Lesson Title:	How Strong are you (Mathematically)?
Length of Lesson	2 Days
Created By	Michael Andre Hamilton
Subject	Geometry, Algebra
Grade Level	10^{th}-12^{th} grade
State Standards	Algebra 1: 2 a, d, e, Geometry 2a
DOK Level	DOK 2
DOK Application	Graph, Compare, Estimate Infer, Predict, Interpret, Make Observation, Summarize
National Standards	Problem Solving Skills for 9 – 12^{th} Math Standards
Graduate Research Element	Human Factors and Work Physiology

Student Learning Goal:

State Standards for 9 – 12^{th} Algebra 1

A. Solve, check and graph multi-step linear equations and inequalities in one variable, including rational coefficients in mathematical and real-world situations.
B. Explain and illustrate how a change in one variable may result in a change in another variable and apply to the relationships between independent and dependent variables.
C. Graph and analyze linear functions.

State Standards for 9 – 12^{th} Geometry

A. Represent data from geometric and real-world contexts with expressions

National Standards for 9 -12^{th}: Problem Solving Skills

A: Understand Histograms, Regression plots, and scatter plots and use them to display data.

B: Understand the meaning of measurement data and categorical data, of univariate and bivariate data, and of the term variable

Materials Needed (supplies, hand-outs, resources):

Writing utensils; Notebook paper; White board; 5-lb dumbbells, 25-lb dumbbells, 35-1b dumbbells; Excel; Inspiring Minds; Stopwatches

Lesson Performance Task/Assessment:

The lesson performance task is to give the student's understanding of independent and dependent variable. Interpret the graphs of a histogram, scatter plot, and regression lines in a real world example. They should learn some elementary elements of excel and the components to create a graph. The elementary elements from excel should be how to take data from a worksheet and create a chart. The instructor will create the charts in excel and explain each step to the students.

Lesson Relevance to Performance Task and Students:
It will help the students understand how data is used to infer assumption about populations. The lesson will also teach the student how to take data and create charts and graph that are useful for data analysis.

Anticipatory Set/Capture Interest:
In the class, students will perform lifting dumbbell tasks. The students will separate into the males and females group for the task. They will plot their individual points on a graph, the x-axis is their name and the y-axis is time (in seconds). On the x-axis, the student will write dumbbells levels and on the y-axis they will write time (in seconds). There will be 3 dumbbell levels (15-1b, 25-lb, and 35-lb) which they will hold in different positions until their muscle fatigue. The stopwatch will start when the student holds the position and stops when they can't hold the position. After gathering the data, the instructor will put the data in excel and show the students how to plot a regression line, histogram, scatter plot.

Guided Practice:
Day One:
Instructor will review how the muscle fatigues and how motor units are recruited. PowerPoint will be created showing the different positions for them to hold the dumbbells and how to record the data points. The first position with the 15-lb dumbbells the student will stand with their arms out-reached to their sides. The second experiment with the 25-lb dumbbell the stand with arms out-reached in front of them. The third position is with the 35-lb dumbbell pulled back in a row position. The instructor will get in front of the class and show an example of each position. Students will be placed into groups and the team leader will demonstrate the positions before starting the experiment.

Day Two:
The instructor will input all the data points for the groups of students. After inputs are recorded, the instructor will show the student how to analyze the data and draw conclusions about the different populations.

Independent Practice:

Day One:
The student will perform the experiment task with the different dumbbells and each group will record the data point they gathered.

Day Two:
The students will interact with the instructor during the data analyzed portion for the class. The instructor will ask the student what they think about the data presented and will make a conclusion of the regression data.

Remediation and/or Enrichment:

Remediation:
Individual IEP; partner help throughout lesson; shorten parts of assignment focus on few processes

Enrichment:
The lesson can be expanded to multiple dependent variables and introduce the use of ANOVA capability. Portable EMGs can be used to evaluate the motor units of the muscles and the amplitude of each motor group.

Check(s) for Understanding:
Day 1:

1. What is the difference between independent and dependent variables?
2. What is categorical versus continuous variables?
3. What goes on the x and y axis?

Day 2:

1. What does a scatter graph tell us?
2. What does a histogram tell us?
3. What are the differences between the female and male regression plots?
4. Did you have fun?

Closure:
Day One:
Collect the data points from the student in the class after performing the experiment.

Day Two:
Explain how data collection is used in other situations and its importance in engineering.

Possible Alternate Subject Integrations:
*Human Anatomy- Students could study how the different muscles work and the effect of the motor unit during each task.

Teacher Notes:
None