

Take a Chance with Probability

Experimental vs Theoretical Probability

Stephanie Bayne, Brittany Bowens, Rachelle Johnson, Corrie Matchell
Published by *K20 Center*

This work is licensed under a Creative Commons CC BY-SA 4.0 License

Grade Level	8th Grade
Subject	Mathematics
Course	Pre-Algebra

Essential Question

When does probability change from theoretical to experimental?

Summary

Students will learn about theoretical and experimental probability through stations and will discuss the differences between them. They will also learn how to write fractions as decimals and as percentages.

Snapshot

Engage

Students will play the card game The 21 Challenge and attempt to beat the teacher by getting as close to 21 without going over.

Explore

Students will investigate different probability situations and hypothesize the outcomes.

Explain

Students will determine the difference between experimental and theoretical probability and calculate the probability from the previous situations.

Extend

Students will develop and solve their own word problem for experimental or theoretical probability.

Evaluate

Students will analyze scenarios for experimental or theoretical probability and summarize the differences between the two types.

Standards

Oklahoma Academic Standards Mathematics (8th Grade)

PA.D.2.1: Calculate experimental probabilities and represent them as percents, fractions, and decimals between 0 and 1. Use experimental probabilities to predict relative frequencies when actual probabilities are unknown.

Attachments

- Gist—Take a Chance with Probability.docx
- Gist—Take a Chance with Probability.pdf
- I Notice, I Wonder—Take a Chance with Probability.docx
- I Notice, I Wonder—Take a Chance with Probability.pdf
- Lesson Slides—Take a Chance with Probability.pptx
- Probability Note Catcher—Take a Chance with Probability.docx
- Probability Note Catcher—Take a Chance with Probability.pdf
- Probability Scenarios—Take a Chance with Probability.docx
- Probability Scenarios—Take a Chance with Probability.pdf
- Probability Stations—Take a Chance with Probability.docx
- Probability Stations—Take a Chance with Probability.pdf
- Station Instructions—Take a Chance with Probability.docx
- Station Instructions—Take a Chance with Probability.pdf

Materials

- Lesson Slides (attached)
- Station Instructions (attached; one set per class)
- Probability Stations packet (attached; print two-sided and stapled; one per student)
- Probability Note Catcher handout (attached; print two-sided; one per student)
- Probability Scenarios packet (attached; print two-sided and stapled; one per student)
- I Notice, I Wonder handout (optional; attached; print one-sided; one per student)
- Gist handout (attached; print two-sided; one per student)
- 2 decks of cards (two cards per student)
- Skittles
- Pennies
- Dice
- Spinners
- Ball
- Trashcan
- Chart paper

Engage

Use the attached **Lesson Slides** to present the lesson to students. Display **slide 2** and introduce students to the lesson title and topic of the lesson: Experimental vs. Theoretical Probability. Use **slides 3–4** to go over the essential question and objectives.

Transition to **slides 5–6** and explain to students the goal and rules of the card game: The 21 Challenge. Pass out two cards to each student from a deck of cards. Instruct students to look at their cards. Deal out two cards for the teacher and reveal one of the cards to the students. Explain to students situations in which they would want to "hit," add another card, or "stand," stay with the cards they have. Those with a value less than 16 should hit, and those who have more than 16 can make the decision to hit or stay. Pass out an extra card to the students that choose to hit. Once all cards are passed out, have students flip over their cards to see whether or not they stayed under 21 or "bust," went over. The first student who reaches 21 or a number higher than the teacher but still below 21 wins.

Explore

Move to **slide 7** and go over the descriptions of the stations that students will be going to:

- Skittles
- Coin Flip
- Dice Roll
- Spinner
- Hoop

Pass out a copy of the **Probability Stations** handout to each student. Explain to students that there are instructions at each station that students need to read prior to performing the activity. Inform students that they will answer questions, perform the activity for 20 trials, and tally up their results in the first table. They should not fill out anything past the first table for each station. They will return to the rest of this handout later. Inform students that once they have completed the activity they will wait to move stations until time is called.

Explain

Pass out the **Probability Note Catcher** to each student. Use **slides 8–9** to go over how to convert a fraction to a decimal and a decimal to a percentage.

Move to **slide 10** and instruct students to complete the remaining table calculations and questions on their Probability Stations handout for each station.

Move to **slide 11** and go over the difference between theoretical and experimental probability. Move to **slide 12**. Have students reflect on the stations they visited and determine which stations represented theoretical and experimental probability. Direct students to the backside of the Probability Note Catcher and use **slides 13–14** to have students practice theoretical vs. experimental probability.

Extend

Have students form groups of three or four. Pass out the **Probability Scenarios** to each student and a piece of chart paper for the group. Move to **slide 15** and inform students that they will create a real-world problem for theoretical or experimental probability and solve for the fraction, decimal, and percentage. Tell students that their problem needs to be reviewed before they can transfer their final word problem onto the chart paper.

Teacher's Note: Scaffolded Instruction

Assign a type of probability problem to each group based on the group's ability or understanding of the concept or to ensure even distribution of experimental and theoretical.

Transition to **slide 16** and invite students to take their handout and do a Gallery Walk to try and solve each word problem. Provide a timer to keep students on task. After rotations are completed, have each group share their scenario and see if the group correctly identified and calculated each scenario.

Optional Career Exploration

Unhide **slides 17–19**. Use this activity to help students connect theoretical vs experimental probability to real-world careers and see how the concepts apply in climatology.

Move to **slide 17** and inform students: "Today, we are going to learn about a profession that involves probability on a daily basis. We are going to meet Dr. Monica Maddox, a Climatologist." Ask if anyone knows what meteorology is. Share that there are lots of jobs in meteorology other than broadcast meteorology (the weather people on TV), and it's a huge field in Oklahoma, too. Introduce students to the I Notice, I Wonder strategy. Pass out the **I Notice, I Wonder** handout and ask students to write down any notices or wonders they hear about the climatology profession, what skills and education are necessary for the job, and to consider times where theoretical or experimental probability is used in this career.

Start the *Career-Focused - Climatologist with Monica Maddox* interview on the slide.

Move to **slide 18** and have students share with an partner about their notices and wonders, and to come up with one of each to share with the whole class. Move to **slide 19** and have students return to their partner to answer the following prompt: "You are a meteorologist studying the weather patterns around your hometown. According to past data, when the weather is under similar conditions as today, storms are produced 85% of the time. Is this experimental or theoretical probability?

Have students share their justifications to the class.

Evaluate

Move to **slide 20** and pass out the **Gist** handout. Introduce students to the Gist strategy. Have students decide from the various scenarios whether they are theoretical or experimental. After completing their placement, guide students to write their gist of 28 words or less to explain the reasoning for their placement using the learned vocabulary.

Resources

- K20 Center. (n.d.). Gallery walk/carousel. Strategies. https://learn.k20center.ou.edu/strategy/118
- K20 Center. (n.d.). Gist. Strategies. https://learn.k20center.ou.edu/strategy/3289
- K20 Center. (n.d.). I notice, I wonder. Strategies. https://learn.k20center.ou.edu/strategy/180
- K20 Center. (2026). *Career-focused - climatologist with Monica Maddox* [Video]. YouTube. https://www.youtube.com/watch?v=Am10w_ksBQg