 Use the results of probability experiments to predict future events (e.g. plot to predict the temperature forecast for the next day).

MATHEMATICAL REASONING

- 1.0 Students made decisions about how to approach problems.**
 - 1.1 Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, sequencing and prioritizing information and observing patterns.
 - 1.2 Determine when and how to break problems into simpler parts.

- 2.0 Students use strategies, skills, and concepts in finding solutions.**
- 2.2 Apply strategies and results from simpler problems to more complex problems.
 - 2.3 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.
 - 2.4 Express the solution clearly and logically by using the appropriate mathematical notation and terms and clear language; support solutions with evidence in both verbal and symbolic work.
 - 2.6 Make precise calculations and check the validity of the result from the context of the problem.
- 3.0 Students move beyond a particular problem by generalizing to other situations.**
- 3.1 Evaluate the reasonableness of the solution in the context of the original situation.
 - 3.2 Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving simpler problems.
 - 3.3 Develop generalizations of the results and apply them to other circumstances.

MATHEMATICS CONTENT NEEDED BY THE TEACHER PRIOR TO TEACHING EXPERIMENTING WITH THE IDEA

A teacher should be able to answer each of following questions:

- What is the probability of an event?
- What is a guess?
- What is a prediction?
- What is informal probability?
- What is mathematical probability?
- What is experimental probability?

DEMONSTRATIONS, ACTIVITIES, AND DISCUSSIONS

There are four activities for Part Three: Experimenting With The Idea.

Activity #3: Let's Roll

Activity #4: Let's Roll Again

Activity #5: Shake It Up

Activity #6: Hunting For The Perfect Frog

ACTIVITY #3: LET'S ROLL

Purpose of the Activity

The purpose of the activity is for students to independently determine the probability of an event. Students state the problem, make a prediction about the probability that an event will occur, state the rationale for the prediction, perform an experiment, record and graph the outcomes, state the findings, and write a summary for an experiment.

Student Learning Outcomes

1. Students will be able to explain an experiment in their own words.
2. Students will be able to make a prediction about the likelihood of an event.
3. Students will be able to state the mathematical probability of an event.
4. Students will be able to explain the reason(s) that supports the probability of the event.
5. Students will be able to perform an experiment.
6. Students will be able to record the outcomes of an experiment and graph the data.
7. Students will be able to report the findings of an experiment both orally and in writing.
8. Students will be able to write and recite the summary of an experiment.
9. Students will be able to determine if the findings of an experiment are reasonable.

Materials for the Teacher

One small brown paper bag
One six-sided number cube

Materials for Each Student

One small brown paper bag
One six-sided number cube

Procedures

1. Show students the number cube noting that there are six sides and numbers 1, 2, 3, 4, 5, and 6 are represented on the sides of the number cube.
2. Select an assistant for this activity.
3. Pose a question to students, *"What is the chance that I will roll a 5 on the number cube?"* Record several responses on the board or overhead. [Note: Instead of using the number 5, you may ask the assistant to select the number on the number cube for this experiment.] Ask students to complete Question 1 for Let's Roll in the Student Workbook. [Sample Response: *What is the chance that I will roll a 5 on the number cube?*]
4. Ask students - *"What information do we know about the number cube?"* Ask students to write this information by completing Question 2 for Let's Roll in the Student Workbook. [Sample Response: *The number cube has six sides and each side contains the numbers 1,2,3,4,5,6.*]
5. Let's find out the probability of rolling a 5 on the number cube by completing Question 3 for Let's Roll in the Student Workbook. Inform students - *"Let's look at the number cube a bit closer. How many numbers are on the number cube?"* [Expected Response: 6] *"We are looking for a 5 on the number cube. How many 5's are there on the number cube?"* [Expected Response: 1] *"So one way to think about the chance of getting a 5 on the number cube is 1 chance out of 6."* [Sample Response: *I think the chance that I will roll a 5 on the number cube is small because there is a 1 out of 6 chance.*]
6. The teacher or assistant reads the directions for the experiment listed in Question 4 for Let's Roll in the Student Workbook.
Directions for the experiment:
 - Shake the bag GENTLY.
 - Place the bag on your desk and carefully open the bag and see what number on the number cube is showing.
 - Record the outcome.
 - Repeat the steps until you have 10 outcomes.
7. Distribute one brown bag containing a number cube to each student.
8. Ask students to perform the experiment by following the directions listed in Question 4 for Let's Roll in the Student Workbook. [Note: A teacher may decide if the students will perform the experiment

independently or the teacher may guide students through each time the experiment is performed.]

9. Students record the outcomes of the experiment by completing Question 5 for Let's Roll in the Student Workbook.
10. Ask students to draw a bar graph of their outcomes by completing Question 6 for Let's Roll in the Student Workbook.
 - The Title of the Graph: **Outcomes of the Let's Roll Experiment**
 - On the horizontal axis, list the numbers **1, 2, 3, 4, 5, and 6** which represents the numbers on the number cube.
 - On the vertical axis, list the numbers **1, 2, 3, 4, 5, 6, 7, 8, 9, 10** which represents the frequency (or number of times) that a particular outcome occurs.
 - Using the outcomes recorded in Question 5, draw a bar indicating the frequency that each of the six numbers on the number cube occurred.
11. Ask students to state the findings of their experiment by completing Question 7 for Let's Roll in the Student Workbook. [Sample Response: When I performed the experiment, I got three 5's.]
12. The teacher and class write the summary for Let's Roll. Students write the summary by completing Question 8 for Let's Roll in the Student Workbook.

Sample Summary

I think the chance that I will roll a 5 is small because there is a 1 out of 6 chance. When I performed the experiment, I rolled three 5's. There is not a good match between my prediction and the outcomes. If we performed the experiment more times I would have a good match. This is GREAT NEWS too!!

ACTIVITY #4: LET'S ROLL AGAIN

Purpose of the Activity

The purpose of the activity is for students to independently determine the probability of an event. Students state the problem, make a prediction about the probability that an event will occur, state the reasons that support the prediction, perform the experiment, record and graph the outcomes, state the findings, and write a summary for an experiment.

Student Learning Outcomes

1. Students will be able to explain an experiment in their own words.
2. Students will be able to make a prediction about the likelihood of an event.
3. Students will be able to state the mathematical probability of an event.
4. Students will be able to explain the reason(s) that supports the probability of the event.
5. Students will be able to perform an experiment.
6. Students will be able to record the outcomes of an experiment and graph the data.
7. Students will be able to report the findings of an experiment both orally and in writing.
8. Students will be able to write and recite the summary of an experiment.
9. Students will be able to determine if the findings of an experiment are reasonable.

Materials for the Teacher

One small brown paper bag
One number cube

Materials for Each Student

One small brown paper bag
One six-sided number cube

Procedures

1. Show students the number cube noting that there are six sides and numbers 1, 2, 3, 4, 5, and 6 are represented on the sides of the number cube.
2. Select an assistant for this activity.
3. Pose a question to students, *"What is the chance that I will roll a number 4 or less on the number cube?"*. Before recording student responses, ask students - *"What numbers on the number cube are we looking for?"* [Expected Response: 1,2,3,4]. Then pose the probability question again, *"What is the chance that I will roll a number 4 or less on the number cube?"*. Record several responses on the board or overhead. Ask students to complete Question 1 for Let's Roll Again in the Student Workbook. [Sample Response: What is the chance that we will roll a number 4 or less on the number cube?]
4. Ask students - *"What information do we know about the number cube?"* Ask students to write this information by completing Question 2 for Let's Roll Again in the Student Workbook. [Sample Response: The number cube has six sides and each side contains the numbers 1,2,3,4,5,6.]
5. Let's look at the probability of rolling a number 4 or less on the number cube. Ask students - *"What is the chance that I will roll a number 4 or less on the number cube?"* Inform students - *"Let's look at the number cube a bit closer. How many numbers are on the number cube?"* [Expected Response: 6] *"What numbers are we looking for?"* [Expected Response: 1, 2, 3, 4] *"Since we are looking for four numbers, the chance of getting a number 4 or less on the number cube is 4 chance out of 6."* Ask students to complete Question 3 for Let's Roll Again in the Student Workbook. [Sample Response: I think the chance that I will roll a number 4 or less on the number cube is very good because there is a 4 out of 6 chance.]
6. The teacher or assistant reads the directions to the class. Directions are listed in Question 4 for Let's Roll Again in the Student Workbook.
Directions for the experiment:
 - Shake the bag GENTLY.
 - Place the bag on your desk and carefully open the bag and see what number on the number cube is showing.
 - Record the outcome.
 - Repeat the steps until you have 10 outcomes.[Note: A teacher may decide if the students will perform the experiment independently or the teacher may guide students through each time the experiment is performed.]

7. Ask students to perform the experiment by following the directions listed in Question 4 for Let's Roll Again in the Student Workbook.
8. Ask students to record the outcomes of the experiment by completing Question 5 for Let's Roll Again in the Student Workbook.
9. Ask students to draw a bar graph of their outcomes by completing Question 6 for Let's Roll Again in the Student Workbook.
 - Title of the Graph: **Outcomes of the Let's Roll Experiment**
 - On the horizontal axis, list the numbers **1, 2, 3, 4, 5, and 6** which represents the numbers on the number cube.
 - On the vertical axis, list the numbers **1, 2, 3, 4, 5, 6, 7, 8, 9, 10** which represents the frequency (or number of times) that a particular outcome occurs.
 - Using the outcomes recorded in Question 5, draw a bar indicating the frequency that each number on the number cube occurred.
10. Ask students to state the findings of their experiment by completing Question 7 for Let's Roll Again in the Student Workbook. [Sample Response: When I performed the experiment, I rolled two 1's; no 2's; no 3's; and one 4.]
11. The teacher and class write the summary for Let's Roll. Students write the summary by completing Question 8 for Let's Roll Again in the Student Workbook.

Sample Summary

I think the chance that I will roll a number 4 or less is very good because there is a 4 out of 6 chance. When I performed the experiment, I rolled two 1's; no 2's; no 3's; and one 4. There is not a good match between the prediction and the outcome. If I performed the experiment more times, we would have a good match. This is GREAT NEWS too!!

ACTIVITY #5: SHAKE IT UP

Purpose of the Activity

The purpose of the activity is for students to independently determine the probability of an event. Students state the problem, make a prediction about the probability that an event will occur, state the rationale for the prediction, perform the experiment, record and graph the outcomes, state the findings, and write a summary for an experiment.

Student Learning Outcomes

1. Students will be able to explain an experiment in their own words.
2. Students will be able to make a prediction about the likelihood of an event.
3. Students will be able to explain the reason(s) of the prediction of an event.
4. Students will be able to perform an experiment.
5. Students will be able to record the outcomes of an experiment and graph the data.
6. Students will be able to state the findings of an experiment both orally and in writing.
7. Students will be able to write and recite a summary for an experiment.
8. Students will be able to determine if the findings of an experiment are reasonable.

Materials for the Teacher

One brown paper bag
One plastic disk with different colors on each side

Materials for Each Student

One brown paper bag
One plastic disk with different colors on each side

Procedures

1. Show students the plastic disk noting that the sides of the disk are different colors.
2. Pose a question to students as the teacher holds up the disk, *"What is the chance that I get the red side when we shake up the bag?"* Record several student responses on the board. Ask students to complete Question 1 for Shake It Up in the Student Workbook. [Sample Response: What is the chance that I will get the red side when I shake up the bag?]
3. Ask students - *"What information do we know about the disk?"* Ask students to complete Question 2 for Shake It Up in the Student Workbook. [Sample Response: One side of the disk is red and the other side of the disk is white.]
4. Ask students - *"What is the chance that I will get the red side when I shake up the bag?"* Inform students, *"Since we are looking for the red side, there is a 1 out of 2 chance that the disk will land on the red side."* Ask students to report the probability by completing Question 3 for Shake It Up in the Student Workbook. [Sample Response: I think the chance that I will get the red side when I shake up the bag is possible because there is a 1 out of 2 chance.]
5. The teacher or assistant reads the directions to the class. Directions are listed in Question 4 for Shake It Up in the Student Workbook.
Directions for the experiment:
 - Shake the bag GENTLY.
 - Open the bag and see what color of the disk is showing.
 - Record the outcomes.
 - Repeat the steps until you have 10 outcomes.[Note: A teacher may decide if the students will perform the experiment independently or the teacher may guide students through each time the experiment is performed.]
6. Distribute a bag containing one disk to each student.
7. Ask students to perform the experiment by following the directions listed in Question 4 for Shake It Up in the Student Workbook.
8. Students record the outcomes by completing Question 5 for Shake It Up in the Student Workbook.
9. Ask students to draw a bar graph of their outcomes by completing Question 6 for Shake It Up in the Student Workbook.

- **Title of the Graph: Outcomes of the Shake It Up Experiment**
 - **On the horizontal axis, list the words Red and White.**
 - **On the vertical axis, list the numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 which represents the frequency (or number of times) that a particular outcome occurs.**
 - **Using the outcomes recorded in Question 5, draw a bar indicating the frequency that the red side and white side occurred.**
10. **Ask students to state the findings of their experiment by completing Question 7 for Shake It Up in the Student Workbook. [Sample Response: When I performed the experiment, I got the red side 5 times.]**
11. **The teacher and class write the summary for Shake It Up. Students write the summary by completing Question 8 for Shake It Up in the Student Workbook.**

Sample Summary

I think the chance that we will get the red side when we shake up the bag is likely because there is a 1 out of 2 chance. When I performed the experiment, I got 5 times. There is a good match between the prediction and the outcome. This is GREAT NEWS!!

ACTIVITY #6: HUNTING FOR THE PERFECT FROG

Purpose of the Activity

The purpose of the activity is for students to independently determine the probability of an event. Students state the problem, make a prediction about the probability that an event will occur, state the rationale for the prediction, perform the experiment, record and graph the outcomes, state the findings, and write a summary for an experiment.

Student Learning Outcomes

1. Students will be able to explain an experiment in their own words.
2. Students will be able to make a prediction about the likelihood of an event.
3. Students will be able to explain the reason(s) of the prediction of an event.
4. Students will be able to perform an experiment.
5. Students will be able to record the outcomes of an experiment and graph the data.
6. Students will be able to state the findings of an experiment both orally and in writing.
7. Students will be able to write and recite a summary for an experiment.
8. Students will be able to determine if the findings of an experiment are reasonable.

Materials for the Teacher

One brown bag
Five frogs in different colors other than blue

Materials for Each Student

One brown paper bag
Five frogs in different colors - the colors of frogs will vary from bag to bag

Procedures

- 1. Inform students the color of the perfect frog. For the experiment presented in this document, the perfect frog is BLUE.**
- 2. Hold up a brown bag containing 5 frogs. Remove the frogs from the brown bag and ask students to note the number of frogs and the how many there are of each color. Record this information on an overhead transparency. Your bag does not contain a BLUE frog. Place the frogs back into the bag.**
- 3. Ask students - "*What is the chance that I will select a BLUE frog?*" [Expected Response: impossible, absolutely no way]**
- 4. Ask students - "*Why do you think this?*" [Expected Response: The chance of selecting a blue frog is impossible because there are no blue frogs in the bag.] Ask students - "*What experiment does this look like?*" [Expected Response: It looks like the chance of selecting the teacher's name from The Velvet Pouch.]**
- 5. Distribute a brown bag containing 5 frogs to each student.**
- 6. Ask students to open the bag and remove the frogs from the bag and place them on the desk. Record the number of frogs by color by completing Question 1 for Hunting For The Perfect Frog in the Student Workbook.**
- 7. Ask students - "*What do I want to know?*" Ask students to complete Question 2 for Hunting For The Perfect Frog in the Student Workbook. [Sample Response: What is the chance that I will select a blue frog from the brown bag?]**
- 8. Ask students - "*What do I already know?*" Ask students to complete Question 3 for Hunting For The Perfect Frog in the Student Workbook. [Sample Response: There are 2 blue frogs in the brown bag.]**
- 9. Ask students to determine the probability of selecting a BLUE frog from their brown bag by completing Question 4 for Hunting For The Perfect Frog in the Student Workbook. [Sample Response: I think that the chance that I will select a blue frog from the brown bag is possible because there is a 2 out of 5 chance of selecting a blue frog from the brown bag.]**
- 10. The teacher reads the directions for the experiment. The directions are listed in Question 5 for Hunting For The Perfect Frog in the Student Workbook.**

Direction for the experiment:

- Shake the bag **GENTLY**.
 - **Without** looking into the bag, select one frog from the bag.
 - Record the color of the frog you selected.
 - Return the frog back into the bag.
 - Repeat the steps until you have 10 outcomes.
11. Ask students to perform the experiment by following the directions listed in Question 5 for **Hunting For The Perfect Frog** in the **Student Workbook**.
 12. Ask students to record the outcomes by completing Question 6 for **Hunting For The Perfect Frog** in the **Student Workbook**.
 13. Ask students to draw a bar graph of their outcomes by completing Question 7 for **Hunting For The Perfect Frog** in the **Student Workbook**.
 - **Title of the Graph: Outcomes of the Hunting For The Perfect Frog Experiment**
 - On the horizontal axis, list the words **Blue, Orange, Yellow, Red, Purple, and Green**.
 - On the vertical axis, list the numbers **1, 2, 3, 4, 5, 6, 7, 8, 9, 10** which represents the frequency (or number of times) that a particular outcome occurs.
 - Using the outcomes recorded in Question 6, draw a bar indicating the frequency of each of the color of the frogs selected.
 14. Ask students to state the findings of their experiment by completing Question 8 for **Hunting For The Perfect Frog** in the **Student Workbook**. [Sample Response: **When I performed the experiment, I selected 2 blue frogs.**]
 15. The teacher and students write a summary for their experiment by completing Question 10 for **Hunting For The Perfect Frog** in the **Student Workbook**. The summaries will vary depending upon the color of frogs in each bag. The sample format for the summary follows.

Sample Summary

I think that the chance that I will select a blue frog is possible because there is a 2 out of 5 chance of selecting a blue frog from the brown bag. When I performed the experiment, I selected 2 blue frogs. There is a good match between the prediction and the outcome. This is GREAT NEWS!!

PART FOUR: TAKING THE IDEA TO THE NEXT STEPS

GOAL

The goal of Taking The Idea To The Next Steps is for students to design their own probability experiment. Working in pairs, students design an experiment, prepare questions that will guide others to solve their experiment, and organize materials needed for their experiment. Students complete an experiment that other classmates have designed.

MATHEMATICS CONTENT STANDARDS

The content and activities in Taking The Idea To The Next Steps, aligns and supports the following Mathematics Content Standards for California Public Schools.

Grade Three **PROBABILITY**

- 1.0 Students conduct simple probability experiments by determining the number of possible outcomes and make predictions.**
 - 1.1 Identify whether common events are certain, likely, unlikely, or improbable.
 - 1.2 Record the possible outcomes for a simple event (e.g. tossing a coin) and systematically keep track of the outcomes when an event is repeated many times.
 - 1.3 Summarize and display the results of probability experiments in a clear and organized way (e.g. use a bar graph or line plot).
 - 1.5 Use the results of probability experiments to predict future events (e.g. plot to predict the temperature forecast for the next day).

MATHEMATICAL REASONING

- 1.0 Students made decisions about how to approach problems.**
 - 1.1 Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, sequencing and prioritizing information and observing patterns.
 - 1.2 Determine when and how to break problems into simpler parts.

- 2.0 Students use strategies, skills, and concepts in finding solutions.**
- 2.2 Apply strategies and results from simpler problems to more complex problems.
 - 2.3 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.
 - 2.4 Express the solution clearly and logically by using the appropriate mathematical notation and terms and clear language; support solutions with evidence in both verbal and symbolic work.
 - 2.6 Make precise calculations and check the validity of the result from the context of the problem.
- 4.0 Students move beyond a particular problem by generalizing to other situations.**
- 4.1 Evaluate the reasonableness of the solution in the context of the original situation.
 - 4.2 Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving simpler problems.
 - 4.3 Develop generalizations of the results and apply them to other circumstances.

MATHEMATICS CONTENT NEEDED BY THE TEACHER PRIOR TO TEACHING TAKING THE IDEA TO THE NEXT STEPS

A teacher should be able to answer each of following questions:

- What is probability of an event?
- What is a guess?
- What is a prediction?
- What is informal probability?
- What is mathematical probability?
- What is experimental probability?

DEMONSTRATIONS AND ACTIVITIES

There are two activities for Part Four: Taking the Idea to the Next Step.

Activity #6: Designing *What's In The Bag?* Experiment

Activity #7: Performing the *What's In The Bag?* Experiment

ACTIVITY #6: DESIGNING THE WHAT'S IN THE BAG? EXPERIMENT

Purpose of the Activity

The purpose of the activity is for students to design their own experiment, write questions about the probability of an experiment, and organize the materials needed for their experiment. The teacher guides students during the process when students design their own probability experiments. This activity may serve as part of the assessment for a unit on probability.

Student Learning Outcomes

1. Students will be able to design an experiment to determine the probability of an event.
2. Students will be able to determine the materials needed for an experiment.
3. Students will be able to write the directions for a probability experiment.

Materials for the Teacher

None

Materials for Each Pair of Students

One brown paper bag

Colored plastic disks

[Note: the number of disks that students use is at the discretion of the teacher.]

Procedures

1. The teacher presents the activity by saying, "*In groups of two, the pairs of students will design a probability experiment. The experiment is called **What's In The Bag?** Students will use a brown paper bag and colored plastic disks to determine the probability of selecting a particular color disk from the brown bag.*"
2. Assign students into groups of two.
3. Place the WHAT'S IN THE BAG? EXPERIMENT - Worksheet #1 transparency on the overhead. The teacher guides students through the directions for designing their own experiment. Ask students to

complete Question 1 for *What's In The Bag?* Experiment in the Student Workbook.

4. Ask the state the probability question by completing Question 2 for *What's In The Bag?* Experiment in the Student Workbook. [Sample Response: What is the chance of selecting a red disk from the brown bag?] The teacher may want to circulate to make sure the groups are on task. The teacher may ask for a few pairs of students to share their probability question.
5. The materials for the experiment consist of a brown bag and colored disks. Each group may decide the number of disks for their experiment. The teacher may decide to limit the number of disks that a group may use by specifying that each group may use no more than 6 disks. Ask students to state the materials needed for the experiment by completing Question 3 for *What's In The Bag?* Experiment in the Student Workbook.
[Sample Response: Materials for the Experiment:
1 brown bag
6 disks of different colors]
The teacher may ask for a few groups to share the materials they used for their experiment.
6. Ask students to write the directions for the experiment by completing Question 4 for *What's In The Bag?* Experiment in the Student Workbook.
[Sample Response: Directions for the Experiment
 1. Open the bag and remove the disks from the bag and place them on the desk.
 2. Record the number of disks of each color.
 3. Place the disks into the bag and fold the bag at the top.
 4. Shake the bag gently three times.
 5. Without looking into the bag, select one disk.
 6. Record the color of the disk.
 7. Place the disk back into the bag and perform the experiment until there are 10 outcomes.]
7. Students gather the materials needed for their experiment. Place the materials in the brown bag and attach the *What's In The Bag?* Worksheet #1 and Worksheet #2 to the outside of the brown bag.
8. The teacher collects all of the bags and worksheets and keeps them for Activity #7: Performing the *What's In The Bag?* Experiment.

ACTIVITY #7: PERFORMING THE *WHAT'S IN THE BAG?* EXPERIMENT

Purpose of the Activity

The purpose of the activity is for students to describe an experiment, make predictions about the probability of an event, perform an experiment, report the outcomes of the experiment, and state the findings of the experiment. This activity may serve as part of the assessment for the unit on probability.

Student Learning Outcomes

1. Students will be able to perform an experiment.
2. Students will be able to report the outcomes of an experiment.
3. Students will be able to write and recite a summary for an experiment..

Materials for the Teacher

None

Materials for Each Pair of Student

One brown paper bag
Colored plastic disks

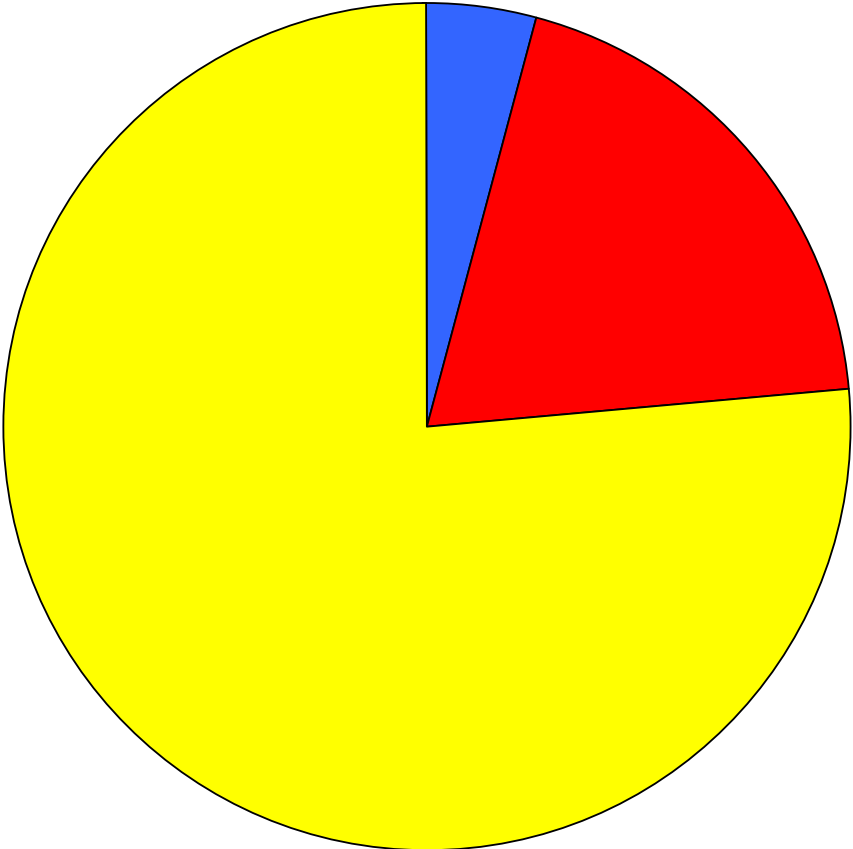
Procedures

1. Place students in the same pairs of two as designated in Activity #6: Designing the *What's In The Bag?* Experiment. Distribute the *What's In The Bag?* materials to each group of students. Be sure that the pairs of students do not have the experiment that they designed.
2. Ask the pairs of students to complete Questions 1-7 on the *What's In The Bag?* Worksheet #2.
3. Select several groups to share their responses to the experiment.
4. Collect the worksheets from this experiment to use as part of the assessment of the probability unit (optional).

APPENDIX A

Spinner for Activity #1 - Spinning Out Of Control

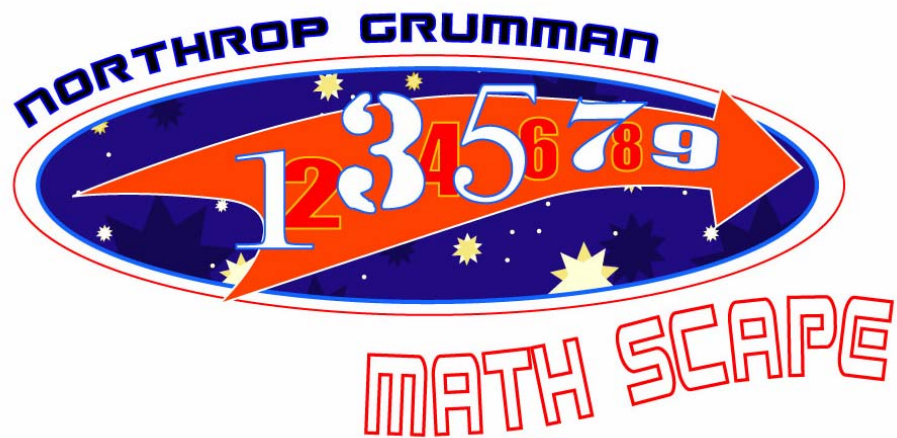
SPINNING OUT OF CONTROL



APPENDIX B

Student Workbook

WHAT ARE MY CHANCES?



Student Workbook

Name _____

TAKING A LEAP

1. Let's define probability.

2. Let's list our words to describe the probability of an experiment.

Impossible

Unlikely

Likely

Certain

3. What are my favorite words to describe probability of an experiment?

Impossible _____

Unlikely _____

Likely _____

Certain _____

4. What is the chance that the teacher will be able to jump over the blue tape?

5. What is the chance that the teacher will be able to jump over the yellow tape?

THE VELVET POUCH

1. What is the name of the student we want to select from The Velvet Pouch?

FINDING THE PROBABILITY

2. What do I want to know?

3. What do I already know?

PERFORMING THE EXPERIMENT

5. Let's record the data. Write the name of the students selected during the experiment.

1) _____

2) _____

3) _____

4) _____

5) _____

6) _____

7) _____

8) _____

9) _____

10) _____

6. Let's report the findings of The Velvet Pouch.

8. Let's record the data. Write the name of the students selected during the experiment.

1) _____

2) _____

3) _____

4) _____

5) _____

6) _____

7) _____

8) _____

9) _____

10) _____

9. Let's report the findings of The Velvet Pouch?

10. What are the chances that the teacher's name will be selected from The Velvet Pouch?

LET'S GO HULA HOOPING

FINDING THE PROBABILITY

1. What do I want to know?

2. What do I already know?

3. What is the chance that the teacher will hula hoop for 1 minute?

PERFORMING THE EXPERIMENT

4. What happened when the teacher performed the hula hooping experiment for 1 minute?

FINDING THE PROBABILITY

5. What do I want to know?

6. What do I already know?

7. What is the chance that the teacher will hula hoop for 3 minutes?

PERFORMING THE EXPERIMENT

8. What happened when the teacher performed the hula hooping experiment for 3 minutes?

LET'S JUMP ROPE

FINDING THE PROBABILITY

1. What do I want to know?

2. What do I already know?

3. What is the chance that the teacher will be able to jump rope 5 times without making a mistake?

PERFORMING THE EXPERIMENT

4. What happened when the teacher jumped rope 5 times without making a mistake?

FINDING THE PROBABILITY

5. What do I want to know?

6. What do I already know?

SPINNING OUT OF CONTROL

FINDING THE PROBABILITY

1. What do I want to know?

2. What do I already know?

3. What are the chances that the spinner will land on the YELLOW area?

4. Directions for the experiment:

- Spin the spinner
- Record the color of the area where the spinner landed.
- Repeat the steps until you have 10 outcomes

5. List the outcomes of the experiment.

- 1) _____
- 2) _____
- 3) _____
- 4) _____
- 5) _____
- 6) _____
- 7) _____
- 8) _____
- 9) _____
- 10) _____

6. Let's graph the outcomes using a bar graph.

Title of the Graph: _____



7. What are the findings of the experiment?

LET'S ROLL

FINDING THE PROBABILITY

1. What do I want to know?

2. What do I already know?

3. What is the chance that I will roll a 5 on the number cube?

PERFORMING THE EXPERIMENT

4. Directions for the experiment:

- Shake the bag **GENTLY**.
- Place the bag on your desk and carefully open the bag and see what number on the number cube is showing.
- Record the outcome.
- Repeat the steps until you have 10 outcomes.

5. List the outcomes of the experiment.

- 1) _____
- 2) _____
- 3) _____
- 4) _____
- 5) _____
- 6) _____
- 7) _____
- 8) _____
- 9) _____
- 10) _____

6. Let's graph the outcomes using a bar graph.

Title of the Graph: _____



7. What are the findings of the experiment?

LET'S ROLL AGAIN

FINDING THE PROBABILITY

1. What do I want to know?

2. What do I already know?

3. What is the chance that I will roll a number 4 or less on the number cube?

PERFORMING THE EXPERIMENT

4. Directions for the experiment:

- **Shake the bag GENTLY.**
- **Place the bag on your desk and carefully open the bag and see what number on the number cube is showing.**
- **Record the outcome.**
- **Repeat the steps until you have 10 outcomes.**

5. List the outcomes of the experiment.

- 1) _____
- 2) _____
- 3) _____
- 4) _____
- 5) _____
- 6) _____
- 7) _____
- 8) _____
- 9) _____
- 10) _____

6. Let's graph the outcomes using a bar graph.

Title of the Graph: _____



7. What are the findings of the experiment?

SHAKE IT UP

FINDING THE PROBABILITY

1. What do I want to know?

2. What do I already know?

3. What is the chance that I will get a red side when I shake up the bag?

PERFORMING THE EXPERIMENT

4. Directions for the experiment:

- **Shake the bag GENTLY.**
- **Open the bag and see what color of the disk is showing.**
- **Record the outcomes.**
- **Repeat the steps until you have 10 outcomes.**

5. List the outcomes of the experiment.

- 1) _____
- 2) _____
- 3) _____
- 4) _____
- 5) _____
- 6) _____
- 7) _____
- 8) _____
- 9) _____
- 10) _____

6. Let's graph the outcomes using a bar graph.

Title of the Graph: _____



7. What are the findings of the experiment?

HUNTING FOR THE PERFECT FROG

FINDING THE PROBABILITY

1. Let's list the number of frogs by color.

Blue _____

Orange _____

Yellow _____

Red _____

Purple _____

Green _____

2. What do I want to know?

PERFORMING THE EXPERIMENT

5. Direction for the experiment:

- **Shake the bag GENTLY.**
- **Without looking into the bag, select one frog from the bag.**
- **Record the color of the frog you selected.**
- **Return the frog back into the bag.**
- **Repeat the steps until you have 10 outcomes.**

6. List the outcomes of the experiment.

- 1) _____
- 2) _____
- 3) _____
- 4) _____
- 5) _____
- 6) _____
- 7) _____
- 8) _____
- 9) _____
- 10) _____

7. Let's graph the outcomes using a bar graph.

Title of the Graph: _____



8. What are the findings of the experiment?

WHAT'S IN THE BAG?

Worksheet #1

TO BE COMPLETED BY THE EXPERIMENT DESIGNERS

1. This experiment is designed by:

2. What is the probability question?

3. What are the materials needed for the experiment?

4. What are the directions for the experiment?

WHAT'S IN THE BAG EXPERIMENT?

Worksheet #2

TO BE COMPLETED BY THE EXPERIMENTERS

1. Experiment Conducted By:

2. What do I want to know?

3. What do I already know?

4. What is the answer to the probability question?

5. After performing the experiment, list the outcomes of the experiment.

- 1) _____
- 2) _____
- 3) _____
- 4) _____
- 5) _____
- 6) _____
- 7) _____
- 8) _____
- 9) _____
- 10) _____

6. What are the findings that I want to share?
