***How Fast Can You Throw? ( 1 hour, 45 minutes )***

**Materials**

* Copies of 1.3 How Fast Can You Throw? Data Collection
* Copies of 1.4 How Fast Can You Throw? Data Analysis
* Copies of 1.5 Are you the Next John Lackey?
* Chalk
* Stop Watches (10)
* 100’ Tape Measure
* Area where kids can throw from 40’ away from a wall or fence
* Rubber Balls (10)
* Calculators (1 per student)

**Standards**

MG 1.1 Compare weights, capacities, geometric measures, times, and temperatures within and between measurement systems (e.g., miles per hour and feet per second, cubic inches to cubic centimeters).

MG 1.3\* Use measures expressed as rates (e.g., speed, density) and measures expressed as products (e.g., person-days) to solve problems; check the units of the solutions; and use dimensional analysis to check the reasonableness of the answer.

SDP 1.1 Know various forms of display for data sets, including a stem-and-leaf plot or box-and-whisker plot; use the forms to display a single set of data or to compare two sets of data.

SDP 1.3\* Understand the meaning of, and be able to compute, the minimum, the lower

quartile, the median, the upper quartile, and the maximum of a data set

**Overview:**

Students will collect data for speeds of throwing a ball with their right and left arms. Students will solve for average speed, create and interpret box and whisker plots, and use dimensional analysis to analyze results.

**Activity Notes:**

Prior to going outside, you need to measure a 40’ distance for a wall where students will be able to throw balls at. Mark the distance for each group using a piece of chalk. (A TA can do this while you are working on 1.1 Adding and Subtracting Integers). Pass out activity sheet 1.3. Put students in groups of three. Each groups needs a stopwatch and a ball. From the 40’ point marked with chalk, **each group member will throw the ball 5 times with the right hand and 5 times with the left hand**. While one group member is throwing, one is retrieving and the other is timing. The timer needs to call out “ready, set, throw.” The thrower should release the ball on the word throw. The timer stops the watch when the ball hits the wall. The retriever gives the ball back and records the time. Repeat this process until each person has 10 times recorded. NOTE: It may be easier to throw the ball *underhand* if a student has a difficult time throwing 40 feet. If a student cannot throw the ball 40 feet, have him/her move up to a point where the ball can reach the wall. Make sure he/she measures the distance and uses that number when calculating average speed.

Once data has been collected, ask each student to calculate the means of their 5 trials. The next section, finding your throwing speed, asks the students to use their average time and distance to solve for their average throwing speed. They are in effect solving the equation *D=RT* for rate, but the formula is not necessary. Make sure the students are aware of the units of this measurement. As they are answering questions 3-5, on the board, make two columns, one for right hand average speed and one for left hand average speed. Have one representative from each team write the average speeds for each group member on the board. **Ask students to round their speeds to the nearest whole number.**

Once all the class data has been brought up, make a stem-and-leaf plot for each set of data. Label the stem as the tens digit and the leaf as the ones digit. (Making the stem-and leaf plot is not essential, but it can be helpful as it gives the students exposure to this standard as well as allows you to put the numbers in order.) Pass out activity sheet 1.4. From the stem-and leaf plot, the students will now make a box-and-whisker plot for the right arm and one for the left arm. You may want to do the right arm together to teach the students how to make a box and whisker plot, and then let them make the left hand one on their own or in their groups.

Once the box and whisker plots are made, discuss vocabulary: box, whisker, mean, and quartile. Have the students answer questions 2-9 from activity sheet 1.4. Give them about 10 minutes for this, and then discuss the answers as a class.

If time allows, continue on to activity sheet 1.5 Are you the next John Lackey?

This part of the activity requires the comparison and conversion of units. Make sure the students are aware of the units being used when comparing their speed to John Lackey’s. Give them the fact that 1 mile equals 5280 feet. Questions 1,3 & 4 require dimensional analysis, so you may want to model one of these for the students.