Title: Skittles Probability

Author: Keelie Kish

Date and Time of Lesson: March 24, 2015 1:50pm-2:30pm

Grade Level: 7th Grade

Lesson Source: GO Math: Independent/Dependent Events

Texas Essential Knowledge and Skills (Process and Concept TEKS):

7.1 Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:

E. Create and use representations to organize, record, and communicate mathematical ideas;

7.6 Proportionality. The student applies mathematical process standards to use probability and statistics to describe or solve problems involving proportional relationships. The student is expected to:

D. Make predictions and determine solutions using theoretical probability for simple and compound events

E. Find the probabilities of a simple event and its complement and describe the relationship between the two

H. Solve problems using qualitative and quantitative predictions and comparisons from simple experiments

English Language Proficiency Standard (learning strategies, listening, speaking, reading or writing):

3) Cross-curricular second language acquisition/speaking. The ELL speaks in a variety of modes for a variety of purposes with an awareness of different language registers (formal/informal) using vocabulary with increasing fluency and accuracy in language arts and all content areas. ELLs may be at the beginning, intermediate, advanced, or advanced high stage of English language acquisition in speaking. In order for the ELL to meet grade-level learning expectations across the foundation and enrichment curriculum, all instruction delivered in English must be linguistically accommodated (communicated, sequenced, and scaffold) commensurate with the student's level of English language proficiency. The student is expected to:

(A) practice producing sounds of newly acquired vocabulary such as long and short vowels, silent letters, and consonant clusters to pronounce English words in a manner that is increasingly comprehensible.

Student Sentence Stem:

The difference between theoretical and experimental probability is…?

Finding the theoretical probability is useful because…?

Concepts Statement:

- Students will determine the difference between theoretical and experimental probability.
- Theoretical - Ratio of the number of ways an event can occur to the total number of equally likely outcomes using math formulas
- Experimental – Ratio of number of times an event occurs to the total number of trials or times the activity is preformed by conducting an experiment and collecting data.
- Students will find the probability of an event using [event]/total to find a probability between 0 and 1.
- Students will convert decimal ratios to percentages by multiplying the decimal by 100.
- Students will learn vocab words independent and dependent events and apply them to calculate probability.
- Independent events- two or more events in which the outcome of one event DOES NOT effect the outcome of the other event(s).
- Dependent events - two or more events in which the outcome of one event DOES effect the outcome of the other event(s).

Objectives:

SWBAT represent probability of a situation as a number between 0 and 1

SWBAT find the theoretical probability given a specific sample size

SWBAT calculate the experimental probability using data that was collected in an experiment.

Appropriateness of Lesson to the Grade Level:

This is very appropriate for a 7^{th} grade class. The material being introduced is with-in their 7^{th} grade TEKS. The use of skittles is very engaging for them and will keep their attention throughout the lesson. This lesson is hands on which will keep them actively engaged and less likely to be distracted by other things around the classroom. By having them work in groups of 2, they will feed off each others idea and learn to interact with others in a working environment which is a key skill to learn at this age.

Materials List:

15 W/S of each handout cut in half (30 total)

15 zip lock bags

30 bags of skittles

Pack of sticky notes (5 different colors per group of 2)

iPad (classroom set)

Advanced Preparations:

Pull up the pie Chart maker online before class (www.meta-chart.com)
Upload "Outfit Combinations" to the each iPad
Put two bags of skittles in each zip lock bag. One bag for every 2 students
Assort the colored sickies before hand (one for every color of skittles)

Safety:

Don't eat the skittles!

ENGAGEMENT		**Time:5 Min**
What the Teacher Will Do	**Probing/Eliciting Questions**	**Student Responses and (*Misconceptions*)**
Teacher will hand out pre-test. Remind the students that this is to be completed individually and to put their names on the top of their paper and turned in when they are finished.	Is this group work? Why or why not?	No, this is your own work to show how much you already know and at the end we will take a post check to see how much we have learned.
Teacher will instruct students to open up the PHET simulation "Outfit Combination" on their iPads.	What are the chances that he wears a red shirt?	1/3
	What are the chances he will wear a hat? Not wear a hat?	2/3, 1/3
Students will be asked to observe how different combinations are made and the chances a specific shirt/pant/accessory will appear.	How many different outfit combinations are there?	Counted number of options = 27
	How do the number of different clothing items relate to the total number of different outfit combinations?	*Incorrect: Add the number of clothing articles: 3+3+3 = 9* Multiply all the options: 3*3*3 = 27 = 3^3

	Probability is between what 2 numbers?	0% and 100% 0 - 1 (event number and 100)
Tell students that we will be calculating what should happen vs. what actually happens today using skittles!	What is the difference between theoretical and experimental probability.	**Theoretical** = probability you should get using math formulas **Experimental** = probability using data collected. (T=percentage number and E=decimal number)

EXPLORATION		**Time: 20 Min**
What the Teacher Will Do	**Probing/Eliciting Questions**	**Student Responses and Misconceptions**
Teacher will hand out paper ("Skittles Probability") and one zip-lock bag of skittles to each group (2 per group).		
Tell students that Skittles makes the same number of red, yellow, green, purple, and orange skittles. Ask students to predict theoretical probability in decimal form and percentage. Students should then input this data into their iPads. Teacher will also input the data and show on the overhead.	How do you find ratio? What is the theoretical probability that you will choose a red skittle? Using theoretical probability, what color are you most likely to choose? Least likely? How does everyone's pie chart look compared to your other classmates? Explain.	Number of (blank) skittles / Total number of skittles 1/5 Both are the same because Skittles makes the same number of all colors (more red because I like red) The same because theoretical is the same for everyone. 1/5 for each color skittle. *Incorrect: Different because we have different bags of skittles*

Students should not open bag and NOT EAT any skittles. On the 2nd part of the handout they should fill in the Total skittles: Once they do that, Have students count how many of each color skittles they have and record under "Number of skittles". On the board, teacher will write, "Red, Orange, Yellow, Green, Blue" to form columns. When students have finished, have them write down how many of each color skittles they had in the bag on a sticky note and stick them on the board under the correct color. When finished teacher should ask students to find the ratio of each color of skittles to the total number of skittles in the bag. (Tell students not to divide this number, just put the fraction)	How do you find the ratio? How is this ratio different from the ratio we got in the first part of the lesson? What is theoretical probability? What is experimental probability?	Number of [color] skittles / total skittles NOT: 1/5 It is not exactly the same. Some have more the 20% of the skittles, others have less. Theoretical - Ratio of the number of ways an event can occur to the total number of equally likely outcomes using math equations Experimental – Ratio of number of times an event occurs to the total number of trials or times the activity is preformed found by conducting experiments and using data collected.

EXPLANATION		**Time:10 Min**
What the Teacher Will Do	**Probing/Eliciting Questions**	**Student Responses and Misconceptions**
Students will look at the board and add up the number of skittles under each color. Then they will find the total number of skittles. Teacher will ask them	What is the theoretical probability of choosing a red skittle out of the whole class? What is the experimental probability of choosing a green skittle out of the whole	1/5 *Incorrect: add up total green out of class total* Number of total green skittles out of total. *Incorrect: green skittles out of 100*

calculate the ratio of the whole classes skittles and teacher will fill out the same worksheet as them in front of the class using the classes data.	class?	
Teacher will then ask students how to calculate probability in decimal form, and percentage. After seeing the teacher perform this procedure on the board, students should do the same with their own data and fill in the blanks on their own paper.	How do we find the experimental probability of getting a red? How do you represent that as a percentage and as a decimal? What does the probability of choosing a red skittle mean? How do we represent the probability as a percentage? What is theoretical probability? What is experimental probability? How did you find experimental probability? If Skittles found that more people liked red	Number of red skittles/ Total number of skittles Percentage = decimal (x100) Probability-The likely hood of you will choose a red skittle of a certain number of skittles Probability x 100 Theoretical - Ratio of the number of ways an event can occur to the total number of equally likely outcomes using math equations Experimental – Ratio of number of times an event occurs to the total number of trials or times the activity is preformed found by conducting experiments and using data collected. Found number of [color] skittles and divided it by the total number of skittles in the bag. Yes it would. There would then be a 2/6 chance that you would pick a red.

	skittles, and they doubled the amount of red skittles in the bag, would theoretical probability change? If yes, how so? What chart can best display probability? What other graphs be used to show percentage?	*Incorrect: 2/5, no* Pie chart Bar chart Pictogram *if they answer other charts, have students explain their reasoning behind it.
Have students label the left half page "Theoretical Probability" and the right half page, "Experimental Probability" Students will now input their data into the iPad. Teacher will use technology to display the results using an online pie chart and the class probability of skittles to show the differences between experimental and theoretical probability.	How is this the 1st page percentage different than the 2nd page percentage? How does the theoretical pie chart compare to the experimental pie chart?	1st page = probability of choosing each color is the same, 20% 2nd page = probability of choosing a color differs from .20 **Experimental pie chart is not even. Some pie sections are bigger than the others.** *Incorrect: They look the same.*

ELABORATION		**Time:10 Min**
What the Teacher Will Do	**Probing/Eliciting Questions**	**Student Responses and Misconceptions**
Hand out "Elaborate Theoretical Probability" handout to students. Students will work individually first and then teachers will go over answers on the board. Teacher will show paper on the overhead and call on	Are these questions experimental or theoretical probability questions? Why is this theoretical probability? How could these	Theoretical Haven't performed the experiment yet. Must be given data that

students to answer the questions and ask how they found their answers.	questions be turned into experimental questions? Give an example. How do you determine the sample size? How does taking an object out without replacing it affect the probability?	was collected by an experiment. "A student rolled a 5, 14 times out of 20. What is the experimental data?" Sample size is the total number of "things" you have *Incorrect: always 100* You must take that "object" out of total objects and whatever event it was associated with. *Incorrect: Doesn't matter if you replace it or not*

EVLUATION		**Time:10 Min**
What the Teacher Will Do	**Probing/Eliciting Questions**	**Student Responses and Misconceptions**
Hand out half worksheet to students. Have them complete it individually and turn it in after they're done. Remind them to put their names on their paper!	What do you do after you are finished?	Turn it in to the teacher.
After they are done, they can "dispose of the skittles" (eat them)		

NAME: _____

The following data was collected by a student by rolling a 6 sided die.

Outcome	Frequency
1	14
2	18
3	10
4	22
5	20
6	16
TOTAL:	100

a. What is the experimental probability of rolling a 4?

b. What is the theoretical probability of rolling a 4?

c. Experimental probability of less than 4? (1, 2, or 3)

d. What percentage of the rolls were a 6?

PRETEST - KEY

The following data was collected by a student by rolling a 6 sided die.

Outcome	Frequency
1	14
2	18
3	10
4	22
5	20
6	16
TOTAL:	100

a. What is the experimental probability of rolling a 4?
.22

b. What is the theoretical probability of rolling a 4?
1/6, .166667

c. Experimental probability of less than 4? (1, 2, or 3)
.42

d. What percentage of the rolls were a 6?
16%

Skittles Probability

Skittles factor produces the same number of red, orange, yellow, green, and purple skittles in their factory every day. In each pack of skittles, there is supposed to be 15 skittles.

The zip-lock bag in front of you has 2 bags of skittles in it. How many skittles should there be in the bag? _____
(Place this number in the box with *** at the top)

Using the information above, calculate the **Theoretical** Probability of each individual color of Skittles in the zip-lock bag.

	Number of skittles per zip-lock bag	Probability	Percentage
Red			
Orange			
Yellow			
Green			
Purple			
Total:	***	**1.00**	**100%**

Without taking the skittles out of your zip-lock bag, **count** how many red, orange, yellow, green, and purple skittles are in your bag and **record** your findings under "Number of Skittles".
Add these numbers up and find the total number of Skittles in your bag.

Using this information, calculate the **Experimental** Probability of each individual color of skittles in the bag.

	Number of Skittles	# of Skittles ------ Total Skittles	Probability (decimal form)	Percentage
Red				
Orange				
Yellow				
Green				
Purple				
Total:				

Calculate the **Experimental Probability** for the entire class below.

	Number of Skittles	**# of Skittles ------ Total Skittles**	**Probability (decimal form)**	**Percentage**
Red				
Orange				
Yellow				
Green				
Purple				
Total:				

Calculate the **Experimental Probability** for the entire class below.

	Number of Skittles	**# of Skittles ------ Total Skittles**	**Probability (decimal form)**	**Percentage**
Red				
Orange				
Yellow				
Green				
Purple				
Total:				

Theoretical Probability

Probability Word Problems

Name: _____ **Date:** _____

(1) Each of the letters in the word VANQUISH are on separate cards face down on the table. If you pick a card at random, what is the probability that the letter on it will fall within the range of "H" and "S" in the alphabet?

(2) You roll a 19-sided die (having values one through 19 on its faces). What is the probability that the value of the roll will be an even number?

(3) A gumball machine contains 20 pink gumballs, 18 green gumballs, and 10 blue gumballs. What is the probability that the next gumball that comes out will be neither pink nor green?

(4) You ask a friend to think of a number from 9 to 15. What is the probability that his number will be a multiple of three?

(5) You pick one card from a standard deck. What is the probability that the card will be a black card higher than eight?

(6) A jar contains 6 orange, 2 yellow, and 5 pink marbles. If you pick one without looking, what is the probability that the marble you pick will be neither orange nor yellow?

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Theoretical Probability

Probability Word Problems

Name: _____ **Date:** _____

(1) Each of the letters in the word VANQUISH are on separate cards face down on the table. If you pick a card at random, what is the probability that the letter on it will fall within the range of "H" and "S" in the alphabet?

5 out of 8 letters, or 62.5%

(2) You roll a 19-sided die (having values one through 19 on its faces). What is the probability that the value of the roll will be an even number?

9 out of 19 sides, or 47.4%

(3) A gumball machine contains 20 pink gumballs, 18 green gumballs, and 10 blue gumballs. What is the probability that the next gumball that comes out will be neither pink nor green?

10 out of 48 gumballs, or 20.8%

(4) You ask a friend to think of a number from 9 to 15. What is the probability that his number will be a multiple of three?

3 out of 7 numbers, or 42.9%

(5) You pick one card from a standard deck. What is the probability that the card will be a black card higher than eight?

12 out of 52 cards, or 23.1%

(6) A jar contains 6 orange, 2 yellow, and 5 pink marbles. If you pick one without looking, what is the probability that the marble you pick will be neither orange nor yellow?

5 out of 13 marbles, or 38.5%

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NAME: _____

Test Your Knowledge

A student rolls a six sided die 100 times. The number of times each number (1-6) was rolled is recorded below under "Frequency". Use this information to answer the questions below.

Dice side number	Frequency of rolls
1	16
2	20
3	22
4	10
5	18
6	14
Total rolls	100

a. What is the experimental probability of rolling a 3?

b. What is the theoretical probability of rolling a three?

c. What is the theoretical probability of rolling less than 3? (1 or 2)

d. What percentage of the total rolls were a 5?

NAME: _____

Test Your Knowledge

A student rolls a six sided die 100 times. The number of times each number (1-6) was rolled is recorded below under "Frequency". Use this information to answer the questions below.

Dice side number	Frequency of rolls
1	16
2	20
3	22
4	10
5	18
6	14
Total rolls	100

a. What is the experimental probability of rolling a 3?

b. What is the theoretical probability of rolling a three?

c. What is the theoretical probability of rolling less than 3? (1 or 2)

d. What percentage of the total rolls were a 5?

Exit Ticket - Key

Outcome	Frequency
1	16
2	20
3	22
4	10
5	18
6	14
Total	**100**

a. Rolling a 3 (use the table)

$\frac{22}{100} = 0.22 = 22\%$

b. What is the theoretical probability of rolling a 3?

$\frac{1}{6} = 0.166666\ldots \approx 17\%$

c. Rolling a number less than 3 (use the table)

(Rolling a 1 or 2) $\frac{36}{100} = 0.36 = 36\%$

d. Rolling a 3 or a 5 (use the table)

$\frac{40}{100} = 0.40 = 40\%$