



# Predicting with Probability: How AI Makes Smart Guesses

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**Target Grade:** 6th Grade (adaptable for 5–8) Math

**Time Required:** 60 minutes

## Standards

Core State Standards – Grade 6

6.SP.A.1 – Recognize a statistical question as one that anticipates variability in the data and accounts for it in the answers.

6.SP.B.5 – Summarize numerical data sets in relation to their context, including:

- 5a. Reporting the number of observations.
- 5b. Describing the nature of the attribute under investigation.
- 5c. Giving quantitative measures of center (median and/or mean) and variability.
- 5d. Describing any overall pattern and any striking deviations from the overall pattern.

## Lesson Objectives

Students will:

- Collect and analyze data from an AI-based drawing activity to evaluate prediction accuracy.
- Conduct probability experiments using coins and dice to compare random outcomes with AI-generated predictions.
- Calculate and interpret averages, ratios, fractions, and percentages from individual and group data sets.
- Collaborate in small groups to synthesize data and identify trends in AI performance.
- Reflect on the relationship between math, data, and artificial intelligence through written and verbal responses.

## Central Focus

In this lesson, students explore how artificial intelligence (AI) uses data and probability to make predictions. Through hands-on activities, including drawing with AI, conducting probability experiments, and analyzing group data, students learn how mathematical concepts like averages, ratios, and experimental probability help machines "guess" more accurately. The lesson emphasizes the connection between data quantity, prediction accuracy, and the role of human interpretation in evaluating AI performance.

Key terms: artificial intelligence, machine learning, student data, classroom technology, STEM integration, math applications, probability experiment, group analysis, data interpretation



## Background Information

Teacher background information:

### Scientific & Mathematical Concepts to Know:

- Artificial Intelligence (AI): Understand that AI refers to computer systems designed to perform tasks that typically require human intelligence, such as recognizing patterns, making predictions, or generating content. In this lesson, AI is introduced as a tool that uses data to make educated guesses.
- Machine Learning: A subset of AI where algorithms improve over time by learning from data. The Quick, Draw! game is an example of supervised learning, where the AI improves its ability to recognize drawings based on labeled examples.
- Probability & Data Analysis: Be familiar with basic probability concepts (e.g., experimental probability, ratios, percentages, and averages) and how they relate to prediction and uncertainty.

### School AI Policy Considerations:

- Check your school or district's policy on using AI tools in the classroom. While Quick, Draw! is a student-friendly tool, some schools may have restrictions on accessing external websites or AI-based platforms.
- If AI tools are restricted, consider projecting the Quick, Draw! game from your device for a class demonstration, or use printed screenshots of sample rounds for students to analyze.

### Possible Areas of Confusion & Solutions:

- Misunderstanding AI as "thinking" like a human: Emphasize that AI does not "think" or "understand" in a human sense. It identifies patterns based on data.
- Confusion between randomness and prediction: Clarify that while coin flips and dice rolls are random, AI predictions are based on patterns in data, which can make them more or less accurate depending on the quality and quantity of that data.
- Difficulty with calculations (fractions, percentages, averages): Be prepared to model these calculations on the board or provide scaffolding (e.g., fraction-to-percent conversion charts or calculators).

### Technology Access & Alternatives:

- *Quick, Draw!* requires internet access and a device. If students don't have individual access:
  - Use it as a whole-class activity with volunteers drawing on a smartboard or projected screen.
  - Provide printed drawing prompts and have students simulate the AI's role by guessing each other's drawings, then compare to actual AI guesses if possible.
- Dice and coins: Have enough physical materials for pairs or small groups. If not, use virtual dice and coin flip simulators (many are free and browser-based).



## Preparation Checklist:

- Preview the Quick, Draw! website to ensure it works on your school's network.
- Print or copy the [AI Predictions and Probability Worksheet](#) for each student.
- Gather materials: coins, dice, colored index cards (green, yellow, red), and optional calculators.
- Prepare to show the "What is AI?" video (check sound and video access).
- Review key vocabulary and consider pre-teaching terms: *prediction, probability, data, AI, model*.

## Student background information:

### Mathematical Concepts:

- A basic understanding of probability, including:
  - The idea of random events (e.g., coin flips, dice rolls).
  - How to calculate experimental probability using frequency and total trials.
- Familiarity with fractions, percentages, and ratios, and how to convert between them.
- Ability to calculate a mean (average) from a set of numbers.

### Data Collection & Organization:

- Experience recording data in a table or chart.
- Understanding how to tally results and interpret simple data sets.

### Vocabulary to Pre-Teach or Review:

- Artificial Intelligence (AI)
- Prediction
- Probability
- Data
- Experimental Probability
- Ratio
- Mean (Average)

## Materials

- [AI Predictions and Probability Worksheet](#) (one per student)
- Internet-connected devices (one per student or pair) to access:
  - [Quick, Draw!](#)
  - [What is AI?](#) video (linked or downloaded in advance)
- Projector or screen to display the video and facilitate class discussions
- Colored index cards (green, yellow, red, 5 of each color per student)
- Coins (one per student or pair)
- Six-sided dice (one per student or pair)
- Pencils or pens
- Calculators (optional, for students who need support with calculations)
- Whiteboard or chart paper for recording class data and discussion points
- Markers or dry-erase markers for board work



## Instruction

### Introduction (10 minutes)

- Begin the lesson by flipping a coin five times in front of the class.
- Ask students to tally the results (heads vs. tails) and record them on the board or a shared display.
- Facilitate a brief discussion about the concept of randomness and whether the outcomes were predictable. Encourage students to share their thoughts.
- Transition the conversation by telling students they will now explore how machines make predictions.
- Play the short video titled [What is AI?](#) to introduce the concept of artificial intelligence.
  - This 2:30 video introduces students to artificial intelligence by comparing it to training a robot dog, explaining how AI learns from data, and highlighting the importance of using AI responsibly and critically.
- After the video, explain that AI is often used as a prediction tool. Provide real-life examples such as Netflix recommendations, AutoFill in search engines, and email spam filters.
- Conclude the introduction by presenting the essential question for today's lesson: "How can math help AI make better guesses?" Write this question on the board and let students know they'll revisit it throughout the lesson.

### Activity #1: Quick, Draw! Data Collection (15 minutes)

- Begin by distributing the AI Predictions and Probability Worksheet to each student. Let them know they will use this packet throughout the lesson.
- Instruct students to open the [Quick, Draw!](#) website on their devices.
  - Quick, Draw! is a free online game by Google where users draw prompts while an AI attempts to guess the drawing in real time, helping demonstrate how machines learn from data.
- Have students play five rounds of the game. As they play, direct them to complete the Activity #1 section of the worksheet by recording:
  - The number of guesses it took the AI to identify their drawing.
  - Whether the AI guessed correctly.
  - The color card that matches the result (based on the key provided in the worksheet).
- Distribute five colored index cards to each student:
  - Green for rounds where the AI guessed correctly in 3 or fewer tries.
  - Yellow for rounds where the AI guessed correctly in 4–5 tries.
  - Red for rounds where the AI guessed incorrectly or took 6 or more tries.
- Ask students to sort each of their five rounds using the appropriate colored cards.
- Once all five rounds are complete, instruct students to fill out the Summary Table in the worksheet:
  - Count how many of each color card they used.



- Convert those counts into fractions, percentages, and ratios.
- Calculate the average number of guesses across all five rounds.

#### Activity #2: Probability Experiments with Coins & Dice (15 minutes)

- Instruct students to turn to Activity #2 in their AI Predictions and Probability Worksheet and provide each student or pair of students with a coin and a standard six-sided die.
- Have students flip the coin 20 times, using tally marks to record the number of heads and tails.
- Then, have them roll the die 20 times, recording the frequency of each number (1 through 6) using tally marks.
- Guide students to calculate the experimental probability for each outcome:
  - For the coin: probability of heads and tails.
  - For the die: probability of each number (1–6).
- Once calculations are complete, lead a brief discussion or have students reflect in writing:
  - How predictable were the coin and die outcomes compared to the AI's guesses in Activity #1?
  - What similarities or differences do they notice between randomness and AI prediction?

#### Activity #3: Group Data Analysis & Interpretation (10 minutes)

- Have students form small groups and turn to the Group Data Analysis section in their AI Predictions and Probability Worksheet. Instruct them to combine their individual results from Activity #1.
- Guide each group to:
  - Calculate the average number of guesses across all group members.
  - Tally the total number of green, yellow, and red outcomes for the group.
  - Recalculate the ratios and percentages for each color category based on the group totals.
- Ask students to record their answers to the reflection questions in the worksheet.
- Facilitate a class discussion to share and compare group responses to the reflection questions:
  - How did your group's data compare to your individual results?
  - What trends do you notice when more data is collected?
  - How does this relate to how AI improves with more training data?

#### Closure (10 minutes)

- Instruct students to turn to the Reflection and Exit Ticket section in their AI Predictions and Probability Worksheet.
- Have students discuss the following reflection questions in pairs, then share within their table groups, and finally invite a few volunteers to share aloud:
  - How is AI like a probability model?
    - AI is like a probability model because it makes predictions based on patterns it has seen before. Just like we can calculate the chance of flipping heads on a



coin, AI calculates the likelihood that a drawing matches something it has learned. It doesn't "know" the answer; it makes a guess based on data and probability.

- What surprised you about how well (or poorly) the AI guessed your drawings?
  - I was surprised that the AI guessed some of my messy drawings really quickly, but missed the ones I thought were clear. It made me realize that the AI might be trained on certain styles or patterns, and if my drawing didn't match those, it struggled, even if it made sense to a human.
- What could help the AI make better predictions?
  - The AI could make better predictions if it had more training data from different people with different drawing styles. It might also improve if it could ask questions or get feedback when it makes a wrong guess, kind of like how people learn from mistakes.
- Ask students to complete the Exit Ticket by responding to:
  - *One way I saw math help AI today was...*
  - *One thing I still wonder about is...*
- Wrap up the lesson by summarizing the key objectives covered, emphasizing how students used data, probability, and group analysis to better understand how AI makes predictions.
- Ask students to clean up their work areas, return any materials (coins, dice, index cards), and submit their completed worksheets before leaving.

### Differentiation

- **English Language Learners (ELLs)** can be supported with:
  - Pre-teaching of key vocabulary (e.g., *prediction*, *probability*, *data*, *AI*).
  - Visual aids and real-life examples to reinforce concepts.
  - Sentence starters for reflection and discussion questions.
- **Students with IEPs or 504 Plans** may benefit from:
  - Modified data collection (e.g., fewer rounds of Quick, Draw! or coin flips).
  - Partner or small-group work for support during calculations.
  - Extra time or simplified versions of the worksheet as needed.
- **Advanced Learners** can be challenged by:
  - Analyzing patterns across larger data sets (e.g., combining class-wide results).
  - Exploring how AI uses algorithms or machine learning models in more depth.
  - Designing their own prediction experiments using probability.

### Assessment

#### Formative Assessment

- Class discussions and partner conversations during the introduction, reflection, and group analysis activities. Listen for accurate use of terms like *probability*, *prediction*, and *data*.
- Worksheet completion during each activity, including:
  - Recording AI guesses and outcomes in Activity #1.



- Calculating experimental probabilities in Activity #2.
  - Collaborating on group data analysis in Activity #3.
- Color card sorting as a visual and kinesthetic check for understanding of AI performance categories.

### **Summative Assessment**

- Completed AI Predictions and Probability Worksheet, which includes:
  - Accurate data collection and calculations (mean, ratios, percentages).
  - Thoughtful written responses to reflection questions.
  - Exit Ticket responses demonstrating synthesis of how math supports AI predictions and identifying lingering questions.
- Class participation in group discussions and final reflections, showing ability to connect mathematical concepts to real-world AI applications.

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Class Period: \_\_\_\_\_

## AI Predictions and Probability Worksheet

### Activity #1: Quick, Draw! Data Collection

Play 5 rounds of Quick, Draw! Record how many guesses it took for the AI to guess your drawing, whether it was correct, and what color card matches your result.

Attempt #	AI Guessed in ____ Tries	Was AI Correct?	Color Card Used
1			
2			
3			
4			
5			

Color Key:

Green = AI guessed correctly in  $\leq 3$  guesses

Yellow = AI guessed in 4-5 guesses

Red = AI guessed in 6+ guesses or was incorrect

### Summary Table

	Frequency	Fraction of Total	Percent	Ratio
Green				
Yellow				
Red				
Total Attempts				
Average # of Guesses				



Name: \_\_\_\_\_ Date: \_\_\_\_\_ Class Period: \_\_\_\_\_

### Activity #2: Probability Experiment Data

Flip a coin 20 times and roll a die 20 times. Record your data below.

#### Coin Flips (20 Flips):

Heads (tally marks):

Tails (tally marks):

Heads (total): \_\_\_\_\_

Tails (total): \_\_\_\_\_

Probability of Heads = \_\_\_\_\_

Probability of Tails = \_\_\_\_\_

#### Dice Rolls (20 Rolls):




Number Rolled	Frequency (Tally Marks)	Experimental Probability
1		
2		
3		
4		
5		
6		

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Class Period: \_\_\_\_\_

### Activity #3: Group Data Analysis

Work with your group to combine your results from Activity #1. Then complete the table and questions below.

#### Group Summary Table

Outcome Color	Group Frequency	Fraction of Total	Percent	Ratio
 Green				
 Yellow				
 Red				
Total Attempts				

**Group Average Number of Guesses:**

#### Group Discussion Questions

1. How did your group's data compare to your individual results?
2. What trends do you notice when more data is collected?
3. How does this relate to how AI improves with more training data?

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Class Period: \_\_\_\_\_

### **Reflection**

- How is AI like a probability model?
- What surprised you about how well (or poorly) the AI guessed your drawings?
- What could help the AI make better predictions?

### **Exit Ticket**

One way I saw math help AI today was: \_\_\_\_\_

One thing I still wonder about is: \_\_\_\_\_