

Session 2

**Baseball
Statistics**

Growing Mathletes

Baseball Statistics

Start the session by posting and discussing this quote:

I've missed more than 9,000 shots in my career. I've lost almost 300 games. 26 times, I've been trusted to take the gamewinning shot and missed. I've failed over and over and over again in my life. And that is why I succeed. Michael Jordan

Key Ideas in the Session: Youth learn about baseball statistics analysis by calculating and simulating batting averages Youth also reflect on a mistake that they made in the last week and learn about how to use mistakes to strengthen their brain.

Driving Questions:

1. What does a batting average mean? How is batting average calculated? What is considered a "good" batting average?
2. Are home runs more important than batting average?

Math Standards:

3.NF.1 Understand a fraction ($\frac{1}{b}$) as the quantity formed by one part when a whole is partitioned into b equal parts; understand a fraction $\frac{a}{b}$ as the quantity formed by a parts of size $\frac{1}{b}$.

4.NF.5 Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 (tenths) and 100 (hundredths).

4.NF.6 Use decimal notation for fractions with denominators 10 (tenths) or 100 (hundredths), and locate these decimals on a number line.

5.NBT.3 Read, write, and compare decimals to thousandths.

5.NBT.3a. Read and write decimals to thousandths using base ten numerals, number names, and expanded form.

5.NBT.3b. Compare two decimals to thousandths based on meanings of the digits in each place, using $>$, $=$, and $<$ symbols to record the results of comparisons.

Activity	Time	Description
Activity 1 Baseball Cards and Batting Average Simulation	40 minutes	Youth explore baseball cards and learn about batting average. Youth roll dice to simulate batting average and record batting average as a fraction, decimal and percent.
Activity 2 Learning from Mistakes	20 minutes	You will reflect on mistakes you have made recently, and learn about how mistakes make your brain grow!

Materials

Baseball Cards (1 per youth)
 Dice (1 per youth pair)
 Worksheet 1 (1 copy per youth pair)
 Worksheet 2 (Grades 68 ONLY)

Set-Up

For Activity 1, distribute a baseball card to each youth. For Activity 2, distribute dice and **Worksheet 1** to each group.

Growth Mindset Connection

The value of mistakes in supporting learning. Malleability of the brain and the role of struggle in learning.

Activity 1 - Baseball Cards and Batting Averages

(40 minutes) Whole Group Discussion

Description




Youth explore baseball cards and learn about batting average. Youth roll dice to simulate batting average and record batting average as a fraction, decimal and percent.

Math Ideas:

The term “average” is used to describe data and is a metric of central tendency. Also called the “mean,” the average value is found by adding up all the values in a data set and dividing by the total number of values in the set.

Background Information on Baseball Cards and Batting Average:

Most baseball cards are for offensive positions. Therefore, the statistics are for hitting and fielding (see card on the left). Some of the baseball cards are for pitchers, which only contain pitching statistics (see sample card below). This lesson focuses on players in offensive positions.

DAVID PERALTA OF													#6	
<i>Ht: 6'3 Wt: 245 Bats: Right Throws: Right</i> <i>Born: 8-14-87, Valencia, Venezuela</i>														
Signed by D-backs as a Minor League free agent (July 3, 2013). He and his wife, Jordan, welcomed their first child, Sofia, on Aug. 14, 2017, also David's 30th birthday. Has a cat named Maximus. Named after a character from his favorite movie, "Gladiator."														
YR	TEAM	G	AB	R	H	2B	3B	HR	RBI	SB	BB	SO	SLG	AVG
15	D-BACKS	109	462	61	144	26	9	8	78	6	44	107	.450	.312
16	D-BACKS	159	567	103	182	38	2	33	110	21	118	151	.570	.321
17	D-BACKS	158	579	106	172	33	3	24	95	32	110	150	.489	.297
18	D-BACKS	155	558	117	166	34	3	36	120	18	94	147	.563	.297
MLB TOTALS 2013-2018		578	2080	288	614	110	32	74	277	29	159	433	.486	.293
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Baseball cards include statistics related to a player's batting average (column labeled “AVG” or “BA”). Batting average is calculated using the “at bat” (AB) value, and the “hits” (H) value. Example with 1 hit and 1 at bat, a player is hitting 1.000. How does that compare to a player that makes 50 hits after 100 at bats? Note: an official at bat is not the same as a plate appearance which may include a base on balls, hit by pitch, interference, or sacrifice fly.

Equation for
Batting
Average:

$$\text{batting average} = \frac{\text{hits}}{\text{at bats}}$$

Activity 1 - Baseball Cards and Batting Averages

LAUNCH Connection to Prior Knowledge:

Distribute one baseball card (for a field player) to each youth. Ask youth to share what they notice and wonder about the card they receive

- What information about the player is included on the baseball card?
- Can you find the player's team?
- Can you find the player's position?
- What other important information do you see on the card?
- Ask youth to share what you notice with a partner.

Key Statistics on a Baseball Card:

Ask youth to find two key statistics on the baseball card. **AT BATS(AB)** and **HITS(H)**.

- **At Bats** is the number of times the player comes to the plate to try to hit the ball.
- **Hits** is the number of times the player hit the ball and did not get out.

Ask youth to find the AB and H on their baseball player card, and to share these statistics with a partner.

Next, ask youth to find the player's **Batting Average (AVG or BA)** on the baseball card.

- You find the **batting average** by dividing the number of "Hits" by the number of "At Bats"
- Invite several youth to share their player's batting average.
- Discuss how to read (say) batting average values. For example, we read 0.280 as "two hundred eighty thousandths." In baseball, we say that this player has a batting average of "280" – which means they get (on average) 280 hits out of every 1000 at bats.

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Activity 1 - Baseball Cards and Batting Averages

Supporting Math Concepts:

Ask youth to discuss what the batting average is for each of the following scenarios. For each scenario, model how to record the average using fractions ($\frac{5}{10}$), and decimals (0.5 or 0.50, or 0.500). To support youth understanding, use visual models such as bar models or 100 grids to represent each scenario.

Also emphasize how to read (say) each value. For example, we read $\frac{4}{10}$ as “four tenths”; we read 0.4 as “four tenths” and 0.40 as “fourty hundredths” and 0.400 as “four hundred thousandths”. Explain to youth that in baseball if someone says they are “batting 200” what they really mean is that they have a batting average of 0.200, or 200 thousandths, or 200 hits out of every 1000 at bats.

- Scenario 1: 4 hits out of 10 at bats (answer = $\frac{4}{10}$, or 0.4 or 0.400)
- Scenario 2: 3 hits out of 10 at bats (answer = $\frac{3}{10}$, or 0.3 or 0.300)
- Scenario 3: 24 hits out of 100 at bats (answer = $\frac{24}{100}$, or 0.24, or 0.240)
- Scenario 4: 31 hits out of 100 at bats (answer = $\frac{31}{100}$, or 0.31, or 0.310)

Discuss with youth that being elite at baseball does not mean perfection. For example, a .300 batting average is considered a very good average and this is roughly equivalent to 3 hits out of 10 at bats. All batting averages are less than 1. Ask youth if they have ever heard the phrase, “batting a 1000”? Ask youth to share their ideas about the meaning of “batting a 1000.” “Batting a 1000” means a perfect batting average of 1.000, which means that a player has a hit for each at bat (5 hits out of 5 at bats, for example).

Partner Discussion:

Ask youth to find a partner and to compare three key baseball statistics from their baseball cards: HITS (H), AT BATS (AB) and BATTING AVERAGE (BA, AVG).

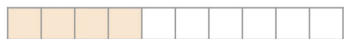
Visual Models to Represent Batting Average

$$\text{Batting Average} = \frac{\text{Hits}}{\text{Atbats}}$$

A batter has 4 hits, out of 10 at bats. What is their batting average?

$$\frac{4}{10} = 0.4 \text{ or } 0.400$$

4 tenths 400 thousandths



A batter has 3 hits, out of 10 at bats. What is their batting average?

$$\frac{3}{10} = 0.3 \text{ or } 0.300$$

3 tenths 300 thousandths



Activity 1

A batter has 24 hits of 100 at bats. What is their batting average?

$$\frac{24}{100} = 0.24 = 0.240$$

24 hundredths 240 thousandths

A batter has 31 hits of 100 at bats. What is their batting average?

$$\frac{31}{100} = 0.31 = 0.310$$

31 hundredths 310 thousandths

Activity 1

Activity 1 - Baseball Cards and Batting Averages

Small Group Activity (Representing Batting Average with Rolling Dice) :

Discuss with youth how to represent a typical or good MLB batting average with a dice rolling activity.

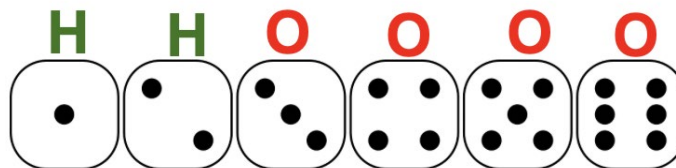
Explain that each time they roll a die, it will count as one AT BAT.

Each number between 1 and 6 will represent either a HIT or an OUT.

Ask youth:

- If we want to represent a typical MLB BATTING AVERAGE, how many numbers should count as HITS?
- What if we said 5 of the numbers were HITS. Would that be a good way to show a typical or a good MLB batting average? (no, this would be a very high batting average, much higher than MLB batting averages)
- What if we said only 1 number was a HIT, and everything else was an OUT. Would that be a good way to show a typical or good MLB batting average? (no, this would be a fairly low batting average $\frac{1}{6}$ or 0.167)

Youth should recognize that since a typical or good MLB batting average is around 0.125-0.300, then selecting 2 numbers as HITS could represent a very good MLB batting average ($\frac{2}{6}$ or 0.333)



- Provide each group with the baseball statistics **Worksheet 1** and a single **die**.
- Ask youth to select two number(s) between 1 and 6 to represent a “hit”. The remaining numbers would result in an “out”. The goal of this activity is for youth to see how often they roll a die and get a “hit”
- Appoint a “**scorer**” for the group and a “**pitcher**”. The “pitcher” will roll the die 10 times. After each roll, the “scorer” will mark if each roll resulted in “hit” or “out” on **Worksheet 1**. Note: suggest that youth rotate rolls as they work, so that each group member has a chance to be a “scorer” and a “pitcher”.
- After 10 rolls, count the number of times the roll turned up “hit” and record the total.
- Youth record the number of “Hits”, out of the 10 rolls, as a *fraction*, as a *decimal*, and as a *percent*

Worksheet 1

Roll #	Hit	Out
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Total		

Record the number of “Hits” as a Fraction: _____

Record the number of “Hits” as a Decimal: _____

Record the number of “Hits” as a Percent: _____

Activity 1 - Baseball Cards and Batting Averages

Provide youth with examples of how they can record the results of their dice rolls in the table on Worksheet 1, and how they can represent the number of hits as a fraction, decimal and percent.

Roll #	Hit	Out
1		X
2		X
3		X
4	X	
5		X
6		X
7	X	
8		X
9		X
10		X
Total	2	8

In this example,
what is your
batting average?

O	O	O	H	O	O	H	O	O	O

Record the number of "Hits" as a Fraction: $\frac{2}{10}$

Record the number of "Hits" as a Decimal: 0.2 or 0.20 or 0.200

Record the number of "Hits" as a Percent: 20%

Activity 1

CLOSURE Reflection:

Wrap up the activity with a reflective discussion about the concepts in the activity and the driving questions for the lesson

- What does a batting average mean? How is it calculated?
- What is considered a "good" batting average in baseball?
- What is a common or typical batting average in baseball?

Activity 1 - Baseball Cards and Batting Averages (Grade 6-8 Extensions)

Whole Group Discussion: (Baseball Cards and Batting Average)

Use the statistics from the **baseball card(s)** to discuss how good a player is based on his batting average (column labeled “AVG” or “BA”). Ask youth to compute the batting average per season using the data in the Hits column (labeled “H”) and At Bats column (labeled “AB”) for your player. Represent the batting average as a fraction, decimal and a percent (For example 144 hits out of a total of 462 hits results in a batting average of $144/462$ (fraction form), or .311 (decimal form), or 31% (percent form).

Discuss the influence of the at bat “AB” value in establishing a useful indicator of the quality of a player. Example with 1 hit and 1 at bat, a player is hitting 1.000. How does that compare to a player that makes 50 hits after 100 at bats?

Discuss short term versus long term averages and *streaks*.

- Does a player’s average vary more at the beginning or end of the season? Why?
- If a player experiences a hitting streak, will it improve his current average more at the beginning, middle, or end of the season?
- For example, one week ago, a player had a season average of 0.300. Since then, he has had 10 “At Bats” and only one hit. Is his current season average higher or lower than 0.300? How many hits would he need to have to keep his 0.300 batting average?

Whole Group Discussion: (Create a Dot Plot)

Create a class dot plot graph where each pair of students represents the number of hits out of 10 rolls (see **Worksheet 2**). Ask students how the horizontal axis of the dot plot should be labelled to capture the range of data. (What is the lowest number of hits per 10 rolls? What about the highest number of hits per 10 rolls?) Ask students to discuss the variability in the data.

- o What is the spread of the data?
- o Where is the center of the data? Is there a cluster in the data? Any outliers?
- o How does the data compare to our predictions about the number of rolls, out of 10, that would be “hits”?
- o If each team of students completed 10 more rolls and noted the number of hits per 10 rolls, how might our graph change?
- How could we compute the AVERAGE number of hits, out of 10 rolls, across all the pairs in the group?

Activity 2 - Learning from Mistakes and Growing our Brains (Growth Mindset)

(20 minutes) Whole Group Discussion

Growth Mindset Connection:

Mistakes are opportunities for learning. When we make a mistake, and we reflect on our mistake, our brains grow. It is good to make mistakes, especially when we are learning new things, or trying challenging tasks, as mistakes help our brains to grow!

Group Discussion:

Discuss with youth the value of mistakes in batting. All players fail to get hits, and this is an important part of the learning process. Even successful batters do not get a hit every time they are at bat. Mistakes are expected. Ask youth to discuss what they think baseball players learn from their mistakes at bat? How are these mistakes opportunities for learning?

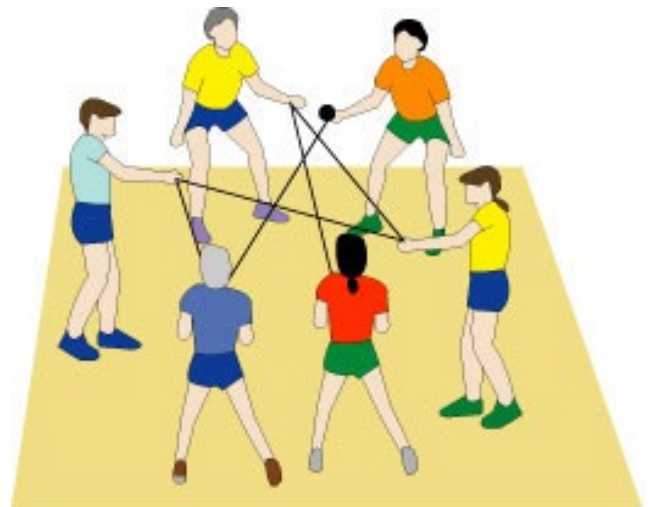
Activity (Small Groups):

Ask youth to stand in a circle with 5 peers. Each youth thinks about a mistake they made in the past week, and what you learned from the mistake. Youth select one member of their group to start with the ball of yarn. That person shares a mistake they made out loud. Then they hold the end of the string, and pass the ball of yarn to another person in the group. (See image below). This person then shares a mistake, holds the string, and passes the ball of yarn to another group member. Youth continue until everyone in their small group has shared at least 2 mistakes.

- Remind youth to hold on to the string before they pass the ball of yarn to the next person in the group.
- Encourage youth to pass the ball of yarn carefully and slowly so that it does not fall.

Group Discussion

Ask youth to share what they notice about the “web of mistakes” that they created. Youth might observe that the web has many crossing lines, or that strings in the web make many connections. Explain that this is exactly what happens in our brain when we make a mistake or when we are learning something new. When we stop and think about our mistakes, our brain makes new connections between ideas.



Activity 2 - Learning from Mistakes and Growing our Brains

Video about Mistakes and our Brain: :

Show the following video about how mistakes help our brains to grow.

Mindset Matters

<https://www.youtube.com/watch?v=9HEgftMEFA>

Ask youth to share what they learned from the video with a partner. Invite several youth to share one idea that they want to remember from the video with the whole group.

Inspirational Video :

Tanner Swanson (00:00:29)

https://www.youtube.com/watch?v=CJNZ2m_CJ8k

- How does failure make you a better baseball player?
- Ask youth to share key ideas from the video.

CLOSURE Reflection:

Wrap up the activity with a reflective discussion about the concepts in the activity and the driving questions for the lesson.

- Thinking about the recent mistake you shared in your small group, what strategies can you use to learn and grow from the mistake?

Worksheet 1- Rolling “Hits” and “Outs”

Round 1: Make a Prediction

Select one number that will result in a hit: _____

How many rolls out of ten will be hits? _____

Roll #	Hit	Out
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Total		

Record the number of “Hits” as a fraction: _____

Record the number of “Hits” as a decimal: _____

Record the number of “Hits” as a percent: _____



Worksheet 2- Class Dot Plot Graph

Grades 68 ONLY

