Do You See What I See?
Is Candy Just a Treat or a Math Tool?
Statistics and You

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Rationale

"Statistics" is a word that conjures up nightmares for those who are not mathematically confident. Even for advanced and/or practicing mathematicians, statistics still seems to make people want to run and hide when the word is brought up or even thought about. Generally, when I teach, I tell to my students that the subjects of English, Reading, Mathematics and Science are all like learning a foreign language. Each of these subjects has its own particular language with vocabulary and key terms that help to navigate through concepts, problems, and solutions. Each subject is taught in successive steps laying the foundation for future learning. We master the first few words and then our vocabularies take off along with our understanding of what is being asked of our students to do. We begin to memorize, categorize, visualize, and conceptualize hundreds to thousands of words with ease as time and additional learning goes on.

Students and teachers alike find it difficult to learn the language of statistics. There are many terms that sound alike or have similar meaning. It is often difficult for students to conjure up an image for understanding and interpreting data. These same skills for a special education student can be even far more difficult. We, as teachers, need to take into account how to address both the way the student learns and how you as a teacher teach the subject matter. For students with disabilities, their teacher needs to be super organized in the way that they teach concepts, vocabulary, and skills. They also need to be able to have multiple strategies to teach the same lesson. Teachers also need to be able to trouble shoot and correct any of the misconceptions developed by the students by looking at their work through their eyes. We also need to regulate the pace of the lesson and its complexity based on how the students learn. The more concrete the lesson and the skills taught the easier recall and application of skills would be for the students. If we teach the students this information methodically or in such away that it allows the student

to develop a tool that he/she can use when learning and review and new material taught and /or learned. If the students can apply these skills for themselves then it will empower them to be in more control of their learning and more interested in what they can learn.

This unit is designed to help all of our students develop a better understanding of statistics. It is intended for seventh and eight grade students working on the statistics strand of the School District of Philadelphia's math curriculum and who may or may not have some degree of a learning disability. It will be geared towards helping special education students but can be equally successful with general education population as well. Some of these activities may seem time consuming and strenuous but repetition and sequencing of skills will help with the students' overall retention of materials taught. The more students become familiar with their work, the better each student can learn the material. We also need to keep in mind that all people have different modalities in which they learn. The idea is to teach while addressing these modalities and increasing the ways in which students get information, so that they have multiple experiences and examples of the skills needed for various concepts.

Without developing a deep understanding of statistical vocabulary and methods, the data presented can be confusing and very abstract. Data can be presented in ways that easily misrepresent the results of the given data. Students need to be able to have a basic understanding of statistics and its everyday applications in our lives before they can use it in more complex ways. This will help the students to recognize the kinds of patterns and logical changes that occur in statistics through everyday examples that the students see and to develop a critical stance toward statistical information that they receive through printed material, or in the media.

I would like to look at statistical data that has been generated by my students until they are more comfortable with data. It is at this point that I will begin to use data from our everyday lives to broaden my students understanding of statistics.

There are lots of ways to do quick formative assessments that can give you immediate feedback in order to re-teach the parts of your instruction that students need clarity on or perhaps you may need to re-teach the entire lesson. The key here is to understand how much your students understand before you move on to the next skill set. This activity will also afford you to be able to have concrete information to give to a fellow teacher who may teach specific content better than you or you can redesign your lesson together in order to make it much more effective. Additionally, in teaching this unit, I want to start by focusing my students attention on the tools need to be able to understand Statistics. I think it is important for them to know that often results are published with failures to honestly convey the statistical facts. I want my students to begin questioning the cultural and economic differences that may affect a statistical data. This may be very difficult for students with disabilities so I will need to use very simple examples. For some students this will help them to pick up this skill and gradually apply it to more complex data. Depending on the student's disability and what is written in the students Individual Education Plan will dictate to you what and to teach and in many instances can offer you

a very clear picture as to how this student learns. This is crucial information especially if the student is new in your classroom.

Statistics is a type of math that deals with collecting data, organizing data and figuring out what this data means. Students will also learn about probability; which is also considered statistical data. Students will need to understand the specific vocabulary and terms used in the collection, also organizing and interpretation of statistical data. These concepts will be difficult for students with disabilities but with the students Individual Education Plan and some great strategies for learning vocabulary students will be able to understand what these words mean. In many cases students will need to learn synonyms for these words, draw pictures, write down the definitions and/ or draw a physical representation of each of these words.

Vocabulary List for Unit:

Measurements
Tables
Sets
Subsets
Variables
Mean Outcomes
Correlation
Causation
Frequency
Mode Frequency
Table Variance
Sample
Unbiased
Median
Statistics
Scatter Plot
Outlier
Distribution
Range
Mutually Exclusive
Normal Distribution
Graphs
Measure of Central Tendency
Bar Graph
Biased
Line Graph
Pie chart
Histogram
Data
Skewed Data
Probability

chance
less likely
least likely
More likely
most likely
certain impossible
equally likely
Predict
possible outcomes
event(s)
Probability Scale

Background

Earlier, I mentioned using a student's modality to help them learn. Modality refers to how a person uses their senses to learn information. In college when learning various teaching pedagogy, we quickly to a modality inventory to see how we learned, and I was taught how to use my modalities for learning. This was great until I got to my special education classes. It is there where I was introduced to the understanding of how much important your modalities are when you do not have all of them. I was introduced to the idea that when you don't have all of your senses how the others are heightened and used to compensate for the missing one(s) in children with special needs.

There are as many modalities of learning as we have sense, seeing, hearing, looking, touching, and even tasting when it can be applied. All of these senses help us to remember and understand things that we have learned or seen. For example, you can have a memory jarred, from your memory by a smell; the sound of a song playing on the radio takes you back to a special place and /or time. Our senses play such a role in our everyday lives that many of us could not perceive how life would be without them or even if they did not work correctly. This is an issue that many children with disabilities are faced with. Many children are faced with sensory issues. These issues cannot be seen and are often overlooked as likes or dislikes. A review of the literature suggests that as many children with special needs experience some form of sensory impairment. It is for this reason that more than one modality needs to be used so that we can utilize the best senses for each student. This will allow students to use the senses that help them to learn more effectively. If classroom lessons are developed with this in mind then all students will have a better chance of learning in the ways that are best for the students.
The four most used modalities are auditory (hearing), visual (seeing or looking), kinesthetic (movement), and tactile (touching). Since this unit is for middle school students, I would like to add tasting to the list of modalities to use. Kids like to eat and what better way to learn a lesson than to complete it and eat it!

I will use some type of candy such as Skittles or M&M's to teach my students key terms. For example, the word frequency can be taught through the use of candy. Each color or flavor is found in the sample of candy that was given to each student, the words

frequency and sample are vocabulary words that will be introduced using sight, touch, hearing (they really do make noise when you shake them in their baggies), and finally taste. If the students don't remember anything else they will remember eating Skittles or M&M's and how much fun they had completing a lesson and eating this candy. Remember that when dealing with children with disabilities that the more severe the student's disability the more using modalities are important for learning. This could mean that you may need to use a much larger variety of foods or even other things that parents can help find that will peek a particular student's interests. Parents know their children best and do not mind letting you know the things that they are most comfortable with.

I also mentioned how students learn first in concrete ways and then in more abstractly as they get older this is a natural progression of learning for all students. When children first come to school they need a lot of visuals and tactile activities to learn letters, counting and even about the jobs that people have in their communities. Children gradually don't need for things to be as concrete when they begin to learn more things. They can imagine shapes, colors, sounds, and even the meaning of various words. For students with disabilities going from the concrete to abstract can be difficult. Students with disabilities tend to learn slower and students who are considered Mentally Gifted can move to more abstract learning both quickly and earlier than students who are on the same grade levels. Since students learn at different paces your lesson plans should reflect how you would handle the students in your classroom that may fall into the categories of Learning Impaired or Mentally Gifted. It is better to be over prepared than not prepared at all. The more you prepare this the easier it will be come over time.

Guided Teaching of Statistical Concepts to Students

I will use examples to explore ways that data collection can give way to errors in the both the collection and analyzing of data. For example, errors can result from the way that the questions for information were formulated, in the way the data is labeled, and even how the question is understood when it is read to the sample group. Furthermore, in trying to get the information collected, theories that people seek to prove or disproved are developed. Data can be purposely skewed so that it gives the results that are needed for a particular study or theory with no clear mention of these changes. For students with special disabilities this particular lesson will be even more difficult if these lessons are not well planned and methodically taught. We need to take into account the diversity of the classes that we are teaching. You may have special education students who have excellent computation skills but have great difficulty in reading or vice versa. Then there will be those students who will only get parts of what you are teaching and that is the foundation for future lessons.

Application of all the aforementioned skills to scenarios and student generated examples.

Objectives

Throughout this unit, students will be able to:

- Define basic terms used in statistics

- Conduct and generate experiments that will generate statistical data.
- Extend survey to wider audience
- Plot on a graph information collected
- Calculate statistical measurements: the mean, mode, median of a data set
- Create graphs and charts to represent data
- Examine charts and graphs from newspapers, magazines and media
- Question the data collected to detect errors

Strategies

Word Acquisition Skills: Students will make flash cards, word booklets, and Quizlet.com to increase student understanding of vocabulary words. Students will work in small groups and whole class to create meaning for each vocabulary word. These flash cards will be concrete. This means that the students will have a physical representation of the word that will give it meaning, a picture, a synonym and examples of how to use the word along with an example of what it is not. When students encounter the vocabulary words, they will be able to recognize the meaning of the word and also understand it.

Students will compare the data and results of practice experiments to identify strengths and weaknesses of their own understanding of the processes and the vocabulary being given in the examples. This will happen slowly but as students get familiar with this tool they will work quickly and much more efficiently.

Experiment Implementation: Students will use various sources to find samples of statistical data to be analyzed and conclusions drawn through Probability and assigned experiments. They will have access to the Internet in class, as well as newspapers and magazine articles to find samples of erred data collected and actually used in studies. Children's literature can also be used to both introduce and or use as a form of assessment for lessons. You can have students read the story and have them put the information that they learned from the reading into their own words. You could also have the students Jig Saw the reading and then have them get into groups to figure out how all of the pieces of information from the reading fits together to teach other students about what they read. Finally, students will analyze data and question possible errors that can skew or totally cause a misinterpretation of data.

Vocabulary Usage Example:
Data is skewed when histogram has a tail that spreads out more to one side than the other. It is skewed to the right or the left depending on which side stretches out farther. To simply read this word from the page it assumes that the student understands some of the keys terms used in statistics such as skewed and histogram. Students having a clear understanding of these words should understand what is being asked and be able to give an example of this information. I would like to use some specific strategies that will help students teach themselves vocabulary much more successfully.

This lesson would take place during the latter part of the school year. This unit will last for about three weeks. I will review and introduce new statistical concepts to students and

re-teach lessons that the students are weak in. There will be three lessons completed weekly on Monday, Wednesday, and Friday. It is important to remember to always include some literature-based activities to increase reading and comprehension skill over time. Given books related to topics will give students more time with the concept being taught and more than one way to learn it.

Data Collection and Usage: Students will record data in a table inserted into a Word document or in an Excel spreadsheet

Creation, Usage and Interpretation of Graphs: A variety of graphs and charts will be used to record, represent, and analyze data.

Student should be able to understand the similarities and differences between words that can lead to a 45% increase in understanding of materials taught according to Marzono's Teaching Strategies (Marzano & Pickerling, 2001). There are tools that can do this online and/or you help the students create a tangible study guide and also give students the proper pronunciation of each word. Students can carry with them vocabulary cards so they can study at any time. This can be done even for students who have specific learning and /or physical disabilities that may not allow them to be able to write, however, if these students have access to technology that can assist them in the process of learning the vocabulary skills needed to successfully master these concepts. The students can also be taught various study skills that will make them more successful students as well.

Students will begin with the vocabulary list provided in order to become familiar with the language of statistics.

Lesson Plans

Lesson Plan 1
Week 1(Vocabulary Acquisition)

Materials Needed:

Copy or line paper about five sheets per student.
Scissors
An Overhead Projector or Smart Board
Vocabulary words and definitions sheet, which will, collected at the end of class.

Students will be given a vocabulary list consisting of thirty words. For this week's lesson it will take all three forty five minute periods set aside this week. Each day the following will occur:

Each student will be given ten words and four sheets of paper.
Each paper will be folded in the hamburger (which means folded in half the short way).
Hold the paper so that the fold is on the left side of the paper and cut the top sheet back to

the fold every two inches and a third of an inch so that it looks as though there are three flaps on the page. (Foldables)

Front Flap 1: On this flap the correct spelling of the first ten words will be given. This procedure will remain the same on days two and three but the list will change each day. Students will complete this assignment whole class. This will ensure that all of the students have both the correct and same meanings for all words. This strategy will also make sure that all of your special education students have the same information.

Inside Flap 2 :(behind the vocabulary word) will have the definition written on it.

Inside Flap 3 :(will be the page flap that you will see when open flaps one and two.) This flap will be reserved for a drawing or physical representation that the class has elected to use or a representation that I have provided for them. These representations can include actual problems or formulas that students will need to use.

Back Flap 4: Will be for what this word is not or it can be used for students to write a synonym for the word. These too should be provided or elected by the class. (Frayer Model)

Quizlet is an on-line vocabulary card designer. You can use it to create your vocabulary card on-line with several features that will help students even more.
Quizlet has a word pronunciation button for each word. It will also read the definition that you provide for the students. Teachers can add class assignments and/or word games. You can assign students who need additional time with this task on computer when allowed. This information can also be sent home for parents to give any student additional parental help. (http://www.quizlet.com/)

Students will need to understand the differences between random and biased data collection. Here is an additional way to reinforce these concepts. The link listed below is to a website that will give your students a scenario of data collection and ask them to decide if the method of collection is either random or biased. This can be used as a homework assignment or a classroom quiz to check for students understanding. After you have introduced the vocabulary. If you need to re-teach it these examples can help you clearly guide your students to a better understanding of these concepts.

http://www.ixl.com/math/grade-8/identify-representative-random-and-biased-samples

Differentiation: Use a few of the one -pound bags of Skittles to create concrete picture reminders for students. Have them create the meaning of the word take a photo of it and put on the students Frayer Model card for that word. Then allow the students to eat the Skittles. This activity will address a few of each student’s modalities. First, the student will have a concrete example that they have made with their own hands which ignites the student’s sense of touch. Next, the students will be able to see how this pile of candy is related to the math concept as an example. The students can be asked to think about how

can this pile of candy and a definition of this word be represented as a picture. You will be tapping into prior knowledge and linking an abstract concept with a concrete example. After the activity is completed allow the students to do something “good and fun” with the Skittles.

You can allow the students to eat them. The students can sort them and use them to create Art Work if you are not a fan of children eating candy. You can have the students use them to create decorative math assignments that can be put on display. You could even use them to help your students create a larger math or art activity that requires the usage of larger numbers and/or data.

Lesson Plan 2
Week Two
(Understanding Data)

For this week’s lesson it will take all three forty five minute periods set aside this week. Each day the following will occur: Students will review all types of graphs using data collected form each class. We will then apply this data to the graph or graphs of the day. This will allow students to see how the same data can be used in different ways but still provide the same information. Students have already been exposed to the type of graph that we will be using in lesson one and can use their Vocabulary Booklet for this unit as a sample guide.

Topics for Data collection and graphing:

1. How many pets do you have?
2. How many hours of television do you watch on the weekend?
3. How many siblings do you have?
4. Graph the color of the cars in the school parking lot.
5. Measure the height of the student in the class.
6. How many students walk, or ride to school?
7. How many students like jumping rope, play football, basketball, or hopscotch?

Remember that since we have gone over the vocabulary, you can ask students to find the mean, median, mode, and rage of answers. You can asked them to use a Scatter Plot Graph for one set of data and then using the same information change it to a Leaf and Stem graph.

Homework will be to take this same information to create another graph that we have not yet used in class. This will help to assess if your students truly understand what they are doing. If not you now have a way to go back and re-teach the same information using another graph.

Differentiation: Use a bag of Skittles and graph all of the colors and the amount of each in an eight-ounce bag of Skittles. Use a large Zip Lock bag so that the students can manipulate and count the number of Skittles in each bag and then have them graph it.

Lesson 3
Week 3
Show Me What You Know

Students will generate a statistical set of information using the data collected from the student's Skittle data or some other data of their choice. They will then graph this information taking care to include a graph, mean, mode, median and range. Students must also present this information along with a graph to the class. Each student will have up to fifteen minutes to present. Students will have write about what they have learned, how is it valuable to them and how they feel about this unit How would they change this unit must all be addressed in the presentation. I would dedicate a week for presentations. I would also give student the time and date of their presentation to avoid any confusion on the student's part.

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Content Standards

Pennsylvania's Statistics Standards (Grade 7)

2.6.7.A: Identify different ways of selecting a sample and choosing an appropriate sampling technique for a given situation.

2.6.7.B: Organize and display data using an appropriate data display, such as circle graphs, histograms, line graphs, double bar graphs, and stem-and-leaf plots, Venn diagrams, tables, and charts.

2.6.7.C: Use numerical summaries to describe different sets of data.

2.6.7.D: Use measures of central tendency and spread to compare data sets.

2.6.7.E: Interpret trends and make predictions based on data displayed in a graph.

Pennsylvania's Statistic Standards (Grade 8)

2.6.8.A: Understand and apply sampling techniques to gather data including simple random sampling and convenience sampling.

2.6.8.B: Organize and display one-variable data using appropriate data display, such as stem-and-leaf and box-and-whisker plots, and two variable data with scatter plots.

2.6.8.C: Calculate quartiles for one-variable data and describe the correlation coefficient for two-variable data displayed in a scatter plot.

2.6.8.D: Compare data sets graphically using double-bar and double-line graphs and numerically using mean, median, mode, range, and quartiles.

2.6.8.E: Determine the effect of extreme values on numerical summaries and calculate estimates based on survey results or graphs.