

Computer Art

Teacher Materials

In this activity, students will: learn about RGB values and learn how a computer reads color.

Acknowledgements and License

This activity was contributed by Zachary Lipman for UNO's TED 8006 course.

Lesson Details

Grade Level: 6–12th graders

Activity Length: 30 minutes

Format: Students working in pairs, materials for 3 pairs

Bin Materials Checklist

#	Description
18	Colored Pencils
3	Pencil Sharpeners
	Multiple copies of student instructions
	Grid Paper

Lesson Setup / Introduction

You view images on your computer every day. But how does the computer store that data? One of the most common formats is to store the image as a series of pixels, or small dots, each with a specific color. Every color is a series of three numbers: how much red, how much green, and how much blue (in that order)!

Be sure to decide if you want students to do the easy (decimal numbers) or more difficult (hexadecimal numbers) exercise and print the corresponding sheets. It is best to paperclip the appropriate pages together before giving to students.

Connection to Computing

Computer displays - monitors and screens - use *pixels* or tiny dots in rows and columns to display images. Computer codes govern what color each pixel should be to make a picture. The kind of “pixel art” created in this activity is similar to what computers really do.

At their most basic level, computers work in binary - series of zeros and ones. A zero or one is a “bit” and these are chunked in the computer into eights. A sequence of eight zeros and ones (8 bits) is a “byte”.

You probably know that the three primary colors of paint are red, yellow, and blue, which can be combined to make any color and if all three are combined it makes black. Computer displays work with light rather than pigment. Thus the three primary colors of light are

red, green, and blue, which can be combined to make any color and if added all together they make white. More light = more white, while more color = more black.

In computers use codes to tell each pixel how much red, green, and blue to show. The range of possible amounts of each color goes from 0 to 255. This can be displayed in decimal (base 10, our everyday number system) as a series of three numbers separated by commas. White is (255, 255, 255), black is (0, 0, 0), green is (0, 255, 0) and yellow is a mix of green and blue: (0, 255, 255). We can also use hexadecimal, which is base 16. We use numbers from 0-9 but then fill in with letters A-F. So 0 = 0 and A = 10, B = 11, C = 12, and so forth.

Further Related Resources

- https://www.w3schools.com/colors/colors_rgb.asp
- <http://whatis.techtarget.com/definition/RGB-red-green-and-blue>
- https://en.wikipedia.org/wiki/RGB_color_model
- <http://www.pcc-services.com/articles/binhex.html>
- <https://curriculum.code.org/csp/unit2/4/>



Answer Key

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1																
2																
3					Orange	Black				Red	Orange	Orange	Orange			Brown
4		Red		Orange	Orange	Black			Red	Red	Orange	Orange	Orange		Brown	Brown
5		Red		Orange	Orange	Black		Red	Red	Red	Red	Orange	Blue	Blue	Brown	Brown
6		Red	Orange	Orange	Black	Black	Orange	Red	Red	Red	Blue	Blue	Blue	Blue	Brown	Brown
7	Red	Red	Black	Black	Orange	Black	Orange	Blue	Blue	Blue	Yellow	Blue	Blue	Blue		
8	Red	Red	Orange	Orange	Orange	Orange	Orange	Red	Red	Blue	Blue	Blue	Blue			
9	Red	Red	Orange	Orange	Orange	Orange	Orange	Red	Red	Blue	Blue	Blue	Blue			
10	Red	Red	Brown	Orange	Brown	Orange	Orange	Blue	Blue	Blue	Yellow	Blue	Blue	Blue		
11	Red	Red	Brown	Brown	Brown	Orange	Orange	Red	Red	Red	Blue	Blue	Blue	Blue	Brown	Brown
12		Red	Brown	Orange	Orange	Brown		Red	Red	Red	Red	Orange	Blue	Blue	Brown	Brown
13				Brown	Brown				Red	Red	Orange	Orange	Orange		Brown	Brown
14										Red	Orange	Orange	Orange			Brown
15																
16																

Figure 1: Medium Activity Answer Key

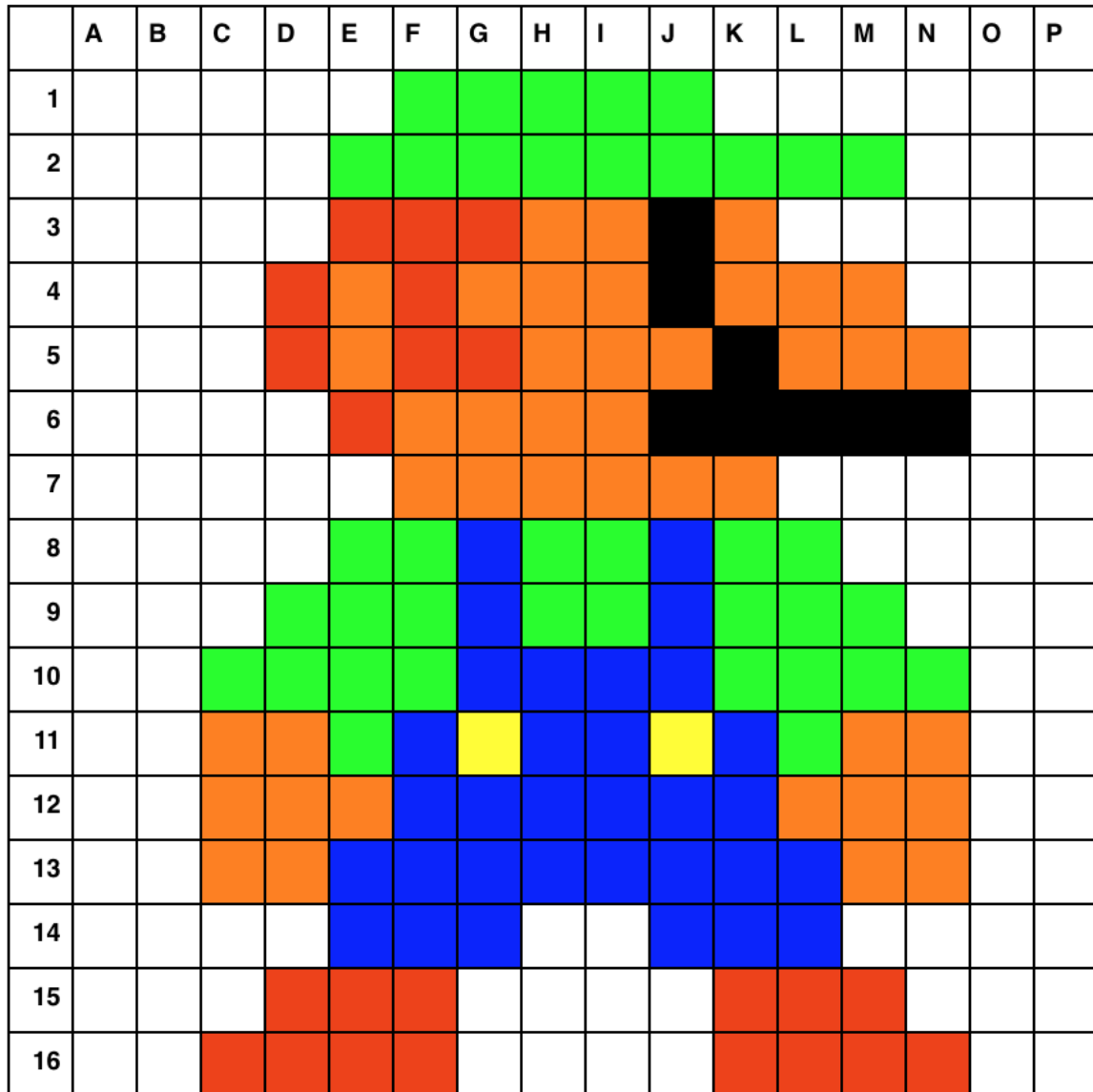


Figure 2: Hard Activity Answer Key

Encoded Color		Real Color
(255, 255, 255)		White
(255, 0, 0)		Red
(255, 128, 0)		Orange
(128, 64, 0)		Brown
(0, 0, 255)		Blue
(0, 0, 0)		Black
(255, 255, 0)		Yellow
Hexadecimal Color	Encoded Color	Real Color
#FFFFFF	(255, 255, 255)	White
#FF0000	(255, 0, 0)	Red
#FF8000	(255, 128, 0)	Orange
#804000	(128, 64, 0)	Brown
#0000FF	(0, 0, 255)	Blue
#000000	(0, 0, 0)	Black
#FFFF00	(255, 255, 0)	Yellow

Figure 3: Table Key



Computer Art

Student Instructions

Background: (Medium Difficulty)

You view images on your computer every day. But how does the computer store that data? One of the most common formats is to store the image as a series of pixels, or small dots, each with a specific color. Every color is a series of three numbers: how much red, how much green, and how much blue (in that order)!

Each color will be given a number between 0 and 255; a higher number means more of that color is included.

For example:

(0,255,0) = (No Red, High Green, No Blue). If you were a computer, you'd draw green!

(255, 0, 255) = (High Red, No Green, High Blue). If you were a computer, you'd draw purple!

Remember: **(Red Value, Green Value, Blue Value) or RGB**

Directions:

1. Your goal is to translate the computer language into an image!
2. Find the grid. Translate each encoded color in the grid to its colored pencil equivalent.
3. Before you begin coloring, check with your teacher to make sure you decoded the RGB values correctly.
4. Use an enclosed blank grid to color in each pixel in the appropriate color.
5. What do you see?

Encoded Color	Real Color
(255, 255, 255)	White
(255, 0, 0)	
(255, 128, 0)	
(128, 64, 0)	
(0, 0, 255)	
(0, 0, 0)	
(255, 255, 0)	

HINT: You should see six total colors: blue, black, brown, red, orange, yellow.

Computer Art

Student Instructions

NOTE: if you don't know hexadecimal, move on to the Medium difficulty version of this activity.

Background: (Hard Difficulty)

You view images on your computer every day. But how does the computer store that data? One of the most common formats is to store the image as a series of pixels, or small dots, each with a specific color. Every color is a series of three numbers: how much red, how much green, and how much blue (in that order)!

Each color will be given a number between 0 and 255; a higher number means more of that color is included.

But computers don't use the decimal number system! They use binary (just 0's and 1's). We group those binary digits (bits) together into groups and write them as hexadecimal numbers, a sixteen-digit number system. In hexadecimal, we use the digits 0 through 9 and then A is 10, B is 11, C is 12, all the way to F (15).

For example:

#00FF00 = (0,255,0) = (No Red, High Green, No Blue). If you were a computer, you'd draw green!

#FF00FF = (255, 0, 255) = (High Red, No Green, High Blue). If you were a computer, you'd draw purple!

Remember **#RRGGBB** (Red Value, Green Value, Blue Value) or **RGB**

1. Your goal is to translate the computer language into an image!
2. Find the grid. Translate each encoded color in the grid to its colored pencil equivalent.
3. Before you begin coloring, check with your teacher to make sure you decoded the RGB values correctly.
4. Use an enclosed blank grid to color in each pixel in the appropriate color.
5. What do you see?

Hexadecimal Color	Encoded Color	Real Color
#FFFFFF	(255, 255, 255)	White
#FF0000		
#FF8000		
#804000		
#0000FF		
#000000		
#FFFF00		

HINT: You should see six total colors: blue, black, brown, red, orange, yellow.

Computer Art!

(Difficulty: Medium)

[illegible]

Hand-Outs: Hard

Computer Art!

(Difficulty: Hard)

#FFFFFF	#FFFFFF	#FFFFFF	#FFFFFF	#FFFFFF	#00FF00	#00FF00	#00FF00	#00FF00	#00FF00	#FFFFFF	#FFFFFF	#FFFFFF	#FFFFFF	#FFFFFF	#FFFFFF
#FFFFFF	#FFFFFF	#FFFFFF	#FFFFFF	#00FF00	#00FF00	#00FF00	#00FF00	#00FF00	#00FF00	#00FF00	#00FF00	#00FF00	#FFFFFF	#FFFFFF	#FFFFFF
#FFFFFF	#FFFFFF	#FFFFFF	#FFFFFF	#F04000	#F04000	#F04000	#FF8000	#FF8000	#000000	#FF8000	#FFFFFF	#FFFFFF	#FFFFFF	#FFFFFF	#FFFFFF
#FFFFFF	#FFFFFF	#FFFFFF	#F04000	#FF8000	#F04000	#FF8000	#FF8000	#FF8000	#000000	#FF8000	#FF8000	#FF8000	#FFFFFF	#FFFFFF	#FFFFFF
#FFFFFF	#FFFFFF	#FFFFFF	#F04000	#FF8000	#F04000	#F04000	#FF8000	#FF8000	#FF8000	#000000	#FF8000	#FF8000	#FF8000	#FFFFFF	#FFFFFF
#FFFFFF	#FFFFFF	#FFFFFF	#FFFFFF	#F04000	#FF8000	#FF8000	#FF8000	#FF8000	#000000	#000000	#000000	#000000	#000000	#FFFFFF	#FFFFFF
#FFFFFF	#FFFFFF	#FFFFFF	#FFFFFF	#FFFFFF	#FF8000	#FF8000	#FF8000	#FF8000	#FF8000	#FF8000	#FFFFFF	#FFFFFF	#FFFFFF	#FFFFFF	#FFFFFF
#FFFFFF	#FFFFFF	#FFFFFF	#FFFFFF	#00FF00	#00FF00	#0000FF	#00FF00	#00FF00	#0000FF	#00FF00	#00FF00	#FFFFFF	#FFFFFF	#FFFFFF	#FFFFFF
#FFFFFF	#FFFFFF	#FFFFFF	#00FF00	#00FF00	#00FF00	#0000FF	#00FF00	#00FF00	#0000FF	#00FF00	#00FF00	#00FF00	#FFFFFF	#FFFFFF	#FFFFFF
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#FFFFFF	#FFFFFF	#FF8000	#FF8000	#00FF00	#0000FF	#FFFFFF	#0000FF	#0000FF	#FFFFFF	#0000FF	#00FF00	#FF8000	#FF8000	#FFFFFF	#FFFFFF
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#FFFFFF	#FFFFFF	#FFFFFF	#F04000	#F04000	#F04000	#FFFFFF	#FFFFFF	#FFFFFF	#FFFFFF	#F04000	#F04000	#F04000	#FFFFFF	#FFFFFF	#FFFFFF
#FFFFFF	#FFFFFF	#F04000	#F04000	#F04000	#F04000	#FFFFFF	#FFFFFF	#FFFFFF	#FFFFFF	#F04000	#F04000	#F04000	#F04000	#FFFFFF	#FFFFFF



Resupply

- Sharpen and/or Restock colored pencils
- Print additional paper grids as necessary