

Probability in Sports

Probability

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Grade Level	8th Grade	**Time Frame**	2-3 class period(s)
Subject	Mathematics	**Duration**	90 minutes

Essential Question

How can probability inform coaching staff decision-making for sporting events?

Summary

In this lesson, students explore the concepts of statistics and probability in the context of basketball. Students play basketball in the classroom, gather data about shots made and missed, and calculate the probability of a successful shot. Students then step into the role of an NBA statistician and calculate the probability of 2-point and 3-point shots using real-world scores from their chosen team. At the end of the lesson, students summarize their understanding in a letter to their team's coach.

Snapshot

Engage

Students discuss what they know about basketball in a Collective Brain Dump and watch a video of NBA highlights.

Explore

Students shoot baskets using “basketballs” to collect data then determine their own probability of making a successful shot.

Explain

Students participate in a class discussion in which they discuss how they analyzed their data, how their data can be used, and which form of probability is most useful in basketball.

Extend

Students take on the role of an NBA statistician and use data from real NBA teams to determine a team’s probability of making 2-point and 3-point shots.

Evaluate

Students summarize their findings in a letter to the coach of their chosen team and argue which type of shots the team should practice.

Standards

ACT College and Career Readiness Standards - Mathematics (6-12)

N 403: Comprehend the concept of length on the number line, and find the distance between two points
N 503: Work with numerical factors

Oklahoma Academic Standards for Mathematics (Grade 8)

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

Attachments

- A Statistician's First Day—Probability in Sports - Spanish.docx
- A Statistician's First Day—Probability in Sports - Spanish.pdf
- A Statistician's First Day—Probability in Sports.docx
- A Statistician's First Day—Probability in Sports.pdf
- Lesson Slides—Probability in Sports.pptx
- Shot Statistics—Probability in Sports - Spanish.docx
- Shot Statistics—Probability in Sports - Spanish.pdf
- Shot Statistics—Probability in Sports.docx
- Shot Statistics—Probability in Sports.pdf

Materials

- Lesson Slides (attached)
- Shot Statistics handout (attached; one per pair of students)
- A Statistician's First Day handout (attached; one per student; print two-sided)
- Classroom "basketballs" (for example: crumpled paper, foam balls, etc.; one per pair of students)
- Classroom "basketball hoop" (for example: trashcan, bowl, etc.; one per pair of students)
- Laptop or tablet (one per student)
- Notebook paper (one per student)

Engage

Teacher's Note: Lesson Preparation

Prior to the lesson, arrange your classroom basketball court. Use a trash can, bowl, or other container as a "basket." Use crumpled paper balls, foam balls, or something similar as "basketballs." Use tape to create a boundary line from which students will shoot. Ensure that there is enough distance between the basket and boundary line to challenge students without being overly difficult. Ensure that the basket lines up with the boundary line for a clear shot. For larger classes, consider preparing more than one basketball court so that multiple groups can take shots simultaneously.

Use the attached **Lesson Slides** to guide the lesson. Begin the lesson by displaying **slide 2** to introduce the title of the lesson. Transition through **slides 3–4** and introduce the essential question and learning objective.

Pass out one sheet of notebook paper to each student and display **slide 5**. Have students participate in a Collective Brain Dump by writing down everything they know about basketball. Encourage students to consider things like rules, teams, players, equipment involved, etc. Remind students that, in this activity, they should focus more on writing down ideas and less on proper grammar or sentence structure.

Start the 4-minute timer on the slide and provide students time to brainstorm. Invite volunteers to share out what they wrote. Consider using a whiteboard space to record student responses from their brain dumps.

Show **slide 6** and play the video *NBA's Best Ball Fakes 2018-2019*.

Embedded video
https://www.youtube.com/watch?v=4FdIRPiL5vA

Teacher's Note: Video Length

The full video is eight minutes long. You may choose to show the full video, a portion of the video, or select highlights, depending on your classroom needs.

Explore

Display **slide 7** and introduce the instructions for the activity. Sort students into pairs and give each pair one classroom "basketball" and one copy of the **Shot Statistics** handout.

Direct students' attention to the shooting line(s) and tell them that one partner from each pair will take turns shooting their "basketball" from the line. The first player should shoot the basketball ten times towards the basket while the second player marks which shots were successful or missed on the Shot Statistics handout. After the first player tosses the ball ten times, have the partners switch roles. The second player should now shoot the ball ten times while the first player records the missed and successful shots.

Allow enough time for each student to have a turn shooting the ball. Have pairs then work together to find the statistical probability of each player making a successful shot. Tell students to record the probability for both players at the bottom of their handouts in decimal, reduced fraction, and percentage forms.

Teacher's Note: Finding Probability

Students should be familiar with how to find simple probabilities, but some may need guidance. If necessary, remind students to divide the number of successful shots by the number of attempts made.

Explain

Move to **slide 8**. Ask for pairs to share their findings. Ask the following guiding questions on the slide:

- How did you calculate the probability?
- Who has the highest chance of making a successful shot?
- Which form (decimal, fraction, or percentage) would be the most helpful to a basketball coach? Why?

Possible Student Responses

Students may respond that higher percentages indicate a greater rate of success and a higher statistical chance of making a shot. Pay close attention to the forms students use when talking about their rates of success—decimals, fractions, or percentages.

When discussing which form of probability would be most beneficial to a coach, guide students to weigh the benefits of each. Help students understand that percentages, as a general rule, would be the best form of probability for a coach to use, as it is most easily understood in terms of successful versus unsuccessful shots.

Extend

Teacher's Note: Guiding the Activity

This portion of the lesson has students navigate the Basketball Reference website and explore data from various basketball teams. You may consider demonstrating how to navigate the website using a projection screen, if available.

Display **slide 9** and pass out one copy of the **A Statistician's First Day** handout to each student. Explain to students that they are about to begin their first day as an official NBA statistician.

Have students navigate to the Basketball Reference website using either the link or QR code on the slide or handout. Instruct pairs to scroll down to the "Conference Standings" chart and choose the team they'd like to work for. When students select their team's name, they'll be able to see a page that offers additional information about the team. Have them select the "Schedule & Results" tab then scroll down to the "Regular Season" table. Tell students to use the four most recent games played to complete the first table on their handouts.

Ensure that when students select the date of a team's most recent game, they then navigate to their team's game, as when a date is selected it will display all teams that played on that date. Students must then find their team's city and select "Shot Chart" within the box. Students may then scroll down and navigate the shot chart to find data for 2-point shots attempted (2PA), 2-point shots successfully made (2P), 3-point shots attempted (3PA), and 3-point shots successfully made (3P). Have students record these numbers on their handouts under each of the four games labeled G1, G2, G3, and G4. Have students also record the date of each game.

Optional Activity Modification

If the activity or website are too complex for students, consider selecting a team in advance and completing the above activity as a class. If pressed for time, you may also consider recording the numbers for the class in advance.

Have students use the data they collected to calculate the probability of both types of shots for each game in simplified fraction and percentage forms. Have them then find the probability of a successful shot across all games for both 2-point and 3-point shots.

Optional ICAP Video Activity

If time allows, unhide **slide 10** and play the *K20 ICAP - Sports Statistician - Real-Time Stats in Sports* video for students. The video features an interview with a sports statistician.

Embedded video
https://youtube.com/watch?v=rGI8PX4UbNI

Evaluate

Show **slide 11**. Have students now use the data they collected and analyzed to write a letter to their team's coach on the back of their A Statistician's First Day handouts. Tell students that they must persuade the coach to practice either 2-point or 3-point shots based on their calculations.

Remind students to be specific with their data and include numbers from their calculations. You may consider having students turn in their handouts to serve as an assessment of the lesson.

Resources

- K20 Center. (n.d.). Collective brain dump. Strategies. https://learn.k20center.ou.edu/strategy/111
- K20 Center. (2021, September 21). *K20 Center 4 minute timer*. https://www.youtube.com/watch?v=kpCsfuvzQeY
- K20 Center. (2023, April 12). *K20 ICAP - Sports Statistician - Real-Time Stats in Sports* [Video]. YouTube. https://youtu.be/rGI8PX4UbNI
- NBA. (2019, July 29). *NBA's best ball fakes* [Video]. YouTube. https://www.youtube.com/watch?v=4FdIRPiL5vA
- *Scores*. (n.d.). Basketball Reference. https://www.basketball-reference.com/boxscores/