Lesson Plan
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Topic: What does the alphabet have to do with statistics?

Lesson Objectives: Students will be able to:

1. gather appropriate information for simple statistical analysis.
2. calculate the probability of picking any letter at random from a piece of printed material.
3. develop skills in calculating percentage probabilities.
4. evaluate his/her own research by comparing his/her results with those of other students and by answering related questions on the worksheets provided.
5. practice appropriate calculator skills and software usage.

Resources/Materials Needed:

1. book, magazine, newspaper, any piece of printed material
2. worksheets and a pencil
3. calculator
4. computer with Fathom software for Extension Activity

Activities and Procedures:

1. Introduce this lesson by playing Hangman with the class for approximately ten minutes. (Leave on the board for comparison and reference later.)
2. Ask questions such as: “Are there some letters that we use more than others?”, “Are there some we hardly use at all?”, “Can you predict the letters that would improve our chances of winning the Hangman game?”
3. Collecting data activity. Have students open their textbook or use various types of printed material such as magazines, newspapers, novels, technical manuals, etc. Choose a page and a place to begin at random. Begin to tally the letters one at a time, filling out the tally sheet provided. Start at the first word and read the letters left to right as you come to them.
4. Add up the totals, which should come to a grand total of three hundred letters.
5. Data Analysis Stage 1. Use a calculator to calculate the percentage probability of finding each letter, correct to one place behind the decimal point. Record the probability as a decimal and as a percent on the tally sheet. Have students compare their percentages with their neighbors to see if they roughly agree or not.

6. Data Analysis Stage 2. Construct a histogram representing the number of times each letter of the alphabet occurs in the data set. Have the students enter the letter number from the data sheet into L_1 and the frequency into L_2. Create a histogram using an appropriate window and bin width.
   Discuss: "Does the data you have on the worksheet correspond to what happened in the Hangman games on the board?"
7. Answer the remaining questions on the worksheet and discuss.

Extension Activity - Fathom Software

Students will be using the same reading passage from the earlier data collection activity. We are going to beak the data into two groups, vowels (a,e,i,o,u) and consonants (all the other letters). Make a prediction on whether vowels or consonants occur more often.

Software Instructions:

- Open Fathom program.
- Make a new Case table by dragging a new table off the shelf. Key in the word "Letter" into the attribute box labeled <new>. Key in the word "Type" as the second attribute.
- Drag a new graph off the shelf.
- Enter the information into the Case table. Key in each letter of the passage, making sure to key in a "v" for vowel {a,e,i,o,u} or "c" for consonants as the second attribute.
- After you have entered 2 or 3 sets of letters, drag the "Letter" attribute to the bottom of the graph and then watch the graph change as you enter each new letter.
- Drag a Summary table off the shelf. Drag both "Letter" and "Type" attributes to the vertical arrow of the table. This will show you how many of each letter is in your data collection and also how many total vowels and consonants are in the data set.
- Note: Letters that occur 0 times are not shown in the Summary table or on the graph.
- Compare Fathom Summary table results to the earlier written results.

Use the activity page provided to record your answers to the following questions. Calculate the percentage of vowels and consonants. Was your earlier prediction correct? Calculate the theoretical probability of getting a vowel in 300 letters and the theoretical probability of getting a consonant in 300 letters. How does this compare with the experimental probability?

West Virginia IGO's addressed by this lesson plan

8th Grade Mathematics:

8.25 investigate and describe the difference between the probability of an event found through simulation or experiment versus the theoretical probability of the same event.
8.26 extrapolate information from multiple-bar graphs, stem-and-leaf plots, histograms, scatterplots, tables, and frequency distributions.
8.27 analyze problem situations and use a statistical sampling to make predictions.
8.28 determine measures of central tendency (mean, median, mode, range), and dispersion form data, graph, tables, and experiments.
8.51 use a calculator to determine measure of central tendency, range, and dispersion from data, graphs, tables, and experiments.

Conceptual Mathematics:

CM.11 apply the basic probability rules in expressing the chances of events occurring using technology when appropriate.
CM.12 create an interpret data using various methods of displaying numerical data, including frequency distributions, graphs, histograms, stem-and-leaf plots, and box-and-whiskers plots, using technology when appropriate.
CM. 21 use a calculator to find measures of dispersions.

Algebra 1:

A1.5 solve literal equations (i.e. formulas) for a given variable and apply the skills toward solving practical problems and better equip students for calculator usage.
A1.6 analyze a given set of data for the existence of a pattern, represent the pattern algebraically and graphically, determine the domain and range, and determine if the relation is a function.

Technology IGO's:

A1.20, CM.18, and 8.46 use appropriate software to practice and master course instructional objectives.

Activity Sources

Site 1: www.learn.co.uk This site offers prerequisite skill practice as well as multiple math topics at different grade levels. This site seems to be student oriented. Sequential units are presented on a menu choice page so you can pick the subject you want to work on as well as the grade level. A link to a glossary is available if needed. The probability units range from "What is probability" to Calculating theoretical and experimental probability to Combined probability and tree diagrams. Topics are discussed using appropriate mathematical vocabulary and example problems with understandable solutions are presented.

Site 2: www.odci.gov/cia/ciakids This website provides an extension activity dealing with coded messages. Click on the link to Break the Code. On this page, you will find links to information sites on topics such as code history. The code breaker game itself can be found on this page. Hints are displayed on the game page. An answer key is available to check your solution.

Site 3: www.pbs.org/wgbh/nova/venona This website provides an extension activity involving the procedures of ciphering and decoding. Resources and Teacher's Guide links are available on this page. Click on the link to Decipher A Coded Message. An information page is displayed with links to other informational sites. You are given a cipher to figure out. You have an option to print the coded message so you can study it and then you can ask for hints and even display the uncoded message to see if your solution was correct.

Name _____ **Date** _____

What does the alphabet have to do with statistics?

Name of the book or magazine being used for your survey:
The page number(s):

Survey 300 letters

Letter	**Tally**	Frequency	Decimal	Percentage
1. A				
2. B				
3. C				
4. D				
5. E				
6. F				
7. G				
8. H				
9. I				
10. J				
11. K				
12. L				
13. M				
14. N				
15. O				
16. P				
17. Q				
18. R				
19. S				
20. T				
21. U				
22. V				
23. W				
24. X				
25. Y				
26. Z				
	Grand Total:	300		100%

Calculator Tip: To find the decimal and percentage

Frequency/Grand Total = Decimal
Decimal X 100 = Percentage

Complete the following:

TOP TEN LETTERS:

1. _____ _____%
2. _____ _____%
3. _____ _____%
4. _____ _____%
5. _____ _____%
6. _____ _____%
7. _____ _____%
8. _____ _____%
9. _____ _____%
10. ____ _____%

BOTTOM FIVE LETTERS:

22. _____ _____%
23. _____ _____%
24. _____ _____%
25. _____ _____%
26. _____ _____%

SURVEY QUESTIONS

1. How many vowels {a,e,i,o,u} are in the TOP TEN? _____
2. Which consonants would be the most useful in HANGMAN or WHEEL OF FORTUNE games?

   _____, _____, _____, _____, _____, _____
3. Which vowel might be the least useful? _____
4. What percentage of all the letters surveyed were vowels? _____
5. See if you can make ten different words using only the top five letters.

LETTERS OF THE ALPHABET
(Statistical Conclusions)

TRUE or FALSE:

1. You should never expect to find the letter Q on "The Wheel of Fortune"

   T F

2. Almost every word requires a vowel. T F

3. The letter K is useful when playing the games of "Hangman" and "Wheel of Fortune".

   T F

4. I and O are the most useful vowels. T F

5. The Top Ten letters account for about 75% of the letters needed to write in the English language.

   T F

6. The English language could get along fine without the letters J, Q, and X.

   T F

7. If you were producing stickers with the letters of the alphabet for use in labeling personal items, such as books, pens, bags, and bedroom doors, which of these letters would you need most? (Circle 5 letters)

   A B C D E
   F G H I J

8. To do a more accurate study for the above "alphabet stickers," I would need to make a survey of . . (Circle the best answer)

   (a) a popular magazine (b) a list of student names
   (c) a dictionary (d) a novel

9. In the game of "Scrabble," which of these letters would you expect to be worth the most points? Hint: the harder it is to use, the more points it is worth. (Circle the best answer)

   H V S

10. In "Scrabble," which of these letters would you expect to be worth only 1 point? (Circle the best answer)

    Q N K

Activity Page for Extension Activity – Fathom Software

1. Percentage of vowels _____ Percentage of consonants _____

2. Was your earlier prediction correct? _____

3. Theoretical probability of getting a vowel in 300 letters _____

   Theoretical probability of getting a consonant in 300 letters _____

4. Experimental probability of getting a vowel in 300 letters _____

   Experimental probability of getting a consonant in 300 letters _____

5. How do the theoretical and experimental probability compare for the vowels and the consonants?

Possible answers to the Survey Questions:

(1) Usually 4 or 5 are vowels.
(2) Usually R, S, T, L, N and one more.
(3) U
(4) About 30% to 40%
(5) Answers will vary.

Possible answers to the Letters of the Alphabet (Statistical Conclusions)

(1) False
(2) True
(3) True or False (K would be a good letter to use to make the game difficult)
(4) False (E is usually better)
(5) True
(6) True or False (How would you replace them?)
(7) A, E, H, I, plus one other
(8) Answers will vary. Answer (b) may not be the most useful since people like to label things with their name.
(9) V
(10) N