

# Colored Chip Probability Game

Blue Ribbon  
Probability and Data Analysis

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# Introduction

The students will play a probability game. They will devise various methods and strategies for winning the game. The students will determine the probability, both empirically and theoretically. They will also predict occurrences that are certain.

## Lesson Objectives — Students will:

- Organize data
- List results empirically
- List results theoretically
- Determine certainty & uncertainty of occurrence
- Predict results

## Materials:

- Opaque bags
- Colored chips, 3 different colors
- Game board
- Tokens – 3 different

## Time Required: 40 minutes

## Prior knowledge:

- Students should have some knowledge of proportions.
- Students should be able to read, listen and follow a given set of directions
- Students should have some knowledge of the basic properties of probability

## Evaluation:

- Each student will receive a grade based on completion & accuracy of the activity sheet
- Students will be observed as they are playing the game

# West Virginia Content Standards and Objectives:

## Standard 5: Data Analysis and Probability (MA.S.5)

- Apply and demonstrate an understanding of basic concepts of probability through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

### Objectives

Students will:

PS.5.1 – distinguish between experimental and theoretical probability

PS.5.3 – determine possible outcomes using tree diagrams and counting principles of permutations and combinations

PS.5.4 – express the chances of events occurring either in terms of a probability or odds

# Performance Descriptors (PS.PD5.1)

## ■ Distinguished

The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills of probability. The student organizes data on a chart.

The student lists the results empirically and theoretically.

The student determines which statements are certain and which are not certain to occur.

The student justifies, evaluates, and predicts solutions in a clear and concise manner.

## ■ Above Mastery

The student demonstrated competent and proficient performance and shows a thorough and effective application of knowledge and skills of probability.

The student organizes data on a chart.

The student lists the results empirically and theoretically.

The student determines which statements are certain and which are not certain to occur.

The student predicts solutions.

## ■ **Mastery**

The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standards in probability.

The student organizes data on a chart.

The student lists results empirically and theoretically.

The student determines which statements are certain and not certain to occur.

## ■ **Partial Mastery**

The student demonstrated basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omission in probability.

The student organizes some of the data and may list some of the results.

The student may list some of the statements that are certain & not certain to occur.

## ■ **Novice**

The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance of probability.

Student data and chart are incomplete.

Student's listed results are incomplete.

### **Procedures:**

Students will work in groups of four.

Students will organize data into a chart, using the prepared worksheet.

Students will be required to list the results of the game based on empirical evidence.

Students will decide if there is a way to compute the theoretical probability for each statement.

Students will determine if there are statements that are certain to occur.

Students will determine if there are statements that are not certain to occur

### **Accommodations:**

1. Provide oral and written instructions
2. Provide an opportunity for students to discuss their work with one or more classmates
3. A member of the group will have the ability to be peer helpers to the other members of the group.
4. Teachers will move around the room working with groups and completion of work

## Teachers Answer Key

4 Red

3 White

1 Blue

$$P_R = 4/8 = 1/2$$

$$P(W) = 3/8$$

$$P(B) = 1/8$$

$$\text{Prob. all 3 are R} = 1/2 \cdot 1/2 \cdot 1/2 = 1/8$$

$$\text{Prob. all 3 are W} = 3/8 \cdot 3/8 \cdot 3/8 = 27/512$$

$$\text{Prob. all 3 are B} = 1/8 \cdot 1/8 \cdot 1/8 = 1/512$$

- A. All chips chosen have the same color  
 $1/8 + 27/512 + 1/512 = 23/128 = 17.9\%$
- B. All chips chosen are red  
 $1/2 \cdot 1/2 \cdot 1/2 = 1/8 = 12.5\%$
- C. Not all chips chosen have the same color  
 $1 - P(\text{ same color}) = 1 - 23/128 = 105/128 = 82.03\%$
- D. There is no blue chip among those chosen  
Prob of no blue chip =  $1 - 1/8 = 7/8$   
 $7/8 \cdot 7/8 \cdot 7/8 = 343/512 = 66.99\%$
- E. There is at least one white chip among those chosen  
Prob of no white chip =  $1 - 3/8 = 5/8$   
 $5/8 \cdot 5/8 \cdot 5/8 = 125/512$   
 $512/512 - 125/512 = 387/512 = 75.58\%$
- F. There is at least one blue chip among those chosen  
Prob of no blue chips =  $343/512$   
At least one =  $1 - 343/512 = 169/512 = 33.01\%$

### Variation 1

Have each student pick 2 statements. The student gets to move if only one chosen statement is true.

### Variation 2

Have each student pick 1 statement from the list, and 1 statement which he/she makes up. The student gets to move if only one chosen statement is true.

## Resources used:

Dr. Butler, Colored Chip Probability Game

## Websites:

<http://classroom.jc-schools.net/basic/math-prob.html>

<http://www.rsscse.org.uk/pose/level1/book7/sectiona.htm>

<http://www.shodor.org/interactivate/activities/>

Round	St. #	Draw 1	Draw 2	Draw 3	Round	St. #	Draw 1	Draw 2	Draw 3
1					29				
2					30				
3					31				
4					32				
5					33				
6					34				
7					35				
8					36				
9					37				
10					38				
11					39				
12					40				
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28					56				