Writing in the Real World

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This curriculum unit is recommended for IB MYP, year 2; Mathematics, grade 7

Keywords: writing, vocabulary, mathematics, real world, tax, tip, total, statistics, expressions, fractions, decimals, percents, probability

Teaching Standards: See Appendix 1 for teaching standards addressed in this unit.

Synopsis: When was the last time you were asked to write actual words in mathematics class? If you said, you never remembered writing in math class, you are grouped with the majority of students today who have never written in math class. There is overwhelming research that to understand a concept, you must be able to express your thoughts and ideas on how you came to the conclusion you did at the end of the problem. Students are losing their ability to communicate effectively their peers not only in a written capacity but also verbally. With technology creating shortcuts and abbreviating words, students have become less comfortable with writing and expressing their own ideas and backing up an argument they may have. This unit is designed to guide students into expressing their processes and arguments in their math classes through communication, verbally and through writing.

I plan to teach this unit during the coming year to 130 students in IB MYP, year 2; Mathematics, grade 7.

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Introduction

Background Information

Piedmont IB Middle School is an International Baccalaureate school located in Charlotte, North Carolina. International Baccalaureate School utilizes the Common Core Standards as well as integrating global context and exploration.

According to data assembled from the 2018-2019 school year survey, Piedmont serves over 1100 students. 68% of our students are African-American, 15% are white, 7% are Hispanic, 7% are Asian, 5% are Multiracial, and 1% are Pacific Islander. The gender breakdown of our school is 47% male and 53% female students. Around 50% of our students are on free and reduced lunch. About 50% of our students live below the poverty line. Piedmont was awarded an "A+" rating by the state of North Carolina, based on our test scores in 2018 and 2019. Piedmont is currently ranked as the 19th top middle school out of 675 middle schools in North Carolina.[1]

The culture at Piedmont, encourages innovation, creativity, and hands-on learning. Teachers are comfortable taking risks and conducting lessons that may not be found in an everyday textbook. The administration trusts the teachers at Piedmont to make decisions about what is best for the students of Piedmont, so the teachers do not feel that anyone is looking over their shoulder, and they do not feel as though they need to conform to any certain style of teaching. At Piedmont we follow the Common Core State Standards in Mathematics. In 7th grade, there is a strong emphasis on Ratios, Proportions, Decimal Operations, Surface Area, Volume, and Statistics.

In the 7th grade at Piedmont, students are split into "Honors" and "Standard" classes. Based on how they do in 6th and 7th grade, our honors students can complete both Math I and Math II in the 8th grade. Math I and Math II are high school courses in Charlotte-Mecklenburg Schools, so some of our brightest students will complete two high school courses before they graduate Piedmont. The rest of the honors students will complete Math I in the 8th-grade and our standard students will complete the 8th grade curriculum as laid out in the CCSS (Common Core State Standards). This unit can be done with both honors classes and standard classes and also, adjusted to students who are "typical learners."[10]

Background Knowledge of Students

With each new school year, students come to Piedmont with varying math backgrounds. Some are great with fractions but struggle with geometry. Some are great at geometry but struggle with decimals and percentages. Some have a strong math background while others may need more assistance. Most of them, as a result of too much standardized testing, have a strong desire to "get the answer" as quickly as possible. They struggle with open-ended questions and questions that require a lot of perseverance to solve. They have been trained that the answer is always "A", "B", "C", or "D". This type of thinking is appropriate for a multiple choice test, but

this type of thinking is less applicable to making an important life decision, inventing something new, or solving a problem that has several possible solutions. Most of my students are all either eleven or twelve years old, with the exception of a few students. Despite the differences that my students have as far as their race, household income, math ability, etc., the fact that they are all eleven or twelve years old means that they have much in common. As it pertains to this unit, my students are supposed to come to Piedmont with knowledge of how to calculate the mean and median of a set of data, understand how fractions work, geometrical shapes, and a variety of other math tasks.

Rationale and Content Objectives

Rationale

By incorporating writing in real world mathematics students can grow in their global awareness, which is the basis of the IB curriculum. Students will also have the opportunity to learn real world situations early that they will encounter as adults (tax, tip, recipe rations, etc.). Brazilian mathematician and math historian, Ubiratan D'Ambrosio calls this idea of bridging real world scenarios and systemic ways to solve a math problem, ethnomathematics[3]. With a growing Hispanic population in our school and country, I find it personally a great way to assist our EL students in the classroom with their writing and vocabulary. Our hispanic students on average, score higher on their math EOGs and MAP tests than their english/ELA tests.

Pertaining to the content itself, this will be a more academically rich method compared to last year. Last year as a PLC, our lessons were based on worksheets and holding three-dimensional figures. This year I am excited for students to write and explain their reasonings with words instead of all computational numbers.

With the technology age taking over, students are losing their ability to communicate effectively on paper and with each other. Students find it easier to sit behind a screen to talk to each other rather than express their thoughts and ideas face to face. The long term implications of this will not only limit students within the classroom but also in their future careers. Forbes, released a study where current employers are finding it hard to hire team members who can and are willing to have face to face communications. This is why it is important for students to continue to learn how to communicate verbally and through written expressions.[6]

Content Research

The content that is included in this unit comes from our state standards and the common core. The emphasis on this unit will be: ratios and proportions, fractions/decimals/percents, and statistics and probability. Within these 3 subsections of our curriculum, students will create and manipulate recipes, produce their own receipts with tax/tip/total, and form their own statistical data. The expectations for students in the 7th grade is that they have mastered the basic concepts of setting up and solving ratios and proportions, have a basic understanding of complex fractions and long division, and understand what a statistic and its purpose.

Walking Before Running, Discussions before Writing

Before students can write down their thoughts, it is important for students to first feel comfortable expressing their thoughts and ideas verbally. Many students can say "I know what I

mean but I do not know how to explain it" [4]. As intimidating as it can be for students to write in math, we have to tackle the verbal expression first as that seems easier for students to verbalize before writing. To do this, a positive and exciting classroom identity must be established. [2]

The identity of a classroom can be described as; a room with four walls, desks, posters, and a whiteboard. But what makes a classroom, is the students. Working with up to 150 students a day, their identity creates the environment, mood, personality, and defining characteristics of the room. One block may be identified as challenging while another, might be the best class in every way. While the teacher is the foundation of the culture in the room, the students are the walls, the decoration, and the slates to the identity of the room.

The *Journal of Educational Psychology* stresses the idea of having a cohesive and strong environment. With the driving force being the idea behind how comfortable a student is their math mastery. A student who is stronger in math, will feel more comfortable sharing their thoughts and ideas while a student who perceives themselves as not being strong, may hinder the classroom environment. [5]

To create a cohesive and accepting environment for students to feel safe to share their thoughts and ideas, there are fundamentals that have to be laid out and explained to our students. There are four main pillars that build a safe, and welcoming environment: child-centered teaching, cultivating diversity as a resource, classroom relationships, and caring classroom environments.

The premier pillar is, child-centered teaching,which is made up of four key concepts: listening, understanding, cooperation, and autonomy. Students often feel ignored or dismissed by their teachers and peers, by taking a true interest (or having the body language that you are listening), this can bring a sense of leadership and participation in the classroom. Secondly, understanding the content is important to the identity of the student. How many times have you or have you heard "I am just not good at (insert subject)"? When students are not the tip top or comfortable with the content, they will not feel like they have a purpose in the class. They are there to get in and get out with a passing grade. A passing grade is not sufficient. Students need to be able to be comfortable enough with the content to take their experience with the content and connect it to real world situations.This builds a stronger sense of understanding.

Cooperation is the third fundamental base. Like a two way road, teachers are the solid yellow line and the students can be in either travel lane. While students have a choice everyday to either go north or go south, it is the teacher that determines the boundary. There is no physical barrier that keeps a driver from crossing the centerline but we respect that paint on the road. With the drivers and the that line, cooperation is in full effect working together to maintain the safety of the road. The last fundamental of student-centered teaching is autonomy.[8] Allowing students to self-govern creates a sense of belonging and responsibility. They feel like they have a purpose in the class, not just as a student who should just get in and out without causing a disturbance They take responsibility for their role and identity in the classroom. Students who have a role, either as the class helper or door opener or classroom phone answerer, have a greater sense of belonging the self-governing environment. The teacher does not give up their role as the foundation or facilitator, they are their to work out any of the kinks. [3]

Activities and Visuals for Child-Centered Teaching from Teaching Tolerance [2]

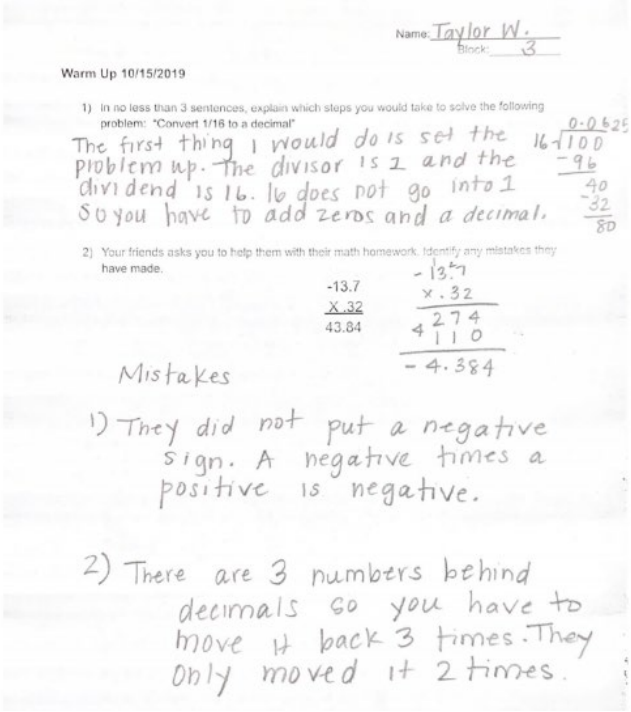
Components	**Activity Aspect**
Listening	When an assignment is reviewed with the class, students must listen to gain knowledge on how to execute the activity
Understanding	Students must execute their activity using a set of instructions as their guide. Having an understanding of the concept is key to being successful.
Cooperation	Students use the "3 then Me" questions system. Students must ask 3 other students before asking the teacher for support. This encourages dialogue and team building.
Autonomy	Students are given a set of instructions and construct product on their own without step by step instructions.

Implementation

The Four Main Types of Mathematical Questions [1]

Four types of questions have been identified that can be used to help students in their mathematical writing skills and to help students communicate their mathematical thinking. The Elementary Mathematical Writing Task Force [1] was utilized to create the following questions.

The first type of question is exploratory. Students use exploratory questions to express their own thinking of how a problem works. For example a student may be asked "What steps would you take to solve this problem". They can even be asked to look at an example of other students thought process and identify and correct any mistakes that may have been made. (*Note:* The following questions were created by the teacher and names have been changed to protect student privacy).



Name: Taylor W.
Block: 3

Warm Up 10/15/2019

1) In no less than 3 sentences, explain which steps you would take to solve the following problem: "Convert 1/16 to a decimal"

The first thing I would do is set the problem up. The divisor is 1 and the dividend is 16. 16 does not go into 1 so you have to add zeros and a decimal.

16 | 100 (0.0625) − 96, 40 − 32, 80

2) Your friends asks you to help them with their math homework. Identify any mistakes they have made.

-13.7 × .32 = 43.84

-13.7 × .32, 274, 4110, −4.384

Mistakes

1) They did not put a negative sign. A negative times a positive is negative.

2) There are 3 numbers behind decimals so you have to move it back 3 times. They only moved it 2 times.

The second type of mathematical writing is informative/explanatory. These questions are designed so students can describe and explain their way of solving a problem. A question that can be asked is "What is the difference between area and volume?"

Name: Zach Matherson
Block: 1

Warm Up 9/30/19

1) Describe the similarities between a square and a cube.
A cube is made up of 6 squares. They both have equivalent dimensions meaning the height is the same as the length and for a cube, also the height.

2) Describe the differences between a square and a cube.
A square has 4 sides and a cube has 6 sides. A square is two-dimensional and a square is three-dimensional. A square has a length and width. A cube has those too but also has a height.

The next type of writing is argumentative. This is the question where students can defend their own answers or make an argument for or against an answer. A typical statement is, "Defend your answer". Students have to show evidence as to why their answer is correct. While many students can show their math, they must understand how mathematical processes work.

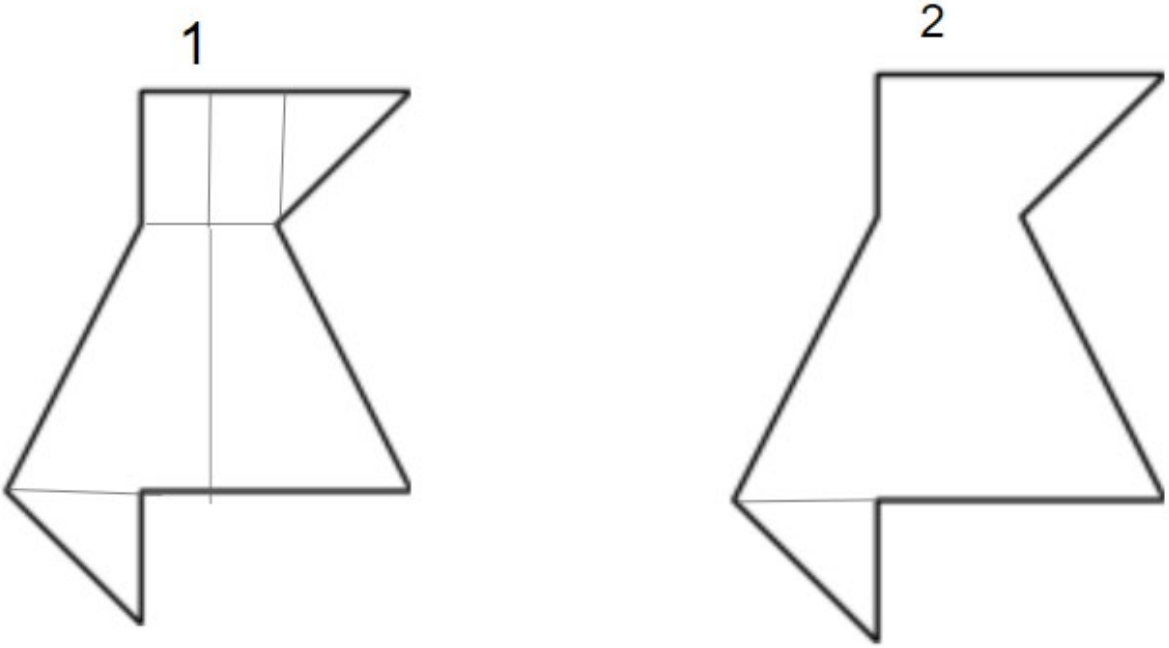
Question: Layla is making a deposit into her bank account she has $202.14 in her account as of today. She plans on depositing $42.45 tomorrow and purchasing a book for $17.19. Her balance at the end of the week will be $227.40. If that is all she plans on spending and depositing, is her ending balance correct? Defend your answer.

Yes, this correct. When you make a deposit you add money to your account. $202.14 + $42.45 is $244.59. When you purchase something, it takes money out of your account. $244.59 - $17.19= $227.40. Her balance (what she has left at the end) is $227.40.

-Zayda Thompson Block 3

Finally, there are mathematically creative questions. Crazy Cakes is one where students use their creativity to answer the question "Cut this cake into fair pieces for you and a friend. The trick is that the piece of cake is irregular in shape. Another key piece to this is the word, "fair". [5] Below you see two students who cut their pieces very differently. Example one shows a student who cut the cake into equal pieces. They defended their answer by saying fair to them was splitting it evenly. In the second example, the student cut a tiny piece. When asked why, the student said, "I do not like cake very much and my partner does. I think it isn't fair if he gives me half and I won't even eat it. That would be wasteful". This activity allows for more than mathematical creativity as seen by the example but also ethical ideas about sharing cake and personal opinions.

Names: Jeremiah and Thomas



Strategies and Classroom Activities

Quarterly Exam Review Activity

Logic:	After students took their quarterly exam, they were asked to present (with or without a partner) a problem that they correctly solved from their quarterly.
Writing Skills:	Explanatory: Students explain the ideas of how they solved to peers. Informative: Students explain their thought process to correctly solve the problem.
Common Core Standard:	CCSS.MATH.CONTENT.7.RP.A.1 Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction 1/2/1/4 miles per hour, equivalently 2 miles per hour. CCSS.MATH.CONTENT.7.RP.A.2 Recognize and represent proportional relationships between quantities. CCSS.MATH.CONTENT.7.RP.A.2.A Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. CCSS.MATH.CONTENT.7.RP.A.2.B Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. CCSS.MATH.CONTENT.7.RP.A.2.C Represent proportional relationships by equations. For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn.

	CCSS.MATH.CONTENT.7.RP.A.2.D Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate.
Unit:	Ratio and Proportions
Previously learned skills:	Setting up and solving ratios Complex Fraction Operations
Skills to be learned:	Verbal and written communication process of solving problems.
Links:	Powerpoint bit.ly/B1Q1R2019

Question 1-Sadie and Harry

1. Jafar runs one lap around a track, representing $\frac{1}{4}$ of a mile, in $1\frac{2}{3}$ minutes. How long, in minutes, will it take him to run one mile?

Miles/Minutes

Miles: ¼

Minutes: 1 ⅔ (5/3)

Answer: 20/3 (6 ⅔)

How we got our answer:
1- we had to decide how we wanted to tackle the problem (Did we want to do a proportion table or cross multiply?)
2- We decided that a proportion table was the best option, and we filled in all the information in the table.
3- After we did that, we saw and realized that if it takes him 1 ⅔ minutes to ¼ of a mile, then we should multiply 5/3 (Improper fraction) 4 times because you need 4/4 to make a whole, and that is how we got our answer.

Q: What do you think was the hardest part of setting up the problem?

A:The hardest part was seeing what we need to do to get the answer

Q: How did you know how to solve it correctly?

A:Our question told us what we had to do so we did it step by step from there

Q: what is a common mistake you can see someone making?

A: In this case, you can divide instead of multiplying if you don't set it up the right way. You could also forget to turn your answer into an improper fraction.

Question 7- Sadie

7. **Determine whether the decimal for $\frac{9}{15}$ will terminate or repeat.**

A. Terminate

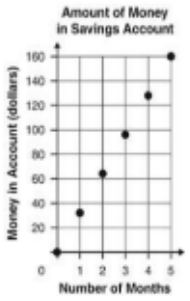
B. Repeat

The decimal for 9/15 will terminate. To change fractions to decimals, you divide the numerator by the denominator. 9 divided by 15 equals 0.6. Therefore, the answer must terminate because it is 0.6.

1) The hardest part of setting up the problem was remembering the equation for changing a fraction to a decimal.
2) I knew how to solve it correctly because of the time when we wrote all of the ways to solve percents to fractions, fractions to decimals, and decimals to percents.
3) It would be easy to divide 15 by 9 instead of 9 by 15.

Question 12- Emmanuel

12. Jeremy started a savings account and deposited the same amount of money each month into his account.



Which is closest to the amount of money Jeremy deposits each month?

A. $27
B. $32
C. $96
D. $160

I did 160 divided by 5, because it was going to give me the amount that was closest to one of the answer choices. 160 is my y, 5 is my x. To find COP k=y/x.

Also, I did 160 into 5 instead of 60 into 2, because it it going to go into one of the answer choices perfectly. The hardest part of setting up the problem is choosing which number to divide

A common mistake is people choosing 20 and 1 and it is closer to 27 which is answer choice A
I knew how to solve this problem correctly because it was a COP problem and k=y/x

Quarterly Review Activity Rubric[7]
Name(s):_____
Question:_____

	1	2	3	4	5
I state my claim by answering the question.	Incorrectly solved, little explanation	Incorrectly solved, lacking explanation	Correct solved, little explanation	Correct solved, lacking explanation	Correctly solved, clear explanation
Written explanation length.	1 sentence	2 sentences	3 sentences	3+ sentences	3+ sentences and able easy to understand
I use specific math words, numbers, equations, diagrams, and/or symbols.	No vocabulary	Little vocabulary	A few key vocabulary words	Consistent vocabulary	Consistent and relevant vocabulary
I use the information from the problem to support my claim.	Unable to answer	Lacking clear answer and response	Developing answer and response	Thoughtful answers with lacking response	Thoughtful answers with clear response

Total points:_____/20

*If working with a partner, you are responsible for sharing the responsibilities.

Partner Responsibilities (What did you do?)

Partner 1 Name:_____	Partner 2 Name:_____

Introduction to Positive and Negative Integers Warm Up

Logic:	The logic behind this activity is to see what students already know about positive and negative integers. Students should have a basic concept of positive and negative integers.
Writing Skills:	Argumentative
Common Core Standard:	Apply and extend previous understandings of operations with fractions. CCSS.MATH.CONTENT.7.NS.A.1 Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram. CCSS.MATH.CONTENT.7.NS.A.1.A Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged*. CCSS.MATH.CONTENT.7.NS.A.1.B Understand $p + q$ as the number located a distance $\|q\|$ from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts. CCSS.MATH.CONTENT.7.NS.A.1.C Understand subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts. CCSS.MATH.CONTENT.7.NS.A.1.D Apply properties of operations as strategies to add and subtract rational numbers. CCSS.MATH.CONTENT.7.NS.A.2

	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. CCSS.MATH.CONTENT.7.NS.A.2.A Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (-1)(-1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts. CCSS.MATH.CONTENT.7.NS.A.2.B Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers, then $-(p/q) = (-p)/q = p/(-q)$. Interpret quotients of rational numbers by describing real-world contexts. CCSS.MATH.CONTENT.7.NS.A.2.C Apply properties of operations as strategies to multiply and divide rational numbers. CCSS.MATH.CONTENT.7.NS.A.2.D Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats. CCSS.MATH.CONTENT.7.NS.A.3 Solve real-world and mathematical problems involving the four operations with rational numbers.1
Unit:	Rational Number System
Previously learned skills:	The value of positive and negative numbers.
Skills to be learned:	Verbal and written communication process of solving problems.

Positive and Negative Integer Warm Up

Answer the follow questions and use the prompts:

A agree because_____.

I do not agree because_____.

When you multiple by a negative number, your answer will always be negative.

When you add a negative number, it is the same as subtracting the number's absolute value?

Positive and Negative Integer Warm Up

Answer the follow questions and use the prompts:

A agree because_____.

I do not agree because_____.

When you multiple by a negative number, your answer will always be negative.

I disagree because if you multiple by one other negative number, you answer will be positive. Because 2 negative numbers multiplied by themselves if positive. But if you have an odd number of negative numbers to multiple, your answer will be negative.

When you add a negative number, it is the same as subtracting the number's absolute value?

I agree because if I try 7+(-8)= I get -1. And if I try 7 - (the absolute value of -8) that means 7- a positive 8 and that is -1.

Introduction to Positive and Negative Integers Warm Up

Logic:	The logic behind this activity is to challenge students ideas on statistics as well as have students think deeply about ideas garnering their lives.
Writing Skills:	Creative
Common Core Standard:	CCSS.MATH.CONTENT.7.SP.A.1 Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences. Investigate chance processes and develop, use, and evaluate probability models. CCSS.MATH.CONTENT.7.SP.C.5 Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event. CCSS.MATH.CONTENT.7.SP.C.6 Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.
Unit:	Statistics and Probability
Previously learned skills:	Basic understanding of statistics and probability.
Skills to be learned:	Verbal and written communication process of solving problems.

The Importance of Statistics

Statistics are used in everyday life decision whether you know it or not. From the amount of movie theaters a movie is released into all the way to how the first spaceship made it to the moon.

Given the following scenarios, describe why you believe or do not believe it is mathematically relevant.

1) 4 out of 5 dentists recommend Colgate toothpaste.

   _____
   _____

2) If you are more likely to be killed by a cow than a shark (20 times more likely!) why are more people afraid to go into the ocean than go to a petting zoo?

   _____
   _____

3) If you were given a choice of rolling a dice where rolling a 1-3 would guarantee $1,000,000 and rolling 4-6 would guarantee never being able to obtain the one thing you want in life, would you roll?

   _____
   _____

Appendix 1

Analyze proportional relationships and use them to solve real-world and mathematical problems.

CCSS.MATH.CONTENT.7.RP.A.1

Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction 1/2/1/4 miles per hour, equivalently 2 miles per hour.

CCSS.MATH.CONTENT.7.RP.A.2

Recognize and represent proportional relationships between quantities.

CCSS.MATH.CONTENT.7.RP.A.2.A

Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.

CCSS.MATH.CONTENT.7.RP.A.2.B

Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

CCSS.MATH.CONTENT.7.RP.A.2.C

Represent proportional relationships by equations. For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as $t = pn$.

CCSS.MATH.CONTENT.7.RP.A.2.D

Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate.

CCSS.MATH.CONTENT.7.RP.A.3

Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.

Use random sampling to draw inferences about a population.

CCSS.MATH.CONTENT.7.SP.A.1

Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the

sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.

CCSS.MATH.CONTENT.7.SP.A.2

Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.

Draw informal comparative inferences about two populations.

CCSS.MATH.CONTENT.7.SP.B.3

Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.

CCSS.MATH.CONTENT.7.SP.B.4

Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.

Investigate chance processes and develop, use, and evaluate probability models.

CCSS.MATH.CONTENT.7.SP.C.5

Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.

CCSS.MATH.CONTENT.7.SP.C.6

Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.

CCSS.MATH.CONTENT.7.SP.C.7

Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.

CCSS.MATH.CONTENT.7.SP.C.7.A

Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.

CCSS.MATH.CONTENT.7.SP.C.7.B

Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?

CCSS.MATH.CONTENT.7.SP.C.8

Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.

CCSS.MATH.CONTENT.7.SP.C.8.A

Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.

CCSS.MATH.CONTENT.7.SP.C.8.B

Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.

CCSS.MATH.CONTENT.7.SP.C.8.C

Design and use a simulation to generate frequencies for compound events. For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?

Notes

1 Casa, Tutita M., Janine M. Firmender, June M.Cahill, Fabiana Cardetti, Jeffery M. Choppin, Jeremy Cohen, Shelby Cole, Madelynn W.Colonnese, Juanita Copley, Michael DiCicco, Jack Dieckmann,Jennifer Dorl, M. KatherineGavin, Michael A. Hebert, Karen S. Karp, Erika LaBella, Judith. Moschkovich, KarenMoylan, Natalie G. Olinghouse, Sarah R.Powell, Erin Price, David Pugalee, BetsyRupp Fulwiler, Linda J. Sheffield, and RileyZawodniak. 2016. Types of and Purposes for Elementary Mathematical Writing: Task Force Recommendations. Retrieved from http://Mathwriting.education.uconn.edu

2 Cohn-Vargas, Becki. "Identity Safe Classrooms and Schools." *Teaching Tolerence*, April 20, 2015.

3 d'Ambrosio, Ubiratan. "What is ethnomathematics, and how can it help children in schools?." *Teaching children mathematics* 7, no. 6 (2001): 308-308.

4 Evens, Hilary, and Jenny Houssart. "Categorizing Pupils Written Answers to a Mathematics Test Question: I Know but I Can't Explain." *Educational Research* 46, no. 3 (2004): 269–82. https://doi.org/10.1080/0013188042000277331.

5 Fast, Lisa A., James L. Lewis, Michael J. Bryant, Kathleen A. Bocian, Richard A. Cardullo, Michael Rettig, and Kimberly A. Hammond. "Does math self-efficacy mediate the effect of the perceived classroom environment on standardized math test performance?." Journal of Educational Psychology 102, no. 3 (2010): 729.

6 Goman, Carol Kinsey. "Has Technology Killed Face-To-Face Communication?" Forbes. Forbes Magazine, November 14, 2018. https://www.forbes.com/sites/carolkinseygoman/2018/11/14/has-technology-killed-face-to-face-communication/#5a72da63a8cc.

7 Lemay, Steven. "Student Math Argumentation Rubric." Bridging Practices among Connecticut Mathematics Educators. University of Connecticut , July 19, 2015. https://bridges.education.uconn.edu/2015/07/19/student-math-argumentation-rubric/.

8 Niemiec, Christopher P., and Richard M. Ryan. "Autonomy, competence, and relatedness in the classroom: Applying self-determination theory to educational practice." *Theory and research in Education* 7, no. 2 (2009): 133-144.

9 Rumsey, Chepina, and Cynthia W. Langrall. “Promoting Mathematical Argumentation.” *Teaching Children Mathematics* 22, no. 7 (March 2016): 412. https://doi.org/10.5951/teacchilmath.22.7.0412.
Russell, S.J., Economopoulos, K., Wittenberg, L., et al. Investigations in Number, Data, and Space®, Second Edition. Glenview: “Crazy Cakes” Pearson, 2008.

10 "Piedmont Open Middle in Charlotte, North Carolina." Piedmont Ib. Middle in Charlotte, NC | StartClass. 2019. Accessed October 21, 2019. http://public-schools.startclass.com/l/66873/Piedmont-Open-Middle.

Annotated Bibliography

Casa, Tutita M., Janine M. Firmender, June M.Cahill, Fabiana Cardetti, Jeffery M. Choppin, Jeremy Cohen, Shelby Cole, Madelynn W.Colonnese, Juanita Copley, Michael DiCicco, Jack Dieckmann,Jennifer Dorl, M. KatherineGavin, Michael A. Hebert, Karen S. Karp, Erika LaBella, Judith. Moschkovich, KarenMoylan, Natalie G. Olinghouse, Sarah R.Powell, Erin Price, David Pugalee, BetsyRupp Fulwiler, Linda J. Sheffield, and RileyZawodniak. 2016. Types of and Purposes for Elementary Mathematical Writing: Task Force Recommendations. Retrieved from http://Mathwriting.education.uconn.edu
This source lays out the foundation of the 4 types of writing for mathematical writing. It is geared towards the elementary level but teachers can modify to fit their grade level needs.

d'Ambrosio, Ubiratan. "What is ethnomathematics, and how can it help children in schools?." *Teaching children mathematics* 7, no. 6 (2001): 308-308.
Ethnomathematics is a term coined by d'Ambrosio to mean real world problems and the systematic ways math is set up to solve everyday problems. While there is a systematic way to solve problems in the classroom, ethnomathematics explores the short cuts we can take. Such as calculating 20% tip. We could move the decimal of our bill, one to the left and multiply by two instead of sitting at the table and making a proportion.

Goman, Carol Kinsey. "Has Technology Killed Face-To-Face Communication?" Forbes. Forbes Magazine, November 14, 2018. https://www.forbes.com/sites/carolkinseygoman/2018/11/14/has-technology-killed-face-to-face-communication/#5a72da63a8cc
This source could be a great read and discussion with students in the classroom on their perception of technology. There is a generational shift between employers and employees and it will only get greater until the later generation retires and is replaced by those raised on technology.

Fast, Lisa A., James L. Lewis, Michael J. Bryant, Kathleen A. Bocian, Richard A. Cardullo, Michael Rettig, and Kimberly A. Hammond. "Does math self-efficacy mediate the effect of the perceived classroom environment on standardized math test performance?." Journal of Educational Psychology 102, no. 3 (2010): 729.
This article asks of the idea of how a student feels and contributes in their math classes, effects the classroom environment and ultimately their end of year tests scores. The short answer is yes but this article takes a much deeper dive.

Niemiec, Christopher P., and Richard M. Ryan. "Autonomy, competence, and relatedness in the classroom: Applying self-determination theory to educational practice." *Theory and research in Education* 7, no. 2 (2009): 133-144.

Autonomy in the classroom is important for students to learn and master skills on their own. Without autonomy, teachers would be doing all of the work while students simply take notes and do not absorb the classroom information.