



# HOW LANGUAGE WORKS IN A CODE

Subject: Math | Current: 2010 | Grade: 9-12

Day: 1 of 3

**1 Purpose** ----- To show letter frequency in the English language

**2 Duration** ----- Approximately Two 55 Minute Class Periods

**3 Objectives** ----- At the conclusions of this lesson students will be able to:

- Use the class sample of data to predict the most frequently used letters in the English language and calculate the percent of frequency.
- Compare class data to outside sample data regarding percent of frequency.
- Use the data to predict how this might affect decoding a message

**4 Standards Addressed** ----- **MATHEMATICS**

**PROBABILITY AND STATISTICS:**

Create, compare, and evaluate different graphic displays of the same data, using histograms, frequency polygons, cumulative distribution functions, pie charts, scatter plots, stem-and-leaf plots, and box-and-whisker plots. Draw these by hand or use a computer spreadsheet programs.

**PS.1.1**

**INTEGRATED MATHEMATICS 1:**

Students find measures of the center and variability of a set of data, as well as construct and analyze data displays and plot least square regression lines.

**IM1.4**

Construct a frequency table for a set of data.

**IM1.4.10**



## BUSINESS MATH

Construct and interpret frequency distribution.

**BMTH.1.3.3**

## BUSINESS, MARKETING, & INFORMATION TECHNOLOGY

### INFORMATION TECHNOLOGY

Students demonstrate knowledge of communication standards for networks.

**IT.13.7**

Demonstrate knowledge of various encoding and framing methods (e.g., Manchester, B8Z8).

**IT.13.7.3**

Students demonstrate knowledge of data-encoding basics.

**IT.13.8**

Apply and convert amongst the four numbering systems binary, octal, hexadecimal, and decimal numbering systems.

**IT.13.8.1**

Demonstrate ASCII representation of characters.

**IT.13.8.2**

Convert between single byte, double byte, and multibyte coding structures (ASCII, EBCDIC, UNICODE).

**IT.13.8.3**

Describe the conversion of analog speech to digital.

**IT.13.8.4**

*Indiana Department of Education. (n.d.). Indiana Standards and Resources: Mathematics: Integrated Mathematics and Business Math; Business, Marketing, and Information Technology. Retrieved from <http://dc.doe.in.gov/Standards/AcademicStandards/StandardSearch.aspx>*

## 5 Vocabulary

----- Students will be able to use these terms:

- **Cipher:** Encoding based on a system of changing the order of letters or words or substituting letters or words with letters, words, numbers, or symbols according to a plan.
- **Cryptoanalysis:** The deciphering of codes.
- **Cryptogram:** A message in code or cipher.
- **Cryptographer:** Someone who write in code or studies codes and cipher systems.
- **Encoding:** Changing plain text into a code.
- **Decoding:** Changing coded text into plain text.



## 6 Materials ----- Library Book

## 7 Methods & Procedures ----- The lesson plan's course is as follows:

### A. Introduction

How many of you text message? Text messaging is a kind of code system where numbers can replace letters and sometimes letters are left out and left for the reader to decode. When you are texting, you are sending a cryptogram, a message in code or cipher. A cipher is an encoding based on the order of letters or words according to the "texting plan".

Someone who works with codes is a cryptographer. Cryptographers work for government, including the national Security Agency, military, and other intelligence operations. Cryptographers also work for private companies that need to keep information secret, especially information stored on a computer. Often when you buy something online and pay for it with a credit card, you will see the claim that the site is "secure." It is a cryptographer's job to make sure information is really "secret."

### B. Development

One of the things a cryptographer needs to be familiar with is the frequency with which letters occur in writing in the English language. In order to find out, each of you will need to count off 100 words in your library book.

You will need to make a frequency table for the 26 letters of the alphabet.

Before you begin to count letters, write down your guess as to:

- Which vowel(s) do you think occurs most often? Least often?
- Which consonant(s) do you think will occur most often? Least often?

After answering these questions, complete your frequency chart.

### C. Practice

After completing your frequency chart, compile a chart for your group (4 -6 students together).

When your group has compiled the data, select one member of your group to put the group information on the overhead. (Teacher will need to make a copy for each student for the next day's lesson).



## D. Independent Practice

As an assignment this evening, you will need to watch Wheel of Fortune. Make a list of the puzzles (excluding the winner's puzzle) and a frequency table for the letters used. Calculate the percent of each letter. How does that compare with what we observed in class? The contestant who participates in the winner's round is given some consonants and a vowel. What are they? Bring this information to class with you tomorrow so we can compare it to what we have found.

## E. Accommodations (Differentiated Instruction)

Students who are struggling may need to have a frequency chart template and some assistance in getting started. For gifted/high ability students, having them compare letter frequency over time on Wheel of Fortune might provide some additional data and an interesting project. They may also want to look at letter frequency in different genre to see if there is a significant difference.

## F. Checking for Understanding

Looking at the classes' chart and without doing any formal calculations, what observations can you make?

## 8 Teacher Reflection

----- The teacher will complete this after teaching the lesson.

## 9 Media & Resources

----- Library Book, Wheel of Fortune - NBC

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