Grade 7 Math · Lesson 9 — The Valley Report

Samples, Inferences and Measures of Center · ages 11 to 14 · 45 minutes · the workbook, one screen, this page, a pencil and paper

At a Glance

- **The book:** 7th Grade Math Workbook: Real-World Problem Solving, Chapter 9 (The Wildlife Biologist), by Dr. Gene A Constant.
- **Free tool:** Statistics Skeptic (how numbers can mislead, as a game), free, no login, plays in the browser: globalsovereignuniversity.org/statistics-skeptic.
- **Free class:** Lesson 9 of the free Grade 7 Mathematics class: globalsovereignuniversity.org/grade-7-math-class#lesson-9.
- **Ages and time:** Grade 7 · ages 11 to 14 · 45 minutes.
- **Prep (5 min):** read the Teaching Creed and have the workbook open to Chapter 9. Write down the ages of everyone at the table on a sheet of paper.

Why this lesson

Every news story, poll and report is built on a sample and an average. A child who can spot a biased sample and choose the right measure of center is hard to fool.

What the learner will be able to do

- Tell a random sample from a biased one
- Use a sample to make an inference about a population
- Find the mean, median, mode and range
- Spot an outlier and explain its effect
- Choose the measure of center that tells the truest story

The 45-Minute Climb

How to read this: the gold box in each step is your lesson, word for word. Run it as written. The notes beneath are optional support. "The group" means your family; "host" means you.

1 · The Hook (5 min)

"Write down the ages of everyone at your table. Now add one 90-year-old. What happens to the mean? What happens to the middle number?"

Say it like this: let your child do it with real objects if you can, then ask how they know their answer is right before you check it.

2 · Work It Together (15 min)

Open the workbook to the worked example Estimating Sick Trees (Section 9.2) together: A biologist checks 40 trees chosen at random from a forest of 2,000. Six have a fungus. Find the sample rate: 6 ÷ 40 = 0.15, or 15%. Apply it to the whole forest: 0.15 × 2,000 = 300. About 300 trees probably have the fungus. Then read Which Average Tells the Truth? (Section 9.3) together: Fish counted at a dam over 7 days: 45, 42, 48, 12, 46, 50, 44. The 12 was a day the counter jammed. Mean: 287 ÷ 7 = 41. In order: 12, 42, 44, 45, 46, 48, 50. Median: 45. The jam pulls the mean down. The median, 45, better describes a typical day.

Read each step aloud and let your child say the next step before you read it. Then play one round of Statistics Skeptic.

3 · The Talk (8 min)

1. What makes a sample fair? 2. Why does one very large or small number change the mean so much? 3. How can a small sample tell you about a whole forest or lake?

You are not fishing for one right answer. You are listening for understanding:

- Q1: Every member of the whole group has an equal chance of being picked.
- Q2: The mean adds every value, so one far-off number pulls the total and the average toward it. The median only looks at the middle.
- Q3: If the sample is random, its rate is a good guess for the whole group, so you scale it up with a proportion.

4 · Solo Climb (12 min)

Five problems on your own, with your work shown.
1. To choose the next project, the office draws 40 names from a box holding all 400 volunteers' names. Biased or unbiased?
2. Of 60 trail cameras tested, 15 have weak batteries. The office owns 1,200 cameras. About how many have weak batteries?
3. Hourly bird counts at a feeder: 14, 28, 8, 35, 12. What is the range? Is the count steady?
4. Boot sizes for new volunteers: 9, 10, 10, 11, 9, 10, 12, 10, 8. What is the mode? Why is it more useful than the mean here?
5. Of 15 beetles caught in a trap, 6 are an invasive species. The valley has about 80 trapped beetles a night. About how many are invasive?

Why solo: a test, a job and real life ask you to work alone. Five problems rehearse exactly that. The answers are at the end of this plan.

Keep It Fresh (5 min, the next day)

Two review problems from the book's Extra Practice.
1. A box is 5 by 5 by 5 inches. Find its volume and surface area.
2. A can has a radius of 3 cm and a height of 10 cm. Find its volume.

Ready to move on? Four of the five Solo Climb problems right, with work shown, means this skill is solid. If not, reread the worked examples together and try two more problems from the chapter before the next lesson. Short review of old skills keeps them from fading.

5 · The Takeaway (5 min)

"A fair sample is a random one. When one value is far off, the median tells the truer story." · Homework: Run a fair survey of your own: ask a random sample of family or friends one question, then decide what your result says about everyone you did not ask.

The badge moment: finishing all five steps earns the Bronze ring of this lesson's badge, The Fair Counter. Mark it on the Climber's Passport now; the homework is how Silver and Gold are earned during the week.

Common Mistakes to Watch For

- Trusting a sample that was not chosen at random.
- Using the mean when one outlier pulls it far away from the typical value.
- Forgetting to put the numbers in order before finding the median.

The Teaching Creed

You are not the expert; the book and the method are. Your job is to ask "how do you know?" one more time than feels natural, and to celebrate wrong answers out loud. In here, a wrong answer is where the lesson lives.

GENO, GSU's free tutor, can explain any step a second way, any hour, in 83 languages, with no login: globalsovereignuniversity.org/free-tutor. A prompt for the host: Ask GENO: "My child does not see why one strange number changes the mean so much. Help them try it with real numbers, without giving the answer."

Adapt It and Measure It

Differentiation

- Struggling: put every data set in order on paper before finding the median.
- Ahead: run a small fair survey of family or friends and report the result.
- Large co-op: each team collects a different sample of the same question and the group compares results.
- Reluctant: let the child collect data on something they care about, such as game scores.

Evidence of learning (no exam)

Look for three things. Tried: finished all five Solo Climb problems with work shown. Noticed: can name the mistake in Common Mistakes that they almost made. Changed: the next day, solves one new problem from the same chapter without help. Those three words are the whole rubric, and they match the badge tiers below.

Gamify It — The Campus Climb

Every GSU lesson is one badge on the Climber's Passport, earned at four depths: Bronze, Silver, Gold and Platinum.

LESSON 9 BADGE — The Fair Counter · Bronze — The Climb: finished the 45-minute lesson, all five steps. · Silver — The Try: did the homework and explained it to the host. · Gold — The Proof: completed the chapter's Action Report in the workbook with every answer checked against the Answer Key. · Platinum — The Teacher: ran this lesson as host for someone else. The harvest of a teacher is teachers.

Answers for the Host

1. Unbiased. Every volunteer had an equal chance
2. About 300 (15/60 = ¼; ¼ × 1,200)
3. Range 27 (35 − 8); no, it swings widely
4. Mode 10. The office needs to know which size to order most of; a mean like 9.9 is not a real boot size
5. About 32 (6/15 = x/80)

Keep It Fresh: 1. 125 cubic inches; 150 square inches · 2. 282.6 cubic cm

Every answer above comes from the workbook's own Answer Key. The book behind this lesson: 7th Grade Math Workbook: Real-World Problem Solving, Chapter 9 (The Wildlife Biologist).

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