6th Grade Math

Unit 14: Data analysis

This unit is all about data: how to collect it, organize it, and interpret it. These skills are essential in our data-driven world and apply to many fields beyond math.

- Create and interpret visual representations of data such as dot plots, histograms, frequency tables, and stem and leaf plots
- Calculate the mean, median, range, and interquartile range of a set of data
- Create and interpret box plots
- Describe the shape of a distribution from histograms and box plots
- Create a two-way table from a set of data as well as two-way frequency tables

<table>
<thead>
<tr>
<th>TEKS standards</th>
<th>Common misconceptions</th>
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</thead>
<tbody>
<tr>
<td>6.12A: Represent numeric data graphically, including dot plots, stem-and-leaf plots, histograms, and box plots</td>
<td>“The height of a dot in a dot plot represents the frequency”</td>
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<tr>
<td>6.12B: Use the graphical representation of numeric data to describe the center, spread, and shape of the data distribution</td>
<td>How to help: When making dot plots, it is important that the dots align both horizontally and vertically. Neatness is crucial. Students can make dot plots on lined paper or graph paper to help keep the dots aligned. Be sure to review with students that it is the number of dots that matters, not necessarily their placement.</td>
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<tr>
<td>6.12C: Summarize numeric data with numerical summaries, including the mean and median (measures of center) and the range and interquartile range</td>
<td>Confusion over what “buckets” or “bins” on a histogram represent</td>
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<td></td>
<td>How to help: Do examples with students and have them organize the data into “buckets” to see how it’s done. The problems in this unit generally put data in buckets of size 10 (0-9, 10-19, etc.) because those numbers are a bit easier to work with and more intuitive for students.</td>
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</table>
“The “stem” and “leaf” are arbitrary” | In stem and leaf plots, the stems and leaves are carefully chosen to best represent the data. It can be confusing and take time for students to understand how a stem and leaf plot works and that they do need to pay attention to which numbers are stems and which are leaves - and to look at the key for information!

How to help: Often, and for all the stem and leaf plots in this unit, the stem represents the tens place and the leaf represents the ones place of the data point. For example, a stem of 2 and a leaf of 3 represents the number 23. In general, the leaf will represent the right-most digit of the number. Students will need extra practice reading stem and leaf plots since they haven’t seen anything like this before. Have students make a stem and leaf plot given a set of data, as well as write out the set of data from a stem and leaf plot. Practice is important here.

“If there’s an even number of data points, you can’t find the median” | The median can be found for any set of data, no matter the number of points. When there are an even number of points and there is no “middle” number, students must find the mean of the two middle numbers.

How to help: Go over examples with students using data sets with both odd and even numbers of points. Students will see that they can always find a median. If they are still unsure, ask them to create a set of data where they think there is no median and then find the median together.
Unit resources

- For lesson 3 and beyond, use this Making histograms workspace to help students organize data and make a frequency table in preparation for making their histogram.
- For lesson 8, students can use the Two-way tables workspace for the first exercise and this Two-way frequency tables workspace for the second exercise.
- For the videos in this unit, use the Learning summary video notetaking guide.
- For the articles in this unit, use the Article notetaking guide.
- For the exercises in this unit, use the Blank workspace template.
- To record key terms and information, use the Vocabulary and notation notetaker.

Lesson overview

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<th>Lesson</th>
<th>Objective</th>
<th>Teaching tips</th>
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</table>
| Lesson 1: Statistical questions | Students will be able to determine whether questions are statistical or not and why. | ● This lesson introduces the definitions of statistics and variability. Students will need to spend time thinking about each question and what data would be needed to answer it.  
● Students can make up their own questions and have their peers determine whether they are statistical or not. Not all questions have a clear answer, so be prepared for a lively discussion!  
● See key vocabulary below in “Best practices.” |
| TEKS standard: 6.13B | | |
| Video | Article | Exercise |
| 1 | 0 | 1 |

| Lesson 2: Dot plots & frequency tables | Students will be able to create and interpret dot plots and frequency tables given a set of data. | ● The big idea of this lesson is that there are many ways to represent data. Students are introduced to tables, histograms, dotplots, and lists but will focus on dot plots and frequency tables in this lesson.  
● In the last exercise, students will be asked to find the total number of data points given a frequency table or dot plot. This may be intuitive for some students, but other students will need a hint to add up the frequency column in a table or the heights of each bar in a histogram. |
| TEKS standard: 6.12A, 6.13A | | |
| Video | Article | Exercise |
| 2 | 0 | 2 |

| Lesson 3: Histograms & stem and leaf plots | Students will be able to create and interpret histograms.  
Students will be able to interpret stem plots. | ● Students will be creating their own histograms given a list of data. They will need to make a frequency table first. Use this Making histograms workspace for the exercises. You can give them extra practice by providing them with additional |
| TEKS standard: 6.12A, 6.13A | | |
| Video | Article | Exercise |
| | | |
### Lesson 4: Mean and median

**TEKS standard:** 6.12B, 6.12C, 6.12D

Students will be able to calculate the mean of a set of data from tables, lists, and dot plots.

Students will be able to calculate the median of a set of data from tables, histograms, dot plots, and lists.

- In this lesson, students are introduced to the mean, median, and mode (though they won’t be asked to find the mode) of a data set. They will be asked to find the mean and median of data sets given in various forms (lists, tables, etc.). Students may struggle with some forms more than others so be sure that they have ample practice with all forms.

- Students may confuse the mean and median at the beginning. Having a reminder on the board or on a poster can be helpful. For median, point out to students that it is like the word “medium,” which is in the middle, just like the median. Show students examples of skewed data sets with different means and medians and discuss how skewing impacts the mean and median.

- Students will benefit from calculators - they are usually available in the exercises but it might be helpful to have them available at all times.

### Lesson 5: Interquartile range (IQR)

**TEKS standard:** 6.12B, 6.12C

Students will be able to find the IQR given a set of data.

- When students find the IQR, there are a lot of steps! Make sure to review them with students (they are in the article) and have them either take notes or post them in your classroom.

- The IQR can seem confusing and time consuming, but students are really just finding a median three times to find Q1, the median, and Q3—and breaking the data up into four equal-sized groups. Then, they find the range of the middle half of data by subtracting Q1 from Q3. They will need to be...
### Lesson 6: Box plots

**TEKS standard:** 6.12A, 6.13A

Students will be able to create and interpret box plots.

- Students will continue to use the first few steps from finding the IQR in order to find the five number summary to make box plots. If they struggled with this in the last lesson, they’ll be able to get more practice here.
- Students will need to be able to interpret and create their own box plots. Because box plots have so many parts, students may need more time to practice making them.

### Lesson 7: Shape of data distribution

**TEKS standard:** 6.12B

Students will be able to describe the shape of a distribution from histograms and box plots as right-skewed, left-skewed, or approximately symmetric.

- This lesson asks students to interpret data from histograms, box plots, and dot plots to describe the patterns they see. It will be important for students to spend time reading and understanding each graph before answering questions about it.
- Remind students that they are looking for overall patterns in the data, like a summary. It can be challenging for some students to remember to look at the big picture.

### Lesson 8: Two-way tables

**TEKS standard:** 6.12D

Students will be able to create two-way tables from Venn diagrams and information in word problems.

- This lesson is different from previous lessons in this unit because now each data point has two pieces of information tied to it. Additionally, we are working with binary questions, where each question only has two choices. For example, each person may be asked whether they play a musical instrument (yes/no) and whether they play a sport (yes/no).
- Two-way frequency tables are just like two-way tables but they include the percent instead of the count. The problem must provide which variable is considered the “whole.”
- Students can use the Two-way tables workspace for the first exercise and this Two-way frequency tables workspace for the second exercise.

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**TRY THIS WITH YOUR STUDENTS**
Best practices

So many options!
Students will see many different ways to display data in this unit—some will be familiar and some will be new. It will be helpful for students to have the different displays and important vocabulary posted somewhere easily accessible.

<table>
<thead>
<tr>
<th>Ways to display data</th>
<th>Ways to describe data</th>
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<tr>
<td>List</td>
<td>Variability</td>
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<tr>
<td>Dot plot</td>
<td>Mean</td>
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<td>Frequency table</td>
<td>Median</td>
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<td>Stem plot</td>
<td>IQR</td>
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<td>Histogram</td>
<td>Shape: Right-skewed,</td>
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<tr>
<td>Stem and leaf plot</td>
<td>left-skewed, symmetric</td>
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<td>Box plot</td>
<td>Peaks</td>
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<td>Two-way table</td>
<td>Gaps</td>
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<tr>
<td>Two-way frequency table</td>
<td>Clusters</td>
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</tbody>
</table>

Students will likely find stem and leaf plots and box plots the most challenging displays as they may have the least experience with them and they appear the most complicated. Two-way tables require logical thinking and reasoning, and that can also be challenging for students. Provide clear methods to create each display and allow them plenty of practice.

CLASSROOM ACTIVITIES

Bring dot plots to life!
Make a dot plot from student data. Choose a topic like height, shoe size, preferred time to wake up on the weekend, etc. (when choosing a topic, make sure that whatever you choose won’t make any students uncomfortable). Collect an answer from each student, who will be one “dot” on the dot plot. Create buckets based on the collected data and write the buckets on labels across the wall or board. Have students line up in front of the bucket that represents them, spreading out evenly to align with others in their bucket and also other horizontal “dots.” Students can create a real-life dot plot! Take a picture!

Student-led data collection
Have students choose a statistical question they want to answer and let them collect their own data. This is a great opportunity for student agency and curiosity. **Pro tip:** Before students begin collecting data, you should vet their proposed questions to ensure they are feasible to investigate. Give a minimum number of data points, say 10-20, and have them create a display (or many!) from their data. Once their displays are complete, they can describe their data using the terms they learned. Have students create posters and/or give presentations.
GENERAL CLASSROOM IMPLEMENTATION RESOURCES:

- **Weekly Khan Academy quick planning guide**: Use this template to plan your week using Khan Academy.

- **Using Khan Academy in the classroom**: Learn teaching techniques and strategies to support your students and save time with Khan Academy.

- **Differentiation strategies for the classroom**: Discover strategies to support the learning of all students.