Standard Indicator
7.1.11

Break the Code!

Purpose

Students will illustrate how numbers can be represented by using sequences of only two symbols, such as 1 and 0 or on or off, and how that affects the storage of information in our society.

Materials

For the teacher: chalk, chalkboard
For each student: copy of Black Line Master (BLM) *Break the Code!*, pencil, graph paper

Activity

A. Pre-Activity Discussion

1. Write the following statements on the board:
   - 0010=2
   - 0110=6
   - 1001=9
2. Ask students if they can determine how you arrived at the numerical values, given a code of just 1s and 0s.
3. Distribute the BLM *Break the Code!* to each student. With the help of the BLM, explain how the binary code works.
4. Explain how numbers can be represented by using sequences of only two symbols, such as 1 and 0.
5. Discuss how each place in the sequence of 1s and 0s represents a particular number (e.g., 8, 4, 2, and 1), based on a power of two.
6. Ask students: "What is the highest numeric value you can represent using only four place values? Can you guess what the highest possible numeric value would be using five place values?"
7. Give students some sample "codes" to decipher.

B. Activity

1. Direct students to the *Digit Decoder* on the BLM. Explain that binary code can be used to represent letters of the alphabet.
2. Tell students that there is a coded message on the BLM. Challenge students to use the decoder to crack the code. Monitor students as they work.
3. Once the message is decoded, discuss with students how numbers and letters can be represented by using sequences of only two symbols.

(continued)

INCORPORATING **TECHNOLOGY**

Direct students to this interactive Web site to learn more about computers in technology: www.brainpop.com/tech/computeranddigital/binary/index.weml.

EXTENDING THE **ACTIVITY**

Have students research different industries to find out how they use the binary code to produce pictures, sounds, words, and numbers.

Standards Links
7.1.9, 7.1.10

Activity (continued)

4. As a class, discuss how computers do not use the same symbols for numbers and letters that we use to read and write. Explain that computers read even the most complicated information using 1s and 0s.
5. Challenge each student to write his/her own coded message.
6. Have students exchange coded messages, decode them, and then present both the coded and decoded messages to the class.

C. Coded Pictures?

1. Explain that information stored in computers is in a series of 1s and 0s or on and off commands.
2. Ask students: "How do you think a computer stores information in the form of a picture?"
3. Distribute graph paper to students and tell them to think of each square as a place for a command of either 1 and 0 or on and off.
4. Direct students to create a simple picture by coloring in some boxes, while leaving others empty. Tell students not to use an area greater than 25 boxes in width or height.
5. Explain that the colored boxes are considered 1, or on, and the empty boxes are considered 0, or off.
6. Have students exchange and then code the pictures. Explain that three colored boxes in a row would be 1-1-1 or on-on-on.
7. Discuss ways in which the use of binary numbers has revolutionized how we store information in our society. Discuss ways in which this revolution has affected our society.

Classroom Assessment

Basic Concepts and Processes

At the end of the activity, ask questions such as the following:

- How can numbers and letters be represented by using sequences of only two symbols?
- How does our society depend on the storage of information in computers?
- How could you develop your own binary "code?"
- Did you have any difficulties creating or decoding a coded message?

Name: _____

BREAK THE CODE!

BINARY BASICS:

Binary code allows you to represent any number using only 1s and 0s. Each digit "1" represents a power of two, and each "0" represents a zero:
0001 is 2 to the zero power, or 1
0010 is 2 to the 1st power, or 2
0100 is 2 to the 2nd power, or 4
1000 is 2 to the 3rd power, or 8

When you see a binary number like "0101," you can find what it means by adding the powers of two:
0101=0+4+0+1=5
1010=8+0+2+0=10

DIGIT DECODER:

A=1	J=10	S=19
B=2	K=11	T=20
C=3	L=12	U=21
D=4	M=13	V=22
E=5	N=14	W=23
F=6	O=15	X=24
G=7	P=16	Y=25
H=8	Q=17	Z=26
I=9	R=18	

CODED MESSAGE:

000011 001111 001101 010000 010101 010100 000101
010010 010011 010011 000101 000101 000101 010110
000101 010010 011001 010100 001000 001001 001110
000111 000001 010011 000001 010011 000101 010010
001001 000101 010011 001111 000110 001111 001110
000101 010011 000001 001110 000100 011010 000101
010010 001111 000101 010011

Decoded message:

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_____

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