

Let's Move!

Description

This two day lesson provides an introduction into a unit about Scatter plots and Lines of Best Fit. It is designed for a Math 1 course, but could be modified for other Math or Technology courses as well.

By the end of the unit, the students will have gone through the Engineering Design Process. However, in these introductory lessons, they will not have completed the whole process.

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Lesson Plan Tags

Check the standards that are met in your lesson plan, check all that apply.

☒Middle School ☒High School ☐6th Grade Science ☐7th Grade Science
☐8th Grade Science ☐Middle School Math ☐Middle School CTE

☐Biology ☐Chemistry ☐Physics ☐Energy Harvesting ☐Anatomy
☐Other High School Science ☒High School Math
☐HS Family and Consumer Science ☐HS BFIT ☐HS Marketing & Entrepreneurship
☐Agriculture ☒HS Technology ☐Trade & Industrial ☐Health Science

Introduction

Analytics are everywhere! Businesses use analytics to provide important decisions about customers, location, and many other factors. In fact, grocery stores use their loyalty programs to track customer spending and keep a demographic profile. They even put more expensive items at eye level so that you will be more likely to purchase them!

In this introductory lesson of a unit, students will start to use the Engineering Design Process to decide where Twitter should relocate in North Carolina. In the unit, they will use statistics for three quantitative factors that they research on their own for three different cities in North Carolina. They will use Microsoft Excel to graph the data points, calculate a line of best fit, and a correlation coefficient. They will also have to explain what the slope, y-intercept, and correlation coefficient mean in context for each of the cities. They will also predict the factors out in 5 and 10 years. From there, the unit wraps up with a sales pitch where each group of students comes together to state where Twitter should relocate and why. This sales pitch is supposed to be presented to the Human Resources Department at Twitter.

Curriculum Alignment

This lesson is designed for a Math 1 course, but could be altered for other courses.

Mathematics Common Core State Standards:

Functions:

- F-IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.

- F-IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

Statistics and Probability:

- S-ID.5 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.
- S-ID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models. b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association.

Objectives

By the end of the lesson, students will:

- Determine qualitative and quantitative factors that Twitter or other companies could use to determine where employees would want to live.
- Begin to research the quantitative factors to find enough data points to plot on a graph or in Excel.

Time & Location

2 - 60 minute class periods or 1.5- 90 minute blocks

The first 60 minutes could be in the classroom. The second 60 minutes could be done in the classroom with laptop carts or any device that connects to the internet. You could also make arrangements to go to a computer lab.

Teacher Materials

- [Let's Move Worksheet and Rubrics](#)
- Whiteboard
- Dry Erase Marker
- Classroom set of technology that uses the internet and access to Microsoft Excel (I personally would NOT use Google Sheets)
- Projector (a way to project a computer or laptop)
- Computer/Laptop

Student Materials

- [Let's Move Worksheet and Rubrics](#)
- Writing utensil
- Pencil
- USB Flash Drive
- TI-83 or 84 Plus Graphing Calculators

Safety

Safety in this case would be to remind students of appropriate internet use. The teacher needs to make sure they have completed the [Common Sense internet training](#) prior to this activity. Make sure you have appropriate consequences in place and they are communicated to students. Discussion with administration before doing these lessons is always recommended.

Student Prior Knowledge

Before this lesson, students should have an understanding of Linear Functions, how to find the slope of a line between 2 points, what the y-intercept is, and what the slope and y-intercept mean in a real-life context.

Students also should know the difference between categorical and quantitative data.

Teacher Preparations

Read through the [Let's Move worksheet](#), have an idea of qualitative and quantitative factors a company might use to determine if they should relocate to a city. Also, make sure to reserve a computer lab or laptop carts for these two lessons. If you end up doing the unit, you will most likely need the computers or laptops for about 2 weeks in a row.

Activities

Day 1 of 60 minute period:

- 1. Introduce the idea of the Engineering Design Process (5 minutes)**

The teacher will (TEACHER): Project a picture of the Engineering Design Process. Read through and discuss the various steps.

2. Introduce the Let's Move Project to the students. (5-10 minutes)

TEACHER: Pass out the Let's Move Project worksheets to the students. Then, he or she will read through the document to the students.

The students will (STUDENTS): Follow along, ask questions for clarification if needed.

TEACHER: When explaining the project, make sure students know the next couple of days we will be identifying the problem and brainstorming in order to create a plan. Make sure to explain that the whole unit will be using the Engineering Design Process and that we are starting the beginning stages.

STUDENTS: Follow along, ask questions for clarification if needed.

3. Brainstorming as a class (5-10 minutes)

TEACHER: Facilitate a discussion with the class about what a company will look for when wanting to relocate.

STUDENTS: Participate by raising hands and providing suggestions.

TEACHER: Ask students for whether each of the traits are qualitative or quantitative. Make sure to ask the question, if you are going to graph the data using a scatter plot, does it have to be qualitative or quantitative? (The answer is quantitative in order to get a linear regression or line of best fit for the data)

STUDENTS: Continue to participate in the discussion and take notes if needed.

TEACHER: Let students know that Twitter only wants to locate to a city in North Carolina. Create a list of major cities in North Carolina.

(It might be beneficial to pull up and project a map of North Carolina or borrow a textbook from a colleague)

STUDENTS: Share their ideas of what major cities there are in North Carolina. Once you see that students generally understand what quantitative variables they could research to put on a scatter plot for this project, and they know the major cities in North Carolina, you can move on to the next step.

4. Allow students to make their own groups of 3-4 (5 minutes)

TEACHER: Allow the students to break up into groups of 3-4. Remind students that this is a major assignment and that they should choose to work with people that they like but that they also can get the work done with.

(Giving them choice is an important part of the Engineering Design Process. I would only speak up if you know a group will not work together at all.)

STUDENTS: Find other students to work with in these groups.

***Note: DO NOT ALLOW ANY STUDENTS TO WORK ALONE! There is a lot of work to do on this project and any student I have had that started working alone got way too overwhelmed in the middle of the project.**

5. Start the Research Process. (30 minutes)

TEACHER: Call the students back together to either take them to a computer lab or pass out laptops. Let students know that they need 10 data points, preferably closer to present day, the more accurate for each city for each factor. Also, let them know that each of the three factors has to be the same for each city so that they can be compared.

STUDENTS: Research quantitative factors for their cities. Students will work together to decide what their factors are.

****Sometimes this can take a while. Students might get frustrated because there might not be enough data out there.**

6. Clean-up/Log off (5 minutes)

TEACHER: Ask for student attention and ask for students to either log off computers or to turn in the laptops. The teacher will remind students that if they have not found information for their factors, that it is due by the end of the next class. It is suggested to talk as a group to see what you can find.

STUDENTS: Turn in laptops and/or log off computers. The students will talk with their group about who will look up what information for homework, if needed.

Day 2 of 60 minute period

1. Remind students of task at hand (5-10 minutes)

TEACHER: Remind students that they need to have the same 3 factors for each of the 3 cities due at the end of the period today. They also need 10 years of data for the cities. They can write this on paper in tables.

STUDENTS: Ask questions for further clarification.

2. Research Time (40 minutes)

TEACHER: Make sure the students are in their groups and working by circulating. He or she will also provide suggestions of statistics that can easily be found for cities (population, population density, crime rate (but each group needs to pick the same crime if it is a specific one), literacy rate, median household income, etc.).

STUDENTS: Continue to work and make sure they have 3 different tables for each of their 3 different cities due by the end of the class period.

3. Clean-up, Log off, and Turn (5-10 minutes)

TEACHER: Get the students attention, have the students turn in their tables in a designated area. The teacher can decide to give the students the opportunity to finish it for homework or not.

STUDENTS: Turn in their tables.

TEACHER: Have the students log off their laptops/computer and clean-up any areas.

Assessment

The assessment in this portion is whether or not students get 3 tables of 10 data points or more for the three factors for 3 cities. This is a checkpoint for the unit and helps with the brainstorming part of the Engineering Design Process.

The next steps would be for students to start putting the data into Microsoft Excel to get a scatter plot and linear regression. To see how I have laid out this unit, see here: [Let's Move Project Timeline 2014](#). Feel free to e-mail me with further [questions—apolashock@gmail.com](mailto:apolashock@gmail.com).

Critical Vocabulary

Categorical/qualitative data- data that can be described through categories and not through values (examples: gender, religious preference, favorite color)

Quantitative Data- data that can be expressed as a number (examples: age, number of hours spent studying, mass of an object)

Function- a relation where each input (or x) has exactly one output (or y)

Linear Function- a function that creates a straight line. Most linear functions are in slope-intercept form or $y=mx+b$, where m is the slope and b is the y-intercept.

Correlation Coefficient- the r-value of the linear regression on a scatter plot. The value is between -1 and 1. The closer the value is to -1 or 1, the stronger the correlation it is. If the r-value is negative or positive, that tells you whether there is a positive or negative correlation. If the r-value is close to 0, then there is no correlation between the data.

Interpolation- to estimate a value inside the values given by using a linear regression.

Extrapolation- to estimate a value that is outside the values given by using a linear regression.

Scatter plot- a graph of plotted points that show the relationship between two sets of data.

Rate of Change/Slope- the ratio between the change of one variable over the change of another variable, the measure of the steepness of a line

Y-Intercept- The point where the graph crosses the y or vertical axis.

Comments/Modifications

Please see the [unit guide](#) to see how this can be implemented as a project.

Author Information

In this section, tell us about yourself and your mentor! Include the following:

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