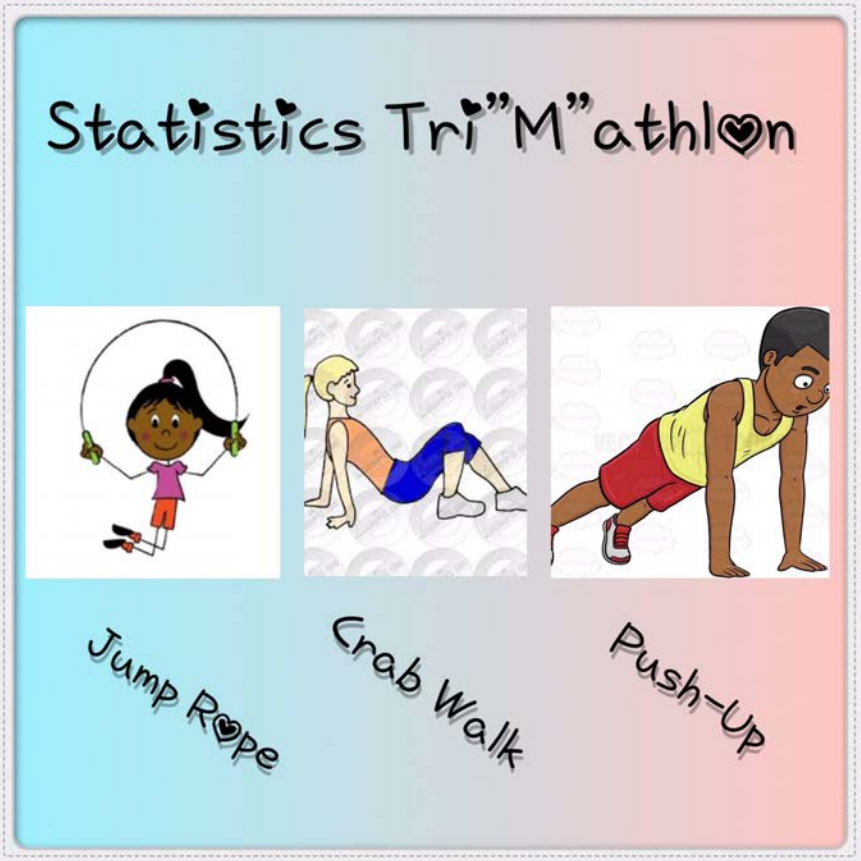
MOMATH

NATIONAL MUSEUM OF MATHEMATICS

# THE 2018 ROSENTHAL PRIZE

## *for Innovation in Math Teaching*




## Mrs. Dwaynea (Golden) Griffin

## 6th Grade

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# Overview

In this lesson, students will perform three forms of exercises like in a triathlon in order to collect and analyze data. The forms of exercises they will be performing includes crab walking, push-ups, and jumping rope.

# Prerequisite Knowledge

In order for students to be successful in this lesson students must be able to do the following: analyzing patterns and seeing relationships; fluency with operations on multi-digit numbers and decimals.

# Lesson Goals

- Recognize that statistical questions and the answers account for variability in the data.
- Collect and analyze data their own data.
- Calculate measures of central tendency and variability.
- Display data using dot plots, box plots, and histograms.

# Assessment

Throughout the lesson, students will complete the attached Statistics Tri "M"athlon handouts collecting, analyzing and displaying their data from each exercise

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# Georgia Standards of Excellence

Develop understanding of statistical variability.

MGSE6.SP.1. Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.

MGSE6.SP.2. Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.

MGSE6.SP.3 Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number. Summarize and describe distributions.

MGSE6.SP.4. Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

MGSE6.SP.5 Summarize numerical data sets in relation to their context, such as by:

a. Reporting the number of observations.

b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range).

d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data was gathered.

# Statistics Tri "M"athlon Activity

| **Length of Lesson:**<br>2-3 class periods<br>(50-60 minutes each) | **Materials:**<br><br>● Statistics Tri "M"athlon Handouts<br>● Pencils<br>● Calculators (optional/class set)<br>● Jump Rope (1)<br>● Timers (2) |
|---|---|
| **Length of Prep Time:**<br>Day 1 10 minutes<br>Day 2 5 minutes<br>Day 3 5 minutes (if needed) | |

# Lesson: Day 1-3 Data Collection & Analysis

**Setting up the Lesson - Day 1**

1. Have each exercise station set up in the room with ample amount of space to perform the activity.
2. All materials needed for each station should also be in place already.
3. Have students already group (6-8 students depending on class size)and assigned to a starting exercise station. (Cooperative groups should have already been in place and students should already know what duties must be assigned to group members).

**Teaching the Lesson - Day 1**

1. Warm-Up/Engagement: 3-5 minutes
    - Introduce the lesson for the day which is Statistics Tri "M"athlon and the types of exercises they will be doing in order to collect their data.
    - Have on some exercising music and have the students stand up and stretch to prepare their bodies for a workout mentally and physically.
    - Have a student demonstrate each exercise so students have a visual of what they will be doing.

2. Initial Focus/Hook: 2 minutes
   - Sing Statistics Song (to the tune of *Row, Row, Row Your Boat*)

Mode, mode, mode the most
Average is the mean
Median, median, median, median always in between
(Repeat 2 times)

3. Vocabulary Start-Up: 8-10 minutes
   - After the song is the best time to review with a Q & A the vocabulary/graphs and clear up any misconceptions that the student may have or encounter in the lesson. (box plot, box plot, histogram, frequency table, inter-quartile range, maximum value, mean, measures of center, measures of spread, median, minimum value, mode, numerical data, outlier, range, skewed data, statistical questions, variability, etc.)

4. Direct Instructions: 5 minutes
   - Go over the instructions on the handouts for each exercise station and check for understanding.
5. Exercise Stations: 35 minutes
   - Students should be actively engaged in the lesson and collecting their data to be analyzed by doing their push-ups, crab walking, or jumping rope.
   - The teacher is monitoring and providing assistance to groups/individuals as needed.
6. Closure: 5 minutes
   - Teacher should pick any item from the handout(refer to vocabulary) to ask to each group to check for their understanding of that concept.
   - Discuss how the groups will rotate the next day.
   - Collect each group handout in designated area for easy access the following day.

**Setting up the Lesson - Day 2 (3 if needed)**

Check to see if stations and materials are still in place from the previous day.

**Teaching the Lesson - Day 2 (3 if needed)**

1. Warm-Up/Engagement: 3-5 minutes (for students who may have been absent previous day)
   - Reintroduce the lesson for the day which is Statistics Tri "M"athlon and the types of exercises they will be doing in order to collect their data.
   - Have on some exercising music and have the students stand up and stretch to prepare their bodies for a workout mentally and physically.
   - Have a student demonstrate each exercise so students have a visual of what they will be doing.

2. Initial Focus/Hook: 2 minutes

- Sing Statistics Song (to the tune of *Row, Row, Row Your Boat*)
  Mode, mode, mode the most
  Average is the mean
  Median, median, median, median always in between
  (Repeat 2 times)

(A copy of the vocabulary with the definitions will be available as needed)

4. Direct Instructions: 5 minutes
   - Go over the instructions on the handouts for each exercise station and check for understanding.
5. Exercise Stations: 40 minutes
   - Students should be actively engaged in the lesson and collecting their data to be analyzed by doing their push-ups, crab walking, or jumping rope.
   - The teacher is monitoring and providing assistance to groups/individuals as needed.
6. Closure: 10 minutes
   - Teacher should pick any item from the handout(refer to vocabulary) to ask to each group to check for their understanding of that concept.
   - Have a class discussion sharing each groups findings for each exercise station and compare with each other.
   - Discuss how the groups will rotate the next day (if needed).
   - Collect each group handout in designated area for easy access the following day (if needed)

## Teacher Expectations

The teacher should expect this lesson to have students take ownership of their learning and be actively engaged in all parts of the lesson. The use of workout music to get the students warmed up and singing the catchy statistics song in the beginning of the lesson should grab their attention from the start. The teacher should expect to hear the students communicating mathematically and using their vocabulary throughout the lesson.

## Student Outcomes

Students should conclude this lesson with a deeper understanding of how to collect, analyze and display their own raw data from each exercise in the Statistics Tri "M"athlon lesson. Students should be able to communicate how their data can be described by a single number.

## Lesson Notes and Suggestions

The lesson can be completed in two sessions but to ensure students deep understanding of the content and the data that they collected it is suggested to extend the lesson into three days. This will allow more time to students to analyze their data and compare with other groups within the class.

## Extension

The opportunity to compare data within the class is already available but to take it even further allow students to compare with additional classes as well. Then this will spark another conversation that allows students to see the different reasons why one group or class data varies over another.

## Common Student Missteps

- The mode is not always the highest number (having the most). It is the number or number(s) that occurred/appeared the most in the data set (most frequent).. Sometimes there will be no mode, one mode, or several modes in a data set.
- All calculations should be done more than once to avoid simple computational errors (apply the meaning of the definitions of the vocabulary).
- The mean is not always the best way to describe the data. Outliers can have an affect on the mean this is when the median may be best to use.
- When data is skewed to the left or the right it does not mean that most of the data is on the side. It is the tail of the data that will be on that given side. Skewed should not be confused with clustering.

## Alternate Method of Data Collection

Students may do a modified version of the exercise or group can change to another measurable exercise other than the one suggested (i.e. running a lap, jumping jacks, sit-ups, etc.) Students may also use their iPads to help capture each exercise through video to ensure they are counting or timing correctly. They can slow down the footage to check the accuracy of the data collected.

## Accommodations for Students with Disabilities

- Students may use a calculator to help with the computation (these are not fluency standards but fluency is still essential). Utilizing the calculator still requires understanding of the vocabulary.
- Provide a copy of the vocabulary with the definitions.
- Allow student to review concepts with Virtual Nerd videos.
- Students may do a modified version of the exercise or group can change to another measurable exercise other than the ones suggested (i.e. running/walking a lap, jumping jacks, sit-ups, etc.)
- Teachers can and should adjust the lesson to meet the needs of their students. Students safety and feeling comfortable in the learning environment is the main priority throughout this lesson.
- For students with physical limitations (or those who are less capable physically) please make accommodations/substitutions with sensitivity so they can still feel invested in the lesson as well. This is a great opportunity to

tie in social acceptance of peers along with Math and Physical Education. I recommend the following:

1. Consult with your Adaptive/Physical Education teacher about how to incorporate different physical activities that students with different physical limitations (permanent or temporary) can or cannot engage in for their safety. Also, consult with your school nurse about any health issues outside of physical limitations that can put a student at risk (i.e. asthma, diabetes, allergies, etc.).
    Examples of substitutions but not limited to:
    a. If a student cannot jump rope they may can turn the rope
    b. Instead of push ups they can plank
    c. Dumbbell biceps curl
    d. Arm circles
    e. Basketball shootout
    f. Football throw
    g. Bean bag toss
    h. Student choice board of physical activities
    i.
2. If a student has an IEP or 504 please review those ahead of time with the Special Education teacher to ensure they do not point out specific limitations for that student.

3. Another option for students with limitations is to allow that small group to report to the gym to collect and analyze data from a random selection of students who will complete the three physical activities of the Tri"M"athlon. Allow the co-teacher, paraprofessional, or student leader to guide this group. This can also be pre-arranged with the Physical Education teacher when you consult with them. Bringing in data from students who are possibly in another grade, dressed out in workout clothes, and in a gym setting can lead to further discussions in the classroom when you compare data.

# Additional Resources

Georgia Department of Education, Georgia Standards of Excellence, https://www.georgiastandards.org/Georgia-Standards/Frameworks/6th-Math-Unit-6.pdf

Lesson Pix https://lessonpix.com/quickSearch.php?word=hermit%2Bcrab

Virtual Nerd, Middle School Math, Probability and Statistics, https://virtualnerd.com/middle-math/all/

Name:_____Date:_____Period:_____

# Statistics Tri "M"athlon: Jump Rope, Push-Up, & Crab Walk Handouts

**STATISTICAL QUESTION: Write S for statistical and NS for non-statistical.**

_____1. How many jumps did you make before you made a mistake?

_____2. How many jumps did each student in your group make before they made a mistake?

**DIRECTIONS: Each student in your group must jump rope until they make a mistake that causes them to stop (i.e. rope is tangled, they drop the rope, etc.). You must record each person's jumps in your data set (including yours). Record your data below and determine the measures of center/variability. Give a short description of what each measure represents.**

3. Data Set:_____

4. Order_____

5. Mean:_____

6. Median:_____

7. Mode: _____

8. Range:_____

9. Outlier:_____

10. Q1:_____

11. Q3:_____

12. IQR:_____

13. Which better describes the data, the median or the mean? Explain your answer.

_____

_____

_____

Dot Plot

Box Plot

Frequency Table

Histogram

**STATISTICAL QUESTION: Write S for statistical and NS for non-statistical.**

_____1. How many push-ups can each student do in 60 seconds?

_____2. How many push-ups can you do in 60 seconds?

**DIRECTIONS: Each student in your group must do as many push-ups as they can in 30 seconds. One person must be the timekeeper. You must record each person's amount of push-ups in your data set (including yours). Record your data below and determine the measures of center/variability. Give a short description of what each measure represents.**

3. Data Set: _____

4. Order: _____

5. Mean:_____

6. Median:_____

7. Mode: _____

8. Range:_____

9. Outlier:_____

10. Q1:_____

11. Q3:_____

12. IQR:_____

13. Which better describes the data, the median or the mean? Explain your answer.

_____

_____

_____

Dot Plot

Box Plot

Frequency Table

Histogram

**STATISTICAL QUESTION: Write S for statistical and NS for non-statistical.**

_____1. How long did it take you to crab walk from one room to another?

_____2. How long did it take each student to crab walk from one room to another?

**DIRECTIONS: Each student in your group will crab walk from one cone to the other and back. You must record each person's time (round to the nearest tenths). One person should be the timekeeper. Record your data below and**

**determine the measures of center/variability. Give a short description of what each measure represents.**

3. Data Set: _____

4. Order: _____

5. Mean:_____

6. Median:_____

7. Mode: _____

8. Range:_____

9. Outlier:_____

10. Q1:_____

11. Q3:_____

12. IQR:_____

13. Which better describes the data, the median or the mean? Explain your answer.

_____

_____

_____

Dot Plot

Box Plot

Frequency Table

Histogram