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Title of Lesson : Interactions with Normal Distribution Curve

Grade Level(s) : Grade 11

Content Area : Algebra II

Unit Topic : Patterns in Variation

**Backward Design Overview**

The student will be able to form a conjecture based on performing an experiment. The student should know that a Normal Distribution curve follows a bell-shaped curve. The student should know that by increasing the number of trials in an experiment and the probabilities, the data should behave like a Normal curve. The student will be able to understand that in a spinner, the data will follow a normal curve if the area of the regions in a spinner don't have 1-1 ratio.

The students will show mastery of the content through experimenting with a spinner online to determine how a normal curve can occur.

**What will you accept as evidence?**

After the students have worked individually on an experiment, they will be able to explain in a journal that a normal distribution curve will occur if the area of the regions on the spinner are organized in a certain manner, and that the areas of each region, moving clockwise on the spinner have to be in 1: 2: 3; ...: 3:2:1 ratio.

**Essential Question(s):**

Given a spinner and a multiple number of spins, how can we organize the data so that the data follows a Normal Distribution curve?

**Standards**

**New York State Learning Standards and Key Ideas**

**Mathematics, Science, and Technology- Standard 3**

Students will:
• understand the concepts of and become proficient with the skills of mathematics;
• communicate and reason mathematically;
• become problem solvers by using appropriate tools and strategies;

through the integrated study of number sense and operations, algebra, geometry, measurement, and statistics and probability.

Problem Solving Strand:

_Students will build new mathematical knowledge through problem solving._

A2.PS.3

Observe and explain patterns to formulate generalizations and conjectures

Statistics and Probability Strand

_Students will collect, organize, display, and analyze data._

A2.S.5

Know and apply the characteristics of the normal distribution

**Objectives**

**Student-Centered Instructional Objectives and Bloom's Taxonomy**

• Explain why the regions in the spinner can't be in equal ratios in order for the data to be normally distributed (Comprehension).
• Given a table of data, the student will be able to graph a histogram and a normal distribution curve (Application).
• Explain the characteristics of a normal distribution curve, such as symmetry and where the mean and standard deviation lie (Comprehension).

**Materials**

_I will need the following materials:_

A computer with internet access

Class worksheet: *Normal Distribution through Interaction Activity Classwork Sheet*
Student Adaptations

Adaptations

One of the students in the class is hearing impaired, so besides repeating all instructions, I will have all directions written on the board and on paper given to all students. So if the hearing impaired student can't hear me, he/she will be able to read the instructions.

Lesson

The Anticipatory Set

As the students enter the computer lab and take their seats, I will hand out the class work sheet. I will have one student come up to the main computer that projects on a screen and have him/her take the class through the instructions written on the top of the page. The task sheet will be used for doing the whole experiment. The task sheet will give instructions to go to a website to perform multiple spins on a spinner and to check if the histogram that's created is normally distributed. In the beginning, the spinner will start with 5 different regions, all of equal area. The needle on the spinner moves clockwise. So with exploring the five equal regions, students will perform 30 spins and see if the data follows a normal curve; it won't, all of the data in the region should create a flat line. The students will then draw their histograms for the five regions.

Moreover, the students will then increase the number of regions to 6, then 7, on the spinner and perform an additional 30 spins to see if there is any change; there shouldn't be any change. Again, I'll ask them to graph the histogram they created.
After, the task sheet will pose a question to the students: How can we get the data to fit a normal curve? The students will then write down a conjecture and they'll see if they're conjecture is right by performing the experiment again using 30 spins.

Finally, the worksheet will pose the following instruction: Now change the size of the different regions again and determine whether there is change in your histogram and whether the data is normally distributed.

**Conclusion**

As the class comes to an end, I will starting facilitating a discussion among the class beginning with: "What do you think we can do to force our data to fit a normal distribution curve?" As the class discuses different possibilities, we will come up with one conclusion at the end.

"So here is what the conclusion of the class is: in order to have the data fit a normal curve, the regions can't be in the same ratio. Also, the largest region has to be strategically placed on the spinner such that it when the spins are performed, the needle lands on the largest area the most."

Having said this, the class will write this conclusion in their journals.

As the student leave the class, I will hand out the homework, which is more practice of the same experiment, using different regions.
Normal Distribution through Interaction Activity Sheet

Directions:

2. Find the “Data Analysis and Probability - 9-12” Box, and click on it.
3. Scroll down to the Spinners interaction game, and click on it.
4. Once the applet appears, click the Record Results button; this will allow a histogram to be created.
5. A histogram window will appear, click on the Close button; now you’re ready to PLAY~ Enjoy!!
6. To change the area of any region or to add a new region, click on the Change Spinner button. The up and down arrows will increase and decrease the area of any region, respectively. To add a new region, you must have the cursor in the text box.
7. You’ll perform 3 trials consisting of 30 spins each. You’ll start with 5 equal regions, perform the thirty, draw the histogram below and decide whether the data fits a normal distribution curve. After, change the number of sections to 6 regions, then 7 regions.

Five Sections:

What can you notice about the histogram?

Does the data follow a Normal Curve?
Six Sections

What can you notice about the histogram?

Does the data follow a Normal Curve?

Seven Sections

What can you notice about the histogram?

Does the data follow a Normal Curve?
As you probably can tell, your data isn’t normally distributed. How can we get the data to fit a normal curve? Write your ideas below.

Now using your idea from above, perform the experiment again using 30 spins and determine if your idea is correct. Again, show your work below.

Draw the histogram.

Was your idea correct?

How many regions were used?

If your idea wasn’t correct, what else do you think we can do to have a normal curve?
Now change the area for each region and strategically place each region on the spinner so that a normal curve appears. Show what you did below.

How many regions were used?

What was the area of each region?

Draw the spinner below with where each region was placed on the spinner

Draw your histogram below:

Does your data fit a normal curve now?
Normal Distribution through Interaction Homework Sheet

Directions:

9. Find the “Data Analysis and Probability - 9-12” Box, and click on it.
10. Scroll down to the Spinners interaction game, and click on it.
11. Once the applet appears, click the Record Results button; this will allow a histogram to be created.
12. A histogram window will appear, click on the Close button; now you’re ready to PLAY~ Enjoy!!
13. To change the area of any region or to add a new region, click on the Change Spinner button. The up and down arrows will increase and decrease the area of any region, respectively. To add a new region, you must have the cursor in the text box.
14. You have below 2 options: either perform the experiment on 3 or 4 sections. You can also pick the number of trials you would like for your experiment. Note that there has to be more than one trial. Draw your histogram below and decide whether the data fits a normal curve.

Three Sections:

What can you notice about the histogram? Does the data follow a Normal Curve?
What can you notice about the histogram? Does the data follow a Normal Curve?

As you probably can tell, your data isn’t normally distributed. How can we get the data to fit a normal curve? Write your ideas below.
Now using your idea from above, perform the experiment again using 30 spins and determine if your idea is correct. Again, show your work below.

Was your idea correct?

How many regions were used?

If your idea wasn’t correct, what else do you think we can do to have a normal curve?

Now change the area for each region and strategically place each region on the spinner so that a normal curve appears. Show what you did below.

How many regions were used?

What was the area of each region?

Draw the spinner below with where each region was placed on the spinner
Draw your histogram below:

Does your data fit a normal curve now?