Numbers and Social Problems: Improving Quantitative Literacy

Robert A. Grant II

Introduction

This unit aims to improve quantitative literacy in middle school students. It is heavily based upon the Next Generation Science Standards. Use of technology and collaboration is encouraged throughout the lessons. Once completed students will be able to identify variables, create data tables, and graph data in visually appealing ways. Students will be taught these concepts centered around the story of Dr. Goldberger and the experiment he used to find the cure for the disease Pellagra.

My current placement is at Gunning Bedford Middle School in New Castle, DE. We are part of the Colonial School District. Gunning Bedford (or GB as we call it) has very high standards for its students. Our principal Drew Moffett has often presented our goal as being the top middle school in New Castle County. We have many initiatives that center around the main ideas of increasing rigor and implementing technology into the classroom. Our school served 984 students last year. Our students come from a wide array of backgrounds which provides an interesting mix of students. Students vary on socioeconomic and cultural scales as well as education level. It can be a struggle to meet the differing needs of so many students but our staff is driven and devoted to producing the best students possible.

I teach approximately 120 students each year. My class size often ranges from 25-35 students a class. Sixth grade science is split into four kits. The first kit is called My Body and Me. We normally begin this kit in September and try to finish by December, My Body and Me is split into two parts. The first part is focused on experimental design while the second part discusses how the human body works. I find that the first part of the unit often goes poorly because the curriculum tries to make a weak connection between experimental design and the human body. In my opinion this causes a weakness in this subject matter that affects students as they progress through middle school.

Our students have many strengths. These children have an excellent grasp on technology. They often teach their teachers how certain pieces of technology work. They are creative and can often find new solutions. Social media is a huge part of their world and how they get most of their information. Kids today have a wide array of interests which they can pursue through the internet. The students' enthusiasm towards their passions is often inspiring. They have the advantage of living in a world where all the information they want to know can be found through a click of the mouse. These kids are

also very involved in the community often knowing one another through a club or activity outside of school. They are good at balancing multiple priorities like school, sports, and other activities.

However, these kids do not lack their weaknesses. An alarming number of students in my school lack social skills and cues due to their dependence on technology. Students have trouble having a respectful conversation because they do most of their communicating through technological means. They lack the ability to put details in their answers and often want to take a shortcut. That is where the students' strength of finding new solutions comes in handy. They will often find the easiest solution, sometimes utilizing their strength in technology. What needs to be understood by my students is that the easiest path is not always the best. These children often want instant gratification due to the world in which they have grown up. Whatever they want to know can often be found by a simple Google search. This often leads to students skipping steps and making careless errors in their experiments.

Rationale

"Mr. Grant, What is a variable?" asked a student in my first year teaching. The experimental design unit was going horribly. I bit my tongue but I am sure that my face told a different story. I had taught variables for the past week and felt like I was talking to a brick wall. After another week of trying to teach them the concept I had to move on to keep pace with my other grade level teachers. I hoped that they would understand it later on in the year. Things went smoothly for awhile until I hit the graphing part of the unit. Once again I received the familiar blank stares. "Mr. Grant, I just don't get it," came out of another student's mouth. "God, please get me out of this unit" I remember thinking to myself.

One of the eighth grade teachers and a good friend of mine came up to me at the end of the year. He was reviewing science material from sixth and seventh grade for the big assessment that eighth graders must take. He asked "How do you guys teach experimental design? My kids are just not getting it". I threw up my hands in frustration. He said "Students consistently have scored poorly on that part of the test for years". I felt responsible for holding our students back from their very best.

In the spring I decided to apply for the Delaware Teachers Institute and I was assigned to the Numbers and Social Problems seminar. At one of our first seminar meetings Dr. Joel Best wrote a data table up on the board for our seminar examine. He asked "How do you read this data table from side to side or up and down?" He explained that you would get a different result based on which way you read it. I mean no disrespect to my colleagues but a majority of them had no clue which was the correct way to read it. Even a room full of college educated adults struggled with variables. Dr. Best went on to explain that there had been many instances where professional data tables and graphs had

been printed in national magazines and articles where their variables were mixed up. I had an epiphany that I was not the only one who was struggling to teach this material. This is a nationwide problem and I was determined to find a solution. I wrote this unit in hopes that fewer students will have blank stares when it comes to variables, data tables and graphing.

Wills and Atkinson discuss how table reading is a foundational research skill. They went over a study where twenty percent of students graduating from four-year colleges and thirty percent of students graduating from two-year colleges had only a basic knowledge of quantitative literacy.[5] Quantitative literacy is a student's ability to understand variables, data tables, and graphs. A student with quantitative literacy understands how the data are represented and how this can affect the findings or conclusions drawn from them. These are very important in the fields of policy, business, and education where outcomes are used to claim whether something is working or not. You also need quantitative knowledge to be competitive in college courses as well as the job market.[5] There is a lot at stake on the ability of these kids to master these concepts. It is clear that the education system has dropped the ball on this skill. I think Levine says it best. "The worlds of science, policy, and business are not going to simplify themselves in order to accommodate the deficiencies of the analyst."[6]

Objectives

Personally, there is a need for this unit due to the consistently poor scores in experimental design in our eighth grade assessments. However, this unit could be used throughout any grade to increase quantitative literacy in our world. My unit will address two of the three dimensions of the Next Generation Science Standards.

The first dimension my unit covers is Practices for K-12 Science Classrooms. These are practices that every science class should be using. Students are supposed to develop and use models. Students will satisfy Practice Two: developing and using models by creating data tables and using them to create graphs. They will then address Practice Four by analyzing and interpreting data by analyzing the graphs they have made to discover relationships or patterns. They will also observe patterns that the independent variable has on the dependent variable. In addition, they will use Practice Five of using mathematics and computational thinking when they input numbers into data tables. They will then engage in arguments based on evidence they collect from their graphs which covers Practice Seven of engaging in argument from evidence. Practice Eight is met by obtaining data, evaluating their graphs and communicating this information to the class.[1]

The second dimension my unit covers is the seven crosscutting concepts of the framework. These concepts can be found throughout all core classes that the students will take according to Common Core and Next Generation Science Standards. The first crosscutting concept they will cover is patterns. Students will identify patterns not only

amongst variables but also in their graphs. Cause and effect is another concept that students will explore in my unit. Students will do this when they look at the how the independent variable causes a change in the dependent variable. The final crosscutting concept the unit will cover is scale, proportion, and quantity. The class will consider scale when developing their graph to make appropriate and visually appealing pieces of work.[1]

Content

Variables

A variable is anything you can change in an experiment. A firm understanding of variables is necessary for all parts of experimental design. It is extremely important when it comes to making data tables and graphs. Errors in variables can lead to huge misrepresentations of data and can skew the conclusions you base upon them. Pollard talks about how confusing your variables can lead to mistakes in the correlation you see between variables. Increasing your sample size helps improve your reliability in an experiment. However increasing sample size when there is an error in variables will increase total error in the experiment resulting in a decrease of power in hypothesis testing.[4]

A common student error is not understanding the difference between the three types of variables. The first type of variable is an independent variable. An independent variable is the one and only variable that you change in an experiment. It is very important that you only change one variable because changing more than one makes your experiment invalid. For example, if you tested what effect sunlight has on plant growth the only variable you would change is the sunlight. If you watered one plant more or planted one plant in better soil, you would never know whether the sunlight accounted for the difference in plant growth.

The second type of variable is a dependent variable. A dependent variable is the variable that you measure or observe in an experiment. If we use our plant example from the previous paragraph, the dependent variable would be the growth of the plant. It is dependent on the independent variable which explains its name. It is also important that you introduce the term sample size during this part of the unit. Sample size refers to the number of cases you observe. Increasing the number of subjects tested increases reliability in that data and creates a more powerful conclusion.

A common error that students make is they don't measure the dependent variable consistently. We discussed this is in seminar when we talked about the trouble with collecting data across time. You have to make sure that you are measuring the same thing and that your data are comparable from time to time. The example of sexual assault came up. The definition of sexual assault has evolved over time and changed what the term means. We discussed that California recently established the yes-means-yes rule: in

order to engage in a sexual act you and your partner must both agree to it by saying yes. If this doesn't take place then it can be counted as sexual assault. The same event would be evaluated differently before and after the rule change.

A control variable is the third type of variable; it is something that you could have changed but control instead to see the effect of changing the independent variable. Controlling certain variables is important so that we can make sure that these variables do not interfere with an experiment. The controlled variables in our plant experiment would be variables like soil, amount of water given, and pot size.

Joel Best describes how social scientists are often challenged when considering other variables in his book Stat-Spotting. Most social scientists base their studies on correlations between variables. A correlation is when the variable A is considered the cause of B. Correlations are not proof of causality. Sometimes there's a third variable X that causes changes in both variables A and B. Best goes on to talk about how the challenge of comparing races is that we tend to correlate race with income and education but assuming this can cause us to ignore other variables. "Because they fail to consider the potential factors, such claims need to be treated with some care."[7] Whites make higher incomes than blacks which may cause these racial disparities. These things need to be considered before we assume that A causes B. He gives another example of a study done on teens that ate dinner with their families. The teens did fewer drugs, received higher grades, and had better relationships with their parents. Other factors like income were not considered so it is impossible to prove the study's correlation. It is important for students to understand control variables so that they do not fall into the same traps that Best describes in his book.[7]

Data Tables

A data table is a chart that is used to organize the independent variables into rows and dependent variables into columns. Data tables need to be set up appropriately in order to avoid confusion. An accurate data table has columns and rows. Students in the sixth grade have little exposure to data tables so you need to make sure that you tell them the difference between the two. Rows go horizontally on a data table. The number of rows you need depend on how many categories of the independent variable there are. A great way to remember how rows are set up is to think of a movie theatre. In most movie theatres the rows are slanted up toward the back of the theatre so that their view of the film is not obstructed by the person in from of them. From the front this appears like the seats sit on top of each other like rows. Columns are vertical on a data table and the number of columns you use depend on how many trials you run in an experiment. Columns can be easily remembered by thinking about columns that hold up buildings because they always stand vertically. The first column is always reserved for different values of the independent variable. All columns to the right of that are reserved for the

dependent variable. The control variables should be represented in a key or note by the table. How variables are organized in a data table is represented in Figure 1.

Figure 1.

Independent Variable Title	Dependent Variable Trial 1	Dependent Variable Trial 2	Dependent Variable Trial 3
Variable Being Changed	Data	Data	Data
Variable Being Changed	Data	Data	Data

In the Wills and Atkinson article they talk about a professor that taught data table reading in his college course. A challenge that the professor faced was getting students to understand if the tables should be percentaged down the columns or across the rows. Students discussed their thoughts on the matter and it was found that the data should be percentaged with the independent variable. [5] An error at this step can cause issues when you create a visual representation of the data in a graph.

Graphs

Making an inaccurate graph can really lead to misunderstandings in the data you collect. A graph is typically represented on two planes or axes. There is a horizontal axis called the x axis and a vertical axis called a y axis. A solid graph should have the independent variable on the horizontal or x-axis. The dependent variable is represented on the vertical or y axis.

Dr. Best talks about how the computer age has made it easier for people to create more entertaining graphs. But these snazzy graphs are not always good graphs. *Newsweek* once displayed a graph about the correlation between being infected with HIV and crystal meth use. The graph illustrated the data as two blobs that represent meth crystals. The blob for HIV positive is far too large, being four times bigger than the other blob instead of twice the size which is what the data showed. The font for each percentage shows inappropriate scale.[7] Teaching students to graph to scale is important because it is a cross-cutting concept of the Next Generation Science Standards.[1]

There are a variety of graphs but for this unit we will focus on bar graphs and line graphs. Bar graphs are used when measuring differing quantities in different groups. Each individual value of the independent variable is listed under the x axis and has a bar above each group measuring the dependent variable.

A line graph is used when you want to show progress or growth over time. In a line graph the x axis represents the independent variable such as the difference of time that

has accrued. Lines are formed by connecting the data points from the dependent variable. It is important the lines differ from one another to avoid confusion if they intersect.

Making graphs is extremely important in observing patterns. Levine argues that the best pattern recognizing device that we have is our eyeball and brain attached. That is why we prepare data in a way that our native equipment is free to do its work. We find patterns in the data when we look at a well-made visual representation of data. We prepare graphs so that errors will stand out visually.[6]

Dr. Goldberger and the Cure for Pellagra

I will center my lessons around the discovery of Pellagra because it shows a simple two variable relationship. Dr. Joseph Goldberger was assigned the task of curing Pellagra in 1914. Pellagra was a disease that causes skin rashes, mouth sores, and diarrhea. If left untreated the disease could even cause insanity. Pellagra had been a minor issue in the South for years before that but drought and economic crisis had led to it reaching epidemic levels. Dr. Goldberger went across the South collecting observations and discovered that people with poorer diets were more likely to get Pellagra.[9]

Dr. Goldberger conducted an experiment in a Mississippi prison to find if diet was the cause of Pellagra. He offered pardons for the prisoners' participation. He was very careful to control the other variables in his experiment so that the inmates were never exposed to the infection through transmission. Prisoners were given the poor Southerner diet that he observed through his travels through the South. Within months the 6 out of 11 prisoners came down with Pellagra. They could not transmit the disease from the prisoners to the healthy guards and prisoners in the prison. Finally, they gave the prisoners a healthy diet and the disease disappeared.[9]

This is a good experiment to introduce and use variables. The independent variable that Dr. Goldberger changed was the diet he fed the prisoners. The dependent variable that Goldberger measured was the appearance of Pellagra in the prisoners. The control variables were the steps that he took to make sure the infection did not occur due to transmission.

Teaching Strategies

Activating Strategy

Activating strategies are used by the instructor to quickly engage the class and are the "hook" to the lesson. Activating strategies are often used at the beginning of the lesson and are brief, ranging from five to ten minutes.[8]

Exit Tickets

Exit tickets are any type of activity that summarizes the lesson and shows the educator that the lesson's objective was reached by all students. Exit tickets are brief often five to ten minutes.[8]

Foldable

Foldables are a unique way for students to take down notes instead of the traditional methods. Some examples of foldables are in the website in the footnotes. [3]

Think, Pair, Share

Students are asked to think about a question or write the answer independently. The child then pairs with a partner and shares their response. This ensures that all students answers are heard by at least one person and meaningful discussion about the subject can take place.[8]

Classroom Activities

Activity 1: Introduction of Case Study/Identification of Variables

Vocabulary: Independent Variable, Dependent Variable, Control Variable, Pellagra, Sample Size

Learning Essential Question: How can we tell the three types of variables apart?

Activating Strategy

Student will view a YouTube video about Pellagra and Dr. Goldberger found in the teacher resources section below. This video show them the discovery of the cure for Pellagra found by Dr. Goldberger. Before the movie begins students will create a graphic organizer to fill out on a piece of paper. They will draw a vertical line down the paper. On the left side of the paper students will write I notice in the top margin. On the right side the students will write the words I wonder. During the video students will write three things they notice and three things that they wonder. After watching the video have students turn to a partner near their seat and have them share what they wrote in a Think, Pair, Share. Students will write down the three things that their partner noticed and wondered. A copy of the I notice/I wonder worksheet is below in the appendix.

Lesson

Start the lesson by having the students make a three door foldable[3]. On the front cover of the foldable you will have students write the three vocabulary terms independent, dependent, and control variables. Inside the flaps of the foldable you will have the

students write the definitions of these three term. Students will find the definitions by doing research on their smart phones. Students without phones can work with the students with phones. If there is a shortage of devices you may want to reserve a computer lab.

Give students the lab sheet template found below in the appendix. As a class fill out the template for the Pellagra experiment that Joseph Goldberger performed. Help students identify the different variables in the experiment. Explain how the independent variable is the variable that you change. Discuss with the class that the variable changed in the experiment was the diet change the prisoners went through.

Instruct the students that the dependent variable is the variable that they measure. Guide the students to answer that the emergence of Pellagra was the thing they were measuring. This is a good part of the lesson to introduce the term sample size. After the students write its definition in their journals, have them research how large a sample size Goldberger used to come to his conclusion. Students will think, pair, share if his sample size was large enough to be reliable.

Finally, explain to students that control variables are the variables that we keep the same to make sure that no other variable affected the experiment. Have students list some of the variables that Goldberger controlled. Possible answers may include what Dr. Goldberger did to insure that the disease was not transmitted but received due to the poor diet. After identifying variables students will be able to fill out the testable question, hypothesis, and procedure boxes on their own. Once finished with the lab template have students go back and add more detail to their foldables.

Exit Ticket

Pass out note cards to all students. Have students write down three things that they learned from the lesson. Students will leave a space below that and write down two things they are left wondering. After this student will leave one last space and write down one thing they found interesting about the lesson.

Extra Activity: Cannon Simulation

Have students go the Cannon Simulation website in the appendix below on their devices or in a computer lab. Allow students to get comfortable with the website for five to ten minutes. Towards the end of the ten minutes pass out the Cannon simulation worksheet also found in the appendix. Explain to students that they will design four different experiments using the simulation website. There are four different variables that students can change which include angle, charge strength, blasto weight, and wind speed. Any variables that you don’t change become your control variables. Have students design four experiments from the simulation.

Activity 2: Constructing Accurate Data Tables

Vocabulary: Data Table

Learning Essential Question: How do we make sure our data tables represent our information accurately?

Activating Strategy

Ask the students the scientific question: How did diet change affect the emergence of Pellagra? Tell students that they need to collect the data from the Pellagra YouTube video. Students will write these data points in their science journals. Have students think, pair, share about how they could organize this data so that someone could understand what they found. Give student the data table graphic organizer found in the appendix below. Show students that the independent variable always goes on the left hand side of a data table. Also tell them to label this independent variable with the x-axis as this will help when we go into our third lesson on graphing. Tell students that all columns on the right are used for the dependent variable and that the dependent variable goes on the y axis. Explain that the number of trials that the experimenter uses correlates with the amount of columns on the right side of the chart. Have students create a data table for the Pellagra data in their science journals.

Lesson

Split students into pair and give each pair a tennis ball. Explore with the tennis ball in hallway by having students pass it back and forth to help them brainstorm what experiments they could create. As a class have the students create a bullseye on a piece of poster paper that they will toss the tennis ball at. Discuss variables that the students could change (ex. overhand/underhand, distance, boy/girl) and plan an experiment for the class to do. Discuss what would be an appropriate sample size for their experiment. Guide students toward the answer 10 trials. Have students create a data table for their experiment.

Introduce the vocabulary term Data Table. Have students research data tables on their smart devices and write its definition in their journals. Have students toss tennis balls at targets from the distance the class has determined. Students will work in groups of two and partners will be recording data in a data table.

Extra Activity: Creating Data Tables Practice Worksheet

Pass out Creating Data Tables Practice Worksheets packets. Have student make the first data table as a class. Students will then create the second data table in pairs. After full class and practice with pairs students will attempt the third data table individually..

Exit Ticket

Have students create a $2 summary of the lesson.[8] Each word in a $2 dollar summary is worth 10 cents so students must limit their summary to 20 words.

Activity 3: Constructing Accurate Graphs

Vocabulary: Bar Graph, Line Graph

Learning Essential Question: How can we visually represent of our data to form conclusions.

Activating Strategy

Have students view the Khan Academy video about reading line graphs below in the appendix. As students view the video they will fill in an I notice/I wonder worksheet. They will have the same procedures that the students followed for the YouTube video in Lesson One. Allow students to research Line Graphs and Bar Graphs on their devices. Tell students that they need to write both definitions into their journals.

Lesson

Tell students to pull out their data tables from their data on the emergence of Pellagra in their journals. Have students create a line graph of their data using the information from their data table graphic organizer and the notes they took during the Khan Academy video. If students are struggling have them think pair share to get notes from their partners. Once students complete their graphs discuss how making graphs makes their work more visually appealing.

Have students create bar graphs based on the data that they found during their tennis ball experiments. Discuss with the class how different graphs work better for different sets of data.

Exit Ticket

Give each student one sticky note in the last five minutes of class. Ask students to answer the lesson's essential question and place the sticky note on the door as they leave the classroom.

Notes

1. "Next Generation Science Standards." Next Generation Science Standards. Accessed October 26, 2014.

2. "Membership." Educational Leadership:Common Core: Now What?:Closing in on Close Reading. Accessed October 26, 2014.

3. Zike, Dinah. "Foldables Basics." Accessed October 26, 2014. http://www.csun.edu/~krowlands/Content/Academic_Resources/Foldables/Basic Foldables.pdf.

4. Pollard, William E., Ruth A Bobbit, and Marilyn Bergner. "Examination of Variable Errors of Measurement in a Survey-Based Social Indicator." *Social Indicators Research* 5, no. 3, 279-301. Accessed October 26, 2014. www.jstor.org.

5. Wills, Jeremiah B., and Maxine P. Atkinson. "Table Reading Skills as Quantitative Literacy." *Teaching Sociology* 35, no. 3, 255-63.

6. Levine, Joel H., and Thomas B. Roos. "Introduction to Data Analysis: The Rules of Evidence." March 21, 1997. Accessed October 26, 2014.

7. Best, Joel. *Stat-spotting: A Field Guide to Identifying Dubious Data*. Berkeley: University of California Press, 2008.

8. "Learning Focused Strategies Resources." Cape Henlopen School District. September 5, 2014. Accessed October 26, 2014. http://cape.de.schoolwebpages.com/education/components/scrapbook/default.php?sectiondetailid=8909&linkid=nav-menu-original-4-1&cms_mode=view.

9. "Pellagra Shown to Be a Dietary Disease." PBS. Accessed December 16, 2014. http://www.pbs.org/wgbh/aso/databank/entries

Appendix: Next Generation Science Standards

DIMENSION 1: PRACTICES FOR K-12 SCIENCE CLASSROOMS

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

DIMENSION 2: SEVEN CROSSCUTTING CONCEPTS OF THE FRAMEWORK

The committee identified seven crosscutting scientific and engineering concepts:

1. *Patterns.* Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.
2. *Cause and effect: Mechanism and explanation*. Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.
3. *Scale, proportion, and quantity*. In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.
4. *Systems and system models.* Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineerin**g**.
5. *Energy and matter: Flows, cycles, and conservation.* Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.
6. *Structure and function.* The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.

7. *Stability and change.* For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

Appendix: Resources for Students and Teachers

Pellagra Video:
https://www.YouTube.com/watch?v=QeloeutvsqM

I Notice/I Wonder Worksheet
https://docs.google.com/a/colonial.k12.de.us/document/d/1TQkF2hztyx14cyeVwAmhXDd93b0lnKoPxNorrUrzzjI/edit

Lab Sheet Template
https://docs.google.com/a/colonial.k12.de.us/drawings/d/1hxF_Mf2SgSRCTsAEdZu_Nz3DBsV9E4E5Vtme2OqnCk8/edit

Cannon Simulation Website: http://archive.fossweb.com/modules3-6/Variables/activities/blasto.html

Cannon Simulation Worksheet:
https://docs.google.com/a/colonial.k12.de.us/document/d/1NcujKvSiZCZmubOa_Yk4Ttqemy0haUTtOGBoSxR-44s/edit

Creating Data Table Graphic Organizer
https://docs.google.com/a/colonial.k12.de.us/document/d/1rXd23yqoS8_YnQoVj1fh8O2HO7HxrbIIej8PsiZV8TA/edit

Making Data Tables Practice Worksheet
https://docs.google.com/a/colonial.k12.de.us/file/d/0B55SccDYNKZ2TlpkcmFzM01kcmM/edit

Khan Academy Video on Reading Line Graphs
https://www.khanacademy.org/math/cc-sixth-grade-math/cc-6th-data-statistics/cc-6th-line-picto-graphs/v/u08-l1-t2-we2-reading-line-graphs

Learning Focused Student Learning Map:

Unit: Errors in Variables, Data Tables, and Graphing

Key Learning: How do we develop models so that others can analyze, argue, and communicate about data and information.

Unit Essential Question: How do we avoid errors in developing different representations of data?

Concept: Variables	**Concept: Data Tables**	**Concept: Graphing**
Essential Question: **Who was Dr. Goldberger and how did he cure Pellagra?** **How can we tell the three types of variables apart?**	**Essential Question:** **How do we design our own experiments so that our results are reliable?** **How do we make sure our data tables represent our information accurately?**	**Essential Question:** **How can we visually represent of our data to form conclusions.**

Key Vocabulary: Independent Variable, Dependent Variable, Sample Size, Control Variable, Data Table, Line Graph, Bar Graph, Pellagra,

Bibliography

Best, Joel. *Stat-spotting: A Field Guide to Identifying Dubious Data*. Berkeley: University of California Press, 2008.

This book discusses taking a critical look at how numbers are used and influence social issues in our culture.

"Learning Focused Strategies Resources." Cape Henlopen School District. September 5, 2014. Accessed October 26, 2014. http://cape.de.schoolwebpages.com/education/components/scrapbook/default.php?sectiondetailid=8909&linkid=nav-menu-original-4-1&cms_mode=view.

This website gives you a lot of great resources to use in Learning Focused strategies in your room

Levine, Joel H., and Thomas B. Roos. "Introduction to Data Analysis: The Rules of Evidence." March 21, 1997. Accessed October 26, 2014.

This article discusses critically analyzing data to make sure that errors are avoided at all costs.

"Membership." Educational Leadership:Common Core: Now What?:Closing in on Close Reading. Accessed October 26, 2014.

This articles gives some great instructions on how to close read in your classroom.

"Next Generation Science Standards." Next Generation Science Standards. Accessed October 26, 2014.

The Next Generation Science Standards are expectations of what science students should be learning at every grade level.

"Pellagra Shown to Be a Dietary Disease." PBS. Accessed December 16, 2014. http://www.pbs.org/wgbh/aso/databank/entries

This website shows Dr. Goldergers discovery of the cure for Pellagra.

Pollard, William E., Ruth A Bobbit, and Marilyn Bergner. "Examination of Variable Errors of Measurement in a Survey-Based Social Indicator." *Social Indicators Research* 5, no. 3, 279-301. Accessed October 26, 2014. www.jstor.org.

This article talks about errors in the measurement variable which lead to poor correlations and conclusions being made.

Wills, Jeremiah B., and Maxine P. Atkinson. "Table Reading Skills as Quantitative Literacy." *Teaching Sociology* 35, no. 3, 255-63.

This article discusses the weakness in education teaching quantitative literacy and what some secondary professors are doing to correct the issue.

Zike, Dinah. "Foldables Basics." Accessed October 26, 2014. http://www.csun.edu/~krowlands/Content/Academic_Resources/Foldables/Basic Foldables.pdf.

This website gives you a lot of examples of different foldables you can do in your classroom.

Learning Focused Student Learning Map:

Unit: Errors in Variables, Data Tables, and Graphing

Key Learning: How do we develop models so that others can analyze, argue, and communicate about data and information.

Unit Essential Question: How do we avoid errors in developing different representations of data?

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Essential Question: **Who was Dr. Goldberger and how did he cure Pellagra?** **How can we tell the three types of variables apart?**	**Essential Question:** **How do we design our own experiments so that our results are reliable?** **How do we make sure our data tables represent our information accurately?**	**Essential Question:** **How can we visually represent of our data to form conclusions.**

Key Vocabulary: Independent Variable, Dependent Variable, Sample Size, Control Variable, Data Table, Line Graph, Bar Graph, Pellagra,