

Probability

Targeted Grade Level: Sixth

A Differentiated Multimedia Instructional Unit

Designed and Developed by:
CCC! Educational Specialists

- *Defining Probability*
Source: Wikipedia
- *Using Technology to Personalize Instruction*
- *Probability in Our Lives*

Prep Time



As a mathematical subject, the theory of probability arose very late—as compared to geometry for example—despite the fact that we have prehistoric evidence of man playing with dice from cultures from all over the world. In fact we have the exact year when it was born; in the year 1654 Blaise Pascal had some correspondence with his father's friend Pierre de Fermat about two problems concerning games of chance he had heard from the chevalier de Méré earlier the same year, whom Pascal happened to accompany during a trip.

One problem was the so called problem of points, a classic problem already then (treated by Luca Pacioli as early as 1494), dealing with the question how to split the money at stake *in a fair way* when the game at hand is interrupted half-way through. The other problem was one about a mathematical rule of thumb that didn't seem to hold when extending a game of dice from using one die to two dice. This last problem, or paradox, was the discovery of Méré himself and showed, according to him, how dangerous it was to apply mathematics to reality. They discussed other mathematical-philosophical issues and paradoxes as well during the trip that Méré thought was strengthening his general philosophical view.

Pascal, in disagreement with Méré's view of mathematics as something beautiful and flawless but poorly connected to reality, determined to prove Méré wrong by solving these two problems within pure mathematics. When he learned that Fermat, already recognized as a distinguished mathematician, had reached the same conclusions, he was convinced they had solved the problems conclusively. This correspondence circulated among other scholars at the time, and marks the starting point for when mathematicians in general began to study problems from games of chance.

This does not mean that Pascal and Fermat had a clear concept of probability, nor that they made the first correct calculations concerning games of chance. No clear distinction had yet been made between probabilities and expected values. The first person known to have seen the need for a clear definition of probability was Laplace. As late as 1814 he stated:

The theory of chance consists in reducing all the events of the same kind to a certain number of cases equally possible, that is to say, to such as we may be equally undecided about in regard to their existence, and in determining the number of cases favorable to the event whose probability is sought. The ratio of this number to that of all the cases possible is the measure of this probability, which is thus simply a fraction whose numerator is the number of favorable cases and whose denominator is the number of all the cases possible.

Harnessing Innovation to Support Student Success Using Technology to Personalize Education

October 2008 Report from:
U.S. Department of Education
Margaret Spellings
Secretary

CONCLUSION of the Findings

We have seen our world change around us and now need to retool our education system to respond. Part of our challenge has been that technology has been applied to the outside of the education process, rather than as a critical tool in revamping the process itself. Personalizing instructional delivery through the strategic use of technology is a key part of that transformation.

However, **educational technology should not be implemented in a vacuum**—it must be tied to the **principles of learning and high-quality teaching**, all of which **must align with challenging content and skill standards**.

Probability in Our Lives

A basic understanding of probability makes it possible to understand everything from batting averages to the weather report or your chances of being struck by lightning! Probability is an important topic in mathematics because the probability of certain events happening - or not happening - can be important to us in the real world. To access many excellent learning activities visit The **Math Forum @ Drexel University** (<http://www.mathforum.org>)

Need additional technology help?

Help students use hyperlinks in their PowerPoint presentations by following these steps:

> Type a word or phrase that you want to hyperlink to a video or video segment in CCC!VOD.

>To find the URL of the video or video segment in CCC!, select the **Additional Information** link shown on each video selection (found above the Teacher Resources). Once you select the Additional Information link, a window will popup and you will see the URLs for each video segment. Copy the URL you want to use in your PowerPoint .

>Hold down the Control Key and select the K key. A hyperlink window will popup. Paste the URL from the video or video segment in the URL field.

>SAVE and test.



Standards-based Instructional Design *versus* Standards-aligned Documentation

CCC!'s content is aligned to the Illinois Learning Standards. The correlation and documentation has been done for you. However, you, as the teacher, hold the instructional decisions regarding which standards must be emphasized with the students who are to participate in the learning opportunities you choose.

Power Standards are standards that teachers identify as those all students [participating in the unit of learning] must know, understand and be able to demonstrate at a mastery level. **Based on student achievement data and formative assessment data of your current students, highlight the standards below that you expect 100% of your students to master, as a result of teaching this unit of study.**

Illinois Learning Standards: Mathematics

STATE GOAL 10: Collect, organize and analyze data using statistical methods; predict results; and interpret uncertainty using concepts of probability.

C. Determine, describe and apply the probabilities of events.

LATE ELEMENTARY	MIDDLE/JUNIOR HIGH SCHOOL	EARLY HIGH SCHOOL
10.C.2a Calculate the probability of a simple event.	10.C.3a Determine the probability and odds of events using fundamental counting principles.	10.C.4a Solve problems of chance using the principles of probability including conditional settings.
10.C.2b Compare the likelihood of events in terms of certain, more likely, less likely or impossible.	10.C.3b Analyze problem situations (e.g., board games, grading scales) and make predictions about results.	10.C.4b Design and conduct simulations (e.g., waiting times at restaurant, probabilities of births, likelihood of game prizes), with and without the use of technology.
10.C.2c Determine the probability of an event involving "and", "or" or "not".		10.C.4c Propose and interpret discrete probability distributions, with and without the use of technology.

This background information has been provided as a planning/preparation step for teachers to complete prior to beginning instruction. Thank you.

- *The World of Work*
- *Researching Skills Aligned to Students' Interest*
- *Demonstration and Application of New Learning*

Lesson Context



Connecting CCC! Resources within a Context of YOUR District's Curriculum:

Many people today rely on the principles of probability (and statistics) to excel within their specific field of work. For this unit, students will choose a career to research and demonstrate to what extent the knowledge of probability is interwoven into the required skills/responsibilities of a particular field of work.

Recommended Careers for Students to Consider for Researching Jobs that have Requirements of Knowledge/Skills of Probability and Statistics:

- > *Firefighter*
- > *Game Designer (winning/losing)*
- > *Scientist (student chooses field)*
- > *Baseball Manager (connection to batting averages)*
- > *School Principal (student achievement)*
- > *Sales (that require a quota)*
- > *Pharmaceutical Company Researcher*
- > *Meteorologist (forecasting)*
- > *Medicine (breast cancer rates)*
- > *Car Insurance Sales (rates of insurance costs based on person's profile)*

Using CCC!VOD, perform a keyword search by using the word probability. Ten results will appear. Each of the above careers is highlighted within one of these ten results. For purposes of this unit, only advance resources are recommended due to the level of the learners for whom this unit of study is being designed (Grade 6/Advanced). By clicking on the video icon, you will be able to see how the chapters of the video are segmented. Decide whether you want students to watch all or part of a video based on their career selection. You can create playlists using the Digital Director feature and name the selections by career in order to help you organize videos and clips in a way that will allow you to archive this information for future years of teaching as well.

Assignment: Students will assume a role as an employee within a chosen field of study and make a presentation to the class on to what extent they must rely on a solid knowledge of probability in order to be successful in their field. Additionally, they should identify a current problem in today's world on which they are working to contribute to making the future better for others.

Assessment: Using the rubric shown to the right, share the criteria for success with students prior to them choosing a career. Students should be clear with regard to expectations and grading parameters prior to beginning their active learning.

Need More?

The **Interactivate** web site found at <http://www.shodor.org/interactivate/lessons> has 15 excellent probability lesson plans that span a wide grade range. Many use the game theory approach, which helps give students repeated opportunities to demonstrate their knowledge, skill and understanding of key probability concepts.



Want to Make More of Your Own Rubrics?

The rubric on the next page was made using a free online tool, entitled RCampus, which can be found at <http://www.rcampus.com/>

“Well, if storytelling is important, then your narrative ability, or your ability to put into words or use what someone else has put into words effectively, is important too.”

Howard Gardner

Assessment Information – Probability Unit

Probability Rubric	Working Towards Grade Level Standards	Working at Grade Level Standards	Exceeding Grade Level Standards
Definition of Concept	Student is able to define the concept of probability and give 2 examples of where probability is used in the real world	Student is able to define the concept of probability and give 3 to 5 examples of where probability is used in the real world.	Student is able to teach others about the concept of probability so that they can provide 6 to 8 examples of where probability is used in the real world.
Research Skills	Student is able to choose a job and summarize research related to probability in the associated field.	Student is able to select a job and report research findings and conclusions related to probability in the associated field.	Student is able to assume a role of a famous person within a field of study that relies on probability and statistics to solve problems. By acting out the persona of a famous person, others will understand the impact/influence this person had in the chosen field.
Problem Solving	Student is able to describe 2 problems that are encountered in the chosen field of study and explain how probability and statistics were used to arrive at plausible solutions.	Student is able to demonstrate a problem/solution within the chosen field of study using probability and statistics appropriately.	Student is able to pose a problem that is encountered within the chosen field of study and use probability/statistics to create an original idea that could make a difference in the lives of others.
Quality	Presentation has introduction, clearly stated purpose statement, visuals that convey key concepts and uses technology to deliver the final presentation.	Presentation is complete with thorough introduction, clear purpose, video resources delivered in through an electronic means and a convincing conclusion statement.	Presentation is thorough and compelling, uses a variety of multimedia resources via electronic means and includes original opinions within the conclusion.

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