K20 LEARN

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Soccer & Statistics

Measures of Central Tendency

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Grade Level	6th – 7th Grade	**Time Frame**	2-3 class period(s)
Subject	Mathematics	**Duration**	150 minutes
Course	Middle School Mathematics		

Essential Question

What are measures of central tendency? How are they used by professionals in a sports organization?

Summary

This lesson gives a sneak peak inside a professional athletic organization to see how its employees use statistics to make an impact on their team's play. Students will analyze data related to measures of central tendency and use data to build a fantasy team or make a player trade. By the end of the lesson, students will be able to calculate measures of central tendency (mean, median, and mode) for a set of data, create arguments based on measure of central tendency calculations, and describe how math is used in the work of sports professionals. This lesson includes optional modifications for distance learning. Resources for use in Google Classroom are included.

Snapshot

Engage

Students watch a video where soccer statisticians talk about the use of statistics and data analysis in their work. They create Cognitive Comics to measure their expectations before and after the video.

Explore

Students explore measures of central tendency using data related to soccer players' cleat sizes.

Explain

Students engage in a class discussion about how they analyzed their data sets, learning academic vocabulary for mean, median, and mode.

Extend

Students apply measures of central tendency using real data and statistics from the OKC Energy soccer team. Students are then given the choice in how they use the data: either to create a fantasy soccer team of the best players or to formulate a player trade with another team.

Evaluate

Students pitch their arguments to the OKC Energy soccer team's general manager.

Standards

Oklahoma Academic Standards for Mathematics (Grade 6)

6.D.1.1: Calculate the mean, median, and mode for a set of real-world data.
6.D.1.2: Explain and justify which measure of central tendency (mean, median, or mode) would provide the most descriptive information for a given set of data.

Oklahoma Academic Standards for Mathematics (Grade 6)

7.D.1.1: Design simple experiments, collect data and calculate measures of central tendency (mean, median, and mode) and spread (range). Use these quantities to draw conclusions about the data collected and make predictions.

Attachments

- Cognitive Comics—Soccer & Statistics - Spanish.docx
- Cognitive Comics—Soccer & Statistics - Spanish.pdf
- Cognitive Comics—Soccer & Statistics.docx
- Cognitive Comics—Soccer & Statistics.pdf
- Lesson Slides—Soccer & Statistics.pptx
- OKC Energy Player Statistics—Soccer & Statistics - Spanish.docx
- OKC Energy Player Statistics—Soccer & Statistics - Spanish.pdf
- OKC Energy Player Statistics—Soccer & Statistics.docx
- OKC Energy Player Statistics—Soccer & Statistics.pdf
- Pitch Rubric—Soccer & Statistics - Spanish.docx
- Pitch Rubric—Soccer & Statistics - Spanish.pdf
- Pitch Rubric—Soccer & Statistics.docx
- Pitch Rubric—Soccer & Statistics.pdf
- Scatterplot for Pre-Algebra Extension—Soccer & Statistics - Spanish.docx
- Scatterplot for Pre-Algebra Extension—Soccer & Statistics - Spanish.pdf
- Scatterplot for Pre-Algebra Extension—Soccer & Statistics.docx
- Scatterplot for Pre-Algebra Extension—Soccer & Statistics.pdf
- What Is Your Cleat Size—Soccer & Statistics - Spanish.docx
- What Is Your Cleat Size—Soccer & Statistics - Spanish.pdf
- What Is Your Cleat Size—Soccer & Statistics.docx
- What Is Your Cleat Size—Soccer & Statistics.pdf

Materials

- Lesson Slides (attached)
- Cognitive Comics handout (attached; one per student)
- OKC Energy Player Statistics handout (attached; one per student)
- Scatterplot for Pre-Algebra Extension handout (optional; attached; one per student)
- "What Is Your Cleat Size?" handout (attached; one per student)
- Pitch Rubric (attached; one per student)

Engage

Use the attached **Lesson Slides** to guide the lesson. Begin with **slide 3** and introduce the essential questions to students: *What are measures of central tendency?* and How are they used by sports organization professionals? Consider also sharing the lesson objectives on **slide 4.**

Move to slide 5. Hand each student a copy of the attached Cognitive Comics handout. Using the Cognitive Comics instructional strategy, ask the students to draw a picture that illustrates the career of a member of a soccer organization in the "Before" column.

Now, invite students to watch a video about a lesser-known soccer career: the soccer statistician. Individuals in this career work with statistics and analyze data to help managers and coaches make decisions that impact the soccer team. Move to slide 6 to watch the video using the link on the slide. The video is also embedded below and linked in the Resources section of this lesson.

Embedded video

https://www.youtube.com/watch?v=GyN-qpVfOWA

After viewing the video, move to **slide 7.** Ask students to draw another picture work on the right side of the Cognitive Comics handout. This time, the picture should illustrate the job description of the statisticians they saw in the video. Use this opportunity to draw attention to the fact that there are individuals besides athletes who are important to a sports organization's success.

Optional Modification For Distance Learning

To make use of the above activity in an online or distance learning environment, consider creating multiple copies (one for each student) of the attached Cognitive Comics handout using Google Docs. Students can add pictures from the web or create a drawing using the Google Draw feature found in the "Insert" column. Download all attachments to use this lesson in Google Classroom.

Explore

Go to **slide 8**. To help students begin exploring the idea that a soccer organization relies on more than just the soccer players themselves, pose the following scenario: “Equipment is a big part of the game, particularly soccer cleats. Shoes must fit correctly in order for players to perform at their best. It is your job as the equipment manager of a fantasy team to order a new player’s shoes. The new player is not responding to your emails, text messages, or phone calls, so you have to order his cleats without knowing his shoe size.”

Go to **slide 9** and give each student a copy of the attached "What Is Your Cleat Size?" handout. Invite students to work with an Elbow Partner to explore the data on the handout and answer the guiding questions.

Teacher's Note: Academic Vocabulary

As they explore the data, students might be analyzing the numbers using methods of central tendency (mean, median, and mode). However, at this point, **don't** use these terms or tell students that these are the methods they are (or should be) using. We'll get to that in the Explain section.

Optional: Pre-Algebra Extension

If you teach pre-algebra, you can also hand out copies of the attached Scatterplot for Pre-Algebra Extension handout. While the students are analyzing the data, have them create a scatter plot of the data points from the "What is Your Cleat Size?" handout.

Optional Modification For Distance Learning

To make use of the above activity in an online or distance learning environment, consider creating multiple copies of the attached What is Your Cleat Size? handout using Google Docs. Assign three students to each copy of the handout and have them collaborate virtually. Students can add notes to the document and collaborate as a group using the "chat" feature in the document. Download all attachments to use this lesson in Google Classroom.

Explain

Once students have calculated their findings and answered the questions on the "What is Your Cleat Size?" handout, move to **slide 10**. Ask students to find another elbow partner and explain to their new partners the reasoning behind their answers.

After this discussion, bring students back together for a whole-class discussion. Move to **slide 11** to display the last question from the handout: "*Is there something else we can do to find a shoe size that would represent all the numbers*?" Solicit a few answers from the class. Click the slide to introduce the mathematical term "mean," which is another way to represent the data set. Click the slide again to reveal the definition of "mean." Tell the students that when we found the average shoe size, we were finding the mean of the data. Together, calculate the mean shoe size of the fantasy players.

Is My Mean Really A Shoe Size?

Address with the class that, although the answer that they calculated in this example should have been 11.5, which is an actual shoe size, that might not be true with all data sets. If they had calculated a mean such as 11.2, they would have needed to round (down to 11 or up to 11.5) to an actual shoe size.

Move to slide 12 and display question 2: "*What shoe size do you think is right in the middle of the biggest and smallest?*" From that question, as a whole group, create a definition of median. Then, create a process for finding the median in a data set. Once you have a definition and process in place, ask the students what they found to be the median shoe size of the fantasy team.

Go to slide 13 and display question 1: "*What do you think is the most common shoe size among the fantasy players?*" From the question, create a definition of mode. Then, create a process for finding the mode in a data set. Once you have a definition and process in place, ask the students what they found to be the mode shoe size of the fantasy team.

Sample Student Responses

Address with the class that, although the median and mode for this data set both happen to be 12, the median and mode are independent of one another and won't always be the same.

Optional: Pre-Algebra Extension

Slides 14, 15, and 16 can be used to continue the earlier extension of the lesson for classes learning pre-algebra. These slides are hidden by default, but they can be made active by right-clicking each slide in the left pane and clearing the Hide Slide selection. If you teach with these slides, begin by moving to slide 14**.** Have students retrieve their Scatterplot for Pre-Algebra Extension handouts from the Explore phase. Show students how to create a line of best fit for the data points on the slide. Talk about different parts of the graph, such as outliers. Then, move to slide 15, and invite students to pick two points on their best-fit line to create an equation for the line. Have a few students share out their equations. Discuss similarities and differences that the students identify. Move to slide 16 and use the questions on the slide to discuss how deleting and inserting points affects the mean, median, and mode. Include the questions on the slides: "What happens if you delete the outlier? How does that affect the data?" and "What happens if you insert two more points that are near the rest? How does that affect the data?"

Optional Modification For Distance Learning

If working in an online or distance learning environment, you may choose to facilitate the discussion in the above activity with your class using a video conferencing application like Zoom. This way, you can show students the lesson slides using screen share and the annotate feature. Download all attachments to use this lesson in Google Classroom.

Extend

Move to slide 17. Hand each student a copy of the attached **OKC Energy Player Statistics** handout. Invite students to answer the questions in the Pre-Game section of the handout. Allow time for students to do so.

Teacher's Note: Make It Your Own

Feel free to use the data set we've provided in the handout, or use it as a model to create your own data set using the latest season's statistics or your favorite team's statistics.

Ask students to look at the Game Time section. Have students each find a statistic of their choice from the chart on the first page of the handout, and then ask them to calculate the mean, median, and mode for that statistic. Allow a few minutes for students to perform the calculations.

Using the statistic that they selected from the Game Time section, have students use the Tweet Up strategy to create a tweet about their calculations in the Post-Game section that includes a hashtag about the main point of the lesson. Ask students to share their tweets with their elbow partners, and then ask for volunteers to share their tweets with the whole class.

Optional Modification For Distance Learning

For an online or distance learning environment, consider assigning the OKC Energy Player Statistics handout to students using Google Docs. Then, students can create their tweets on a digital poster using a site such as VoiceThread. With VoiceThread, you can upload students' posters to the site beforehand. Then, students can choose whether they would like to make a quick video, a voice memo, or a written note to give feedback on other students' tweets. Download all attachments to use this lesson in Google Classroom.

Evaluate

Move to **slide 18**. The next activity involves two evaluation options for students: 1) creating their own fantasy team of players for the OKC Energy soccer team, or 2) making an argument centered on trading a player with another team based on player statistics. Both options are detailed below.

Option 1: Building A Team

Have students examine the player statistics on the first page of the OKC Energy Player Statistics handout. Each student should select 11 players from the team's roster of 22 whom they feel would make the best starting lineup based on player statistics. Have students use those statistics to formulate an argument for why they chose their lineup.

Option 2: Trading A Player

Have students examine the player statistics on the first page of the OKC Energy Player Statistics handout, and then formulate an argument for a player trade with another team based on player statistics. This option requires that students research which team to make a trade with. The trade must be with a player from a team in the same league and should be justifiable by comparing the two players' statistics from the most recent season. Students who choose this option need access to a device with internet access to complete the research. The USL Championship website is a great place for students to access information about the OKC Energy and other teams in the United Soccer League.

Give students the Pitch Rubric handout. Have students develop a pitch to present their formulated arguments to the team's general manager. To develop and present their pitch, students can use a format of their choice, such as PowerPoint, Google Slides, or Prezi. Or, to streamline the pitch process, consider having students prepare an Elevator Speech. The pitch should include all of the following:

- The 11-player lineup chosen (for option 1), **or** the recommended player trade (for option 2).
- The data used to make these choices.
- The rationale behind these choices.

Allow time for students to present their pitches to the class, and then use the rubric to evaluate their work.

Optional Modification For Distance Learning

For an online or distance learning environment, you may choose to facilitate the class discussion in this activity with a video conferencing application like Zoom. Students can use the screen share feature to deliver the presentation they've created using Google Slides. Download all attachments to use this lesson in Google Classroom.

Resources

- K20 Center. (n.d.). Cognitive Comics. Strategies. https://learn.k20center.ou.edu/strategy/fe96d3de46cfdc1f385aab7e7500a422
- K20 Center. (n.d.). Elbow Partners. Strategies. https://learn.k20center.ou.edu/strategy/ccc07ea2d6099763c2dbc9d05b00c4b4
- K20 Center. (n.d.). Elevator Speech. Strategies. https://learn.k20center.ou.edu/strategy/4787a0baaee3a5bf7e3e8444ee0050e7
- K20 Center. (n.d.). Tweet Up. Strategies. https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f505fb94
- (n.d.). OKC Energy FC Standings. United Soccer League. https://www.uslchampionship.com/okc-energy-fc-standings USL Championship. (2020). https://www.uslchampionship.com/okc-energy-fc-standings
- Numberphile. (2013, March 21). Statistics on match day - Numberphile [Video]. YouTube. https://www.youtube.com/watch?v=GyN-qpVfOWA
- OKC Energy FC. (2019). Player statistics and USL standings. Sports Engine, Inc. https://www.energyfc.com/stats-standings