Let's Investigate!
Probability and Statistics

Explorations in real-world probability and statistics

V1.0a

Learn Through Experience

About the authors

Judy Bippert is a credentialed teacher with a master's degree. She has more than 35 years of experience teaching junior high and college level students, coordinating Gifted Education programs, and supervising student teachers. She is recently retired from being a faculty member at San Diego State University where she taught mathematics methods to preservice teachers and coordinated Field Experience. She has made recent presentations at the National Council of Teachers of Mathematics, California Mathematics Council, Greater San Diego Mathematics Council, Conference for the Advancement of Mathematics Teaching (Texas), and California Association for the Gifted annual conferences. She has co-authored 11 mathematics simulations with Interact and contributed to university texts.

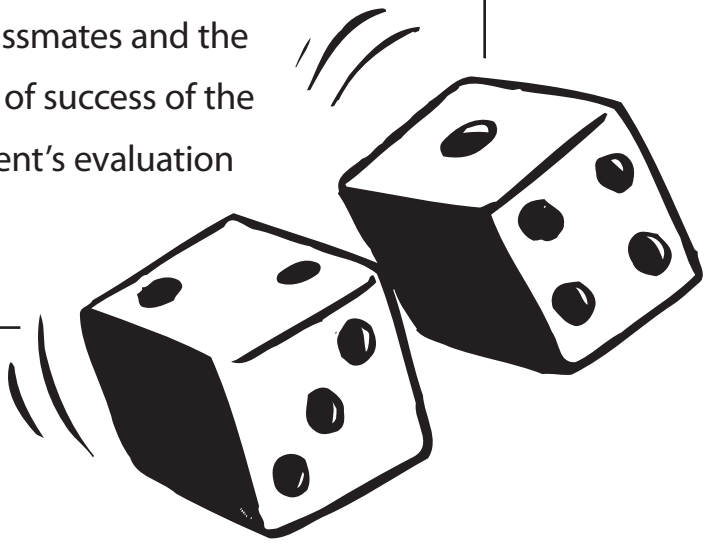
Louise Vandling is a credentialed teacher and administrator with a master's degree. She has more than 35 years of experience as an elementary teacher, administrator, district math mentor, staff developer and university math instructor. She is retired from the Vista Unified School District where she was the grades 2–5 mathematics specialist at Casita Center, a math magnet school in the district. She has co-authored 7 nationally published math simulations through Interact Publications and has contributed to Mathematics journals. Currently she consults for districts in mathematics and continues to present at the National Council of Teachers of Mathematics, California Mathematics Council, Greater San Diego Mathematics Council, Texas and Arizona math teachers Associations, California Association for the Gifted and Association of San Diego Educators for the Gifted annual conferences.

©2011 Interact
10200 Jefferson Blvd • P.O. Box 802 Culver City, CA 90232
Phone: (800) 359-0961 • www.teachinteract.com
ISBN# 978-1-56004-691-2

Welcome to *Let's Investigate!*

One of the most effective learning tools for students is discovering knowledge for themselves. This unit will take you and your students on an adventure investigating probability and statistics concepts. The unit supports and reinforces classroom instruction or can be used to introduce probability concepts before standardized testing. It provides for your students to use their knowledge and skills to solve real-life problems.

Students will be responsible for their choice of investigations and will sign a contract along with their parent and teacher stating their goal for a grade on the project. Students develop their organizational skills as they plan how they will collect information from their investigations and keep the record of their completed work. They will design a means of sharing their new knowledge with their classmates and the teacher. The difficulty and level of success of the work will determine each student's evaluation (grade/rubric score).



From 'Let's Investigate! Probability and Statistics'. Product code INT872.
Interact. (800) 359-0961. http://www.teachinteract.com/

Teacher Note

Investigations are based on the hierarchy of levels of Bloom's Taxonomy. They are designed to encourage students to use higher order thinking skills and, in addition, use a variety of learning styles: written, oral, visual and tactile. Each investigation is separate from the others and does not depend on knowledge gained from other investigations in the unit.

Students from grades 3–6 will benefit from this unit. It will provide a variety of experiences with probability and statistics, reinforcement of skills and will help students needing review.

These investigations are ideal for students in homeschool.

The best way to learn anything is to discover it by yourself.
—George Polya

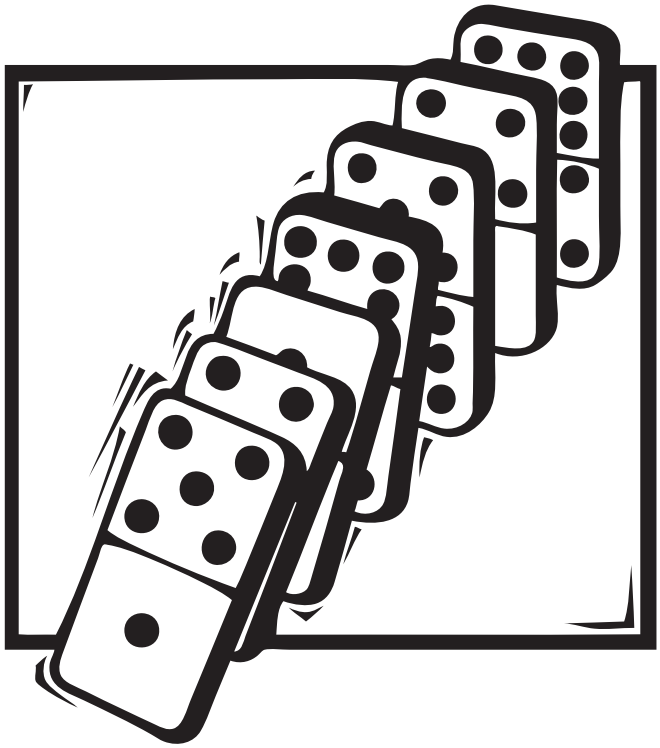


Table of Contents

Purpose and Overview

What is *Let's Investigate! Probability and Statistics*?

Let's Investigate! Probability and Statistics is a collection of activities that enhance the instruction of mathematical ideas/content. These tasks provide support for:

- on-going teaching of probability and statistics;
- review of previously taught material;
- chances to investigate ideas of interest;
- opportunities to make real-world connections in mathematics;
- situations where individual students can make their own choices, work with others and have fun with math while communicating their learning in written, oral or visual form.

The selection of investigations will vary according to the needs of the individual. Each investigation sets up a situation or poses a problem where students will work with one or more mathematical ideas.

What do students learn?

In the current climate toward common core standards, developing an understanding of probability and statistical skills is increasingly important. Specifically, students will enhance their knowledge of the following:

Knowledge

- Developing an understanding of probability
- Understanding and applying concepts of statistics and probability
- Evaluating previous information in making decisions
- Understanding the need to make sense of problems and to persevere in solving them
- Developing number sense
- Connecting math to real-world applications

Skills

- Collecting and interpreting data
- Predicting outcomes
- Organizing and writing about mathematical information

- Setting goals and making a contract commitment
- Using appropriate tools strategically to gather data
- Working independently or with others toward a goal
- Using higher order thinking skills
- Using technology as a tool for research and to share learning
- Communicating mathematically

Attitudes

- Feeling at ease with evaluating data and making predictions
- Appreciating the importance of using data to make decisions
- Developing a positive attitude toward mathematics
- Developing confidence in math abilities
- Having a sense of accomplishment when the contract goals are successfully completed

How are students organized?

Students should be allowed to choose to work on their own or with a partner or group of three to complete their contract. Students individually or with their partner(s), make their own decisions about which investigations they want to do and thereby they choose the grade they want to achieve. For students working on their own, there are some tasks that need to be completed by pairing with another student or a parent at home such as investigating the outcome of a game.

How much time is required?

Teaching tip
The midway evaluation form will help with assessing progress.

The number of investigations and the duration of the unit will depend on the way you choose to use the unit and the needs of your students. There are a variety of ways to approach these investigations. The contract can take up to three or more weeks to complete depending on the number of investigations you decide will be required and the amount of class time used by students to complete the activities. If you decide to allow more time, it's important to build in time to meet with students weekly to assess progress on completion of the contract.

How is learning assessed?

Let's Investigate! Probability and Statistics contains a rubric for the completion of projects assigning the point value for each category of activities based on the level of thinking (difficulty). Students are expected to reflect on their finished work with the teacher or their classmates in written, oral, or some form of visual presentation.

Why use *Let's Investigate! Probability and Statistics*?

The investigations support the nationally recommended Common Core State Standards for Mathematical Practices. These are:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Using this unit promotes your students' discovery of basic concepts of probability and use of data and statistics to support their understandings. The unit provides a way to use a wide variety of mathematical skills and apply the mathematics students have already learned. Investigations by their very nature promote higher level thinking skills. As students understand and gather information, then transform it by analyzing, evaluating and applying, they are moving toward the life skills they will use in all careers and managing family responsibilities.

Differentiation

The Let's Investigate! Contract offers a student the opportunity to make choices and to work at their own pace individually or in pairs to solve problems. It accommodates multi-ability levels in that you can modify the contract for students who need more time or have mastered what you are currently teaching and need to go farther. You can select specific investigation choices that you think are most appropriate for students.

Homeschool teachers will appreciate the flexibility and variety of challenges this unit provides.

Let's Investigate! Probability and Statistics is centered on Bloom's levels of thinking and the scoring (grade) is based on the number and levels and the quality of the final products completed by the student. The unit is also designed to incorporate a variety of learning styles including writing, oral communication, visual and tactile experiences.

Name: _____ Date:_____

Investigations

Bloom's levels of thinking questions

Section I: Knowledge and Comprehension:

1. Define the following vocabulary and explain how each relates to probability.

Certain _____

Combination _____

Data _____

Experiment _____

Fairness _____

Graph _____

Likely _____

Never _____

Odds _____

Outcome _____

Possible _____

Prediction _____

Probability _____

Sample Space _____

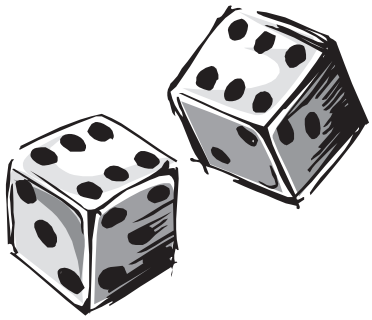
Sampling _____

Statistics _____

Tally _____

Unlikely _____

2. For this investigation, you will need 2 regular 6-sided dice. Two different colored dice would be best. When you roll the two dice and add them together you can get the sums 2–12. Predict what sum will come up most often if you roll the dice 20 times. Test your prediction.



   - Roll the two dice 20 times.
   - Tally the sum for each roll.
   - What sum(s) come up the most?
   - Make an organized chart or grid showing all the possible sums and all the ways you can get those sums.
   - Try the experiment again. Predict the sum that will come up most often.
   - Roll the dice 20 more times and tally the sums.
   - Describe how the second set of 20 tosses compares to the first set.
   - Do the experiment a third time. Predict what sums will come up most often. Test your prediction.
   - Tell what your predictions were for each 20 rolls and what you found out about the sum(s) which will be most likely to come up when 2 dice are rolled and why you think this will happen.

3. There are 28 dominoes in a standard set of double-6 dominoes.

   - When you add the dots together on the dominoes what are the possible sums? (Don't forget double zero.)
   - Predict which sum comes up most often.
   - Turn all the dominoes upside down and mix them up.
   - Draw a domino 25 times, replace the domino and mix them up after each draw, then record the sums. Were the results what you predicted?
   - Make a list or chart with all the possible sums. Be sure to include those most likely and those least likely to be drawn.
   - Which sum is expected to come up most often?
   - Share your completed chart(s) with your teacher/class.

4. A high school boy has a part time job. He has 3 new shirts, red, blue and green and 2 new pairs of pants, black and brown for his new job. The boy does not want to wear the same shirt and pants together in a week.

   - Predict the number of combinations of pants and shirts the boy has.
   - Draw a picture showing all the different outfits the boy can make with his new pants and shirts.
   - What if he got another pair of pants, navy blue? Then how many combinations would he have?